HQCA
Health Quality Council of Alberta

OVERWEIGHT AND OBESITY IN ADULT ALBERTANS: A ROLE FOR PRIMARY HEALTHCARE

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Promoting and improving patient safety and health service quality across Alberta

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1.0 EXECUTIVE SUMMARY

Introduction

The rise in obesity is a worldwide public health issue, and the burden of excess weight on both the individual and the healthcare system is substantial. The worldwide prevalence of overweight and obesity (as defined by the World Health Organization's [WHO] body mass index [BMI] categories) has been followed closely over the past three decades; agencies such as the WHO and the Organization for Economic Co-operation and Development routinely summarize data from across the globe. Their findings suggest that the prevalence of obesity nearly doubled between 1980 and 2008; moreover, it is estimated that more than half a billion adults worldwide were obese in 2008.[1,2]

Two key public health impacts are associated with adult obesity: an increased risk for several chronic conditions (e.g., Type 2 diabetes, hypertension, and cardiovascular disease),[3] and more frequent use of healthcare services. In Canada, the total direct costs[i] of illness attributable to overweight and obesity is upwards of $6 billion, which represents more than 4.1 per cent of total Canadian healthcare expenditures (2006).[4] In Alberta, total direct and indirect costs of illness associated with overweight and obesity is upwards of $1.27 billion,[ii] representing more than 5.6 per cent of provincial healthcare expenditures (2005).[5] Three approaches for targeting obesity have been noted by the Canadian Institute for Health Information, including health service and clinical interventions at the individual level, community interventions, and public policies.[3] Although the prevention and reduction of obesity must be supported by multiple public policy sectors (i.e., education and civic planning), this report focuses on the role of the healthcare system in Alberta and, in particular, primary healthcare.

The objectives of this report are to: (1) present data from the Health Quality Council of Alberta's (HQCA) *2014 Satisfaction and Experience with Healthcare Services* survey, a biennial survey of the Alberta population, (2) provide an in-depth analysis of the prevalence, burden, and rates of use of a number of key healthcare services, and (3) provide a rationale for the role of primary healthcare in weight management, for adult Albertans living with overweight and obesity.

Methodology

In 2014, the HQCA surveyed 4,424 adult Albertans about their individual socio-demographic characteristics (e.g., age, gender, ethnicity, education, and income) as well as their use and satisfaction with healthcare services within the previous 12 months. Self-reported height and weight were also collected from individuals (n = 4,287, 96.9%) in order to calculate their BMI. The unadjusted[iii] self-reported prevalence of overweight and obesity (defined as individuals with a BMI of 25.0-29.9 and ≥

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[i] The direct costs were extracted from the National Health Expenditure Database and allocated to each of 18 comorbidities using weights primarily from the Economic Burden of Illness Report, 2005-2008 in Canada (found at http://www.phac-aspc.gc.ca/publicat/ebic-femc/2005-2008/assets/pdf/ebic-femc-2005-2008-eng.pdf).

[ii] This cost represents 28 per cent of the total direct and indirect costs associated with the 22 specific health conditions that were partially attributable to overweight and obesity (analyzed in *The Cost of Obesity in Alberta Summary Report*).

[iii] Self-reported data are subject to respondent bias (people tend to underestimate their weight and overestimate their height, resulting in an overall underestimation of BMI) and therefore adjustment equations can be applied to account for this bias. This report presents unadjusted data. Adjusted BMI data are presented in Appendix I.

30.0, respectively) was examined as well as the association between BMI category and key demographic variables, including gender, age, and region. All analyses presented were weighted for age, gender, and Alberta Health Services (AHS) zone. Therefore, values presented reflect estimates for the entire Alberta population. Full details of the survey methodology and data can be found in the HQCA's *Satisfaction with Healthcare Services: A Survey of Albertans 2014* technical report.[6]

In addition to the HQCA survey data, online literature searches were conducted to identify reports (e.g., from Statistics Canada, the WHO, and other provincial health quality councils) that would validate the HQCA survey data. Additionally, three structured literature reviews were conducted in OvidSP Medline and selected OvidSP Evidence-Base Medicine Reviews databases (e.g., Cochrane Database of Systematic Reviews) to identify studies published within the last 10 years (January 1, 2004 – June 30, 2014) that addressed any of the following three questions:

1. What is the current understanding of the epidemiology, etiology, and risk factors associated with overweight and obesity?
2. What is the burden of disease (morbidity, mortality, healthcare utilization, and costs) locally (Alberta), nationally (Canada), and in select western countries (Australia, the United Kingdom, and the United States)?
3. What is the reported effectiveness of weight-management strategies delivered within a primary healthcare setting in adults with overweight and obesity?

Key findings

Prevalence, risk factors, comorbidities, and health-related quality of life in overweight and obesity: the Alberta context

According to the HQCA's *2014 Satisfaction and Experience with Healthcare Services* survey results, nearly three out of five Albertans over the age of 18 are either overweight or obese. The estimated provincial prevalence of adults with overweight and obesity is 35.2 per cent and 23.9 per cent, respectively. Comparing the HQCA's *2012* and *2014 Satisfaction and Experience with Healthcare Services* survey results, there were no significant changes in the prevalence of overweight and obesity in the province between the two time periods.

Overweight and obesity result from complex interactions of personal and societal risk factors, along with an individual's health status.[7] According to data from the HQCA's *2014 Satisfaction and Experience with Healthcare Services* survey, these risk factors include:

- Age (compared to those 18–25 years old, those 25–44 were at greater risk of being overweight and obese)
- Gender (males were at greater risk of being overweight and obese compared to females)
- Living in the AHS North or South zones compared to the Calgary zone
- Having no post-secondary education

An examination of the health burden of overweight and obesity in Alberta (HQCA's *2014 Satisfaction and Experience with Healthcare Services* survey) revealed that the prevalence and risk of experiencing a number of chronic illnesses/diseases – including asthma, diabetes, high blood pressure, high cholesterol, sleep apnea, congestive heart failure, depression/anxiety, chronic pain, osteoarthritis, and heart disease

– are higher in those who are overweight or obese than in those with a normal BMI. Findings suggest that as BMI increases so too does the burden of illness associated with excess weight. In addition, results of the HQCA's *2014 Satisfaction and Experience with Healthcare Services* survey further showed evidence of decreased health-related quality of life (measured using the EQ-5D)[iv] among those Albertans with a higher BMI.[8,9] Specifically, for all domains of health measured by the EQ-5D, the severity of the health problem increased with increasing BMI. Overall health-related quality of life, as measured by the EQ-5D VAS (visual analogue scale) score, decreases as BMI increases:

- Normal-weight BMI: 81.0 (95% confidence interval (CI): 80.1 – 81.8)
- Overweight BMI: 78.6 (95% CI: 77.8 – 79.5)
- Obese BMI: 72.7 (95% CI: 71.5 – 73.8)

Overweight- and obesity-related use of the healthcare system in Alberta

Results of the HQCA's *2014 Satisfaction and Experience with Healthcare Services* survey showed significant variation in the use of healthcare services by Albertans with obese as compared to normal-weight and overweight BMIs. For example:

- A higher percentage of individuals with an obese BMI reported using the healthcare system for 'more serious' and 'serious ongoing/long term problems'.
- A significantly greater percentage of individuals with an obese BMI reported using primary care physicians, emergency departments, specialists, diagnostic services, and pharmaceuticals in the past 12 months.
- The number of primary care physician visits, but not emergency department or specialist visits, was significantly higher for Albertans with an obese BMI as compared to those with a normal-weight BMI.

Weight management in the healthcare system: a role for primary healthcare

Because of the unique role primary healthcare plays in health promotion, disease prevention, and co-ordination of patient care, primary healthcare may be well positioned within the healthcare system to manage overweight and obesity. Findings show, however, that not all Albertans with overweight and obesity report receiving counselling from their physicians on those factors that are strongly linked to weight loss and weight control.

In addition, team-based care coordination may be particularly important for patients with overweight and obesity who are more likely than normal-weight individuals to have multiple comorbidities and require treatment by a team of professionals to effectively manage their health. Findings from the HQCA survey suggest, however, that although individuals with overweight and obesity were more likely to have regularly received healthcare from a coordinated team of healthcare providers, as compared to normal-weight individuals, it is still only a small percentage of Albertans with overweight and obese

[iv] The EQ-5D tool is a questionnaire that asks individuals to rate their perceived quality of life from 1 'no problems' to 5 'extreme problems' across five domains of health: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. The EQ-5D also provides a measure of overall health-related quality of life, using a visual analogue scale (VAS), by which respondents rate their health status on a scale of 0 (worst imaginable health state) to 100 (best imaginable health state).

BMIs who are being engaged in team-based care (22.9% of normal-weight, 28.7% of overweight, and 33.8% of obese individuals).

Environmental scan of obesity interventions in Alberta

An environmental scan identified a number of programs and initiatives offered in the province that focus on weight management and/or dealing with chronic diseases, including obesity. The search results showed a broad range of AHS and primary care network-specific programs. The search results further indicated that a number of the primary care networks employ AHS programming, including 'Chronic Disease Management', 'Weight Wise', and 'Better Choices, Better Health™', or have created programs that use components of these AHS programs. The majority of the weight-management programs identified offer educational support to patients through lifestyle or behavioural interventions. Little information on program effectiveness has been reported, however (Appendix IV).

Literature review of the effectiveness of behavioural and cognitive-behavioural weight management interventions in primary healthcare[v]

Evidence shows that management of overweight and obese populations within primary healthcare can lead to benefits in weight management as compared to usual care. Of particular note, findings from the literature suggest that brief (e.g., 15 minute) behavioural and cognitive-behavioural weight management interventions, delivered by a primary care physician or a non-physician primary healthcare provider in a multidisciplinary primary healthcare team, can promote modest, but significant, weight loss in patient populations with overweight and obesity.

Conclusion

The findings from this report show that overweight and obesity pose an important health issue for all Albertans; obesity is associated with an increased risk of multiple comorbidities and higher use of healthcare system services. It also has a detrimental effect on individual quality of life. Within the healthcare system, the task of managing overweight and obese populations, as well as comorbid conditions, falls predominantly on primary healthcare providers. Evidence shows that diverse strategies for the management of overweight and obesity within primary healthcare are associated with benefits in weight management as compared to usual care; however, the most effective mix of providers, interventions, and duration, as well as generalizability to larger populations, still requires further evaluation. Moving forward, Alberta may benefit from working towards a more unified strategy for weight management. In addition, there remain opportunities to engage more Albertans in discussions about weight management, and to increase the use of team-based care across all weight categories. At a minimum, primary healthcare in Alberta should strive towards the routine collection of BMI and health-related quality-of-life indicators (i.e., EQ-5D). In addition, key chronic disease indicators e.g., diabetes, hypertension etc., will provide primary healthcare providers the means to monitor changes in BMI across a patient's lifetime and to examine the effect of a patient's weight on self-reported health status

[v] One option for weight management in patients with overweight and obesity is patient referral to a commercial weight management or weight-loss program. Although commercial programs may prove to be effective in reducing overweight and obesity, the focus of this report is on weight management *within* the primary healthcare setting. A review of the effectiveness of commercial weight management programs falls outside the scope of this report.

and health-related quality of life. Furthermore, an evaluation of new or ongoing weight-management strategies in the province is needed to better identify those programs that are working well and benefitting the health of Albertans. These suggestions are aligned with the most recent set of recommendations released by the Canadian Task Force on Preventative Health Care.[10]

2.0 INTRODUCTION

Overweight and obesity (as defined by the World Health Organization's (WHO) body mass index (BMI) categories; see Section 3) is a major public health concern. The worldwide prevalence of overweight and obesity has been followed closely over the past three decades and agencies such as the WHO and the Organization for Economic Co-operation and Development routinely summarize data from across the globe. Their findings suggest that the worldwide prevalence of obesity nearly doubled between 1980 and 2008; moreover, it is estimated that more than half a billion adults worldwide were obese in 2008.[1]

In Canada, national surveys, including the Canadian Community Health Survey (CCHS), the National Population Health Survey, and the Canadian Health Measures Survey, are used to monitor changes in the prevalence of underweight, normal-weight, overweight, and obesity in the Canadian population. Results have shown that the prevalence of overweight and obesity has increased over recent decades in adult populations across all areas of the country (CMAJ, 2007).[vi] For example, in Canada between 1985 and 2011, the prevalence of overweight individuals increased by 5.8 per cent (from 27.8% to 33.6%) and the prevalence of obesity increased by 12.2 per cent (from 6.1% to 18.3%).[11] The most recent data from the CCHS (2014) now estimate that approximately half (54.0%) of Canadian adults are either overweight (33.8%) or obese (20.2%).[12]

In Canada, provincial variation is seen in the prevalence of overweight and obesity, with overall prevalence of overweight and obesity ranging from 46.9 per cent in British Columbia to 69.1 per cent in Newfoundland and Labrador (Figure 1).[12] In Alberta, the most recent data from the Health Quality Council of Alberta's (HQCA) *2014 Satisfaction and Experience with Healthcare Services* survey (a biennial survey of the Alberta population) estimate that as of 2014 more than half of Albertans (59.0%) were either overweight (35.1%) or obese (23.9%); see Section 4 for information on variation by geographic region, gender, and age in Alberta.[vii] These results are consistent with the 2014 CCHS results, which reported that 55.0 per cent of Albertans were overweight (33.5%) or obese (21.5%).[12]

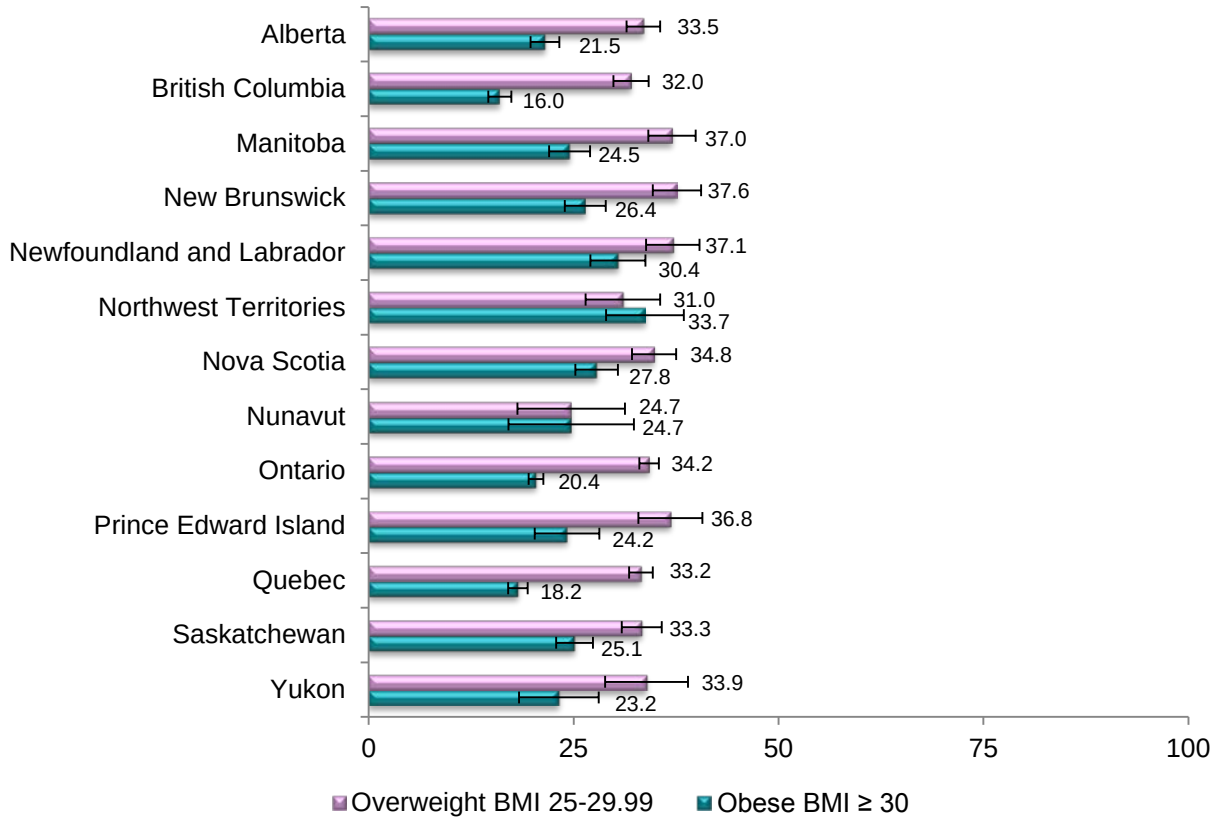
The rise in obesity is a public health issue, and the burden of excess weight on both the individual and the healthcare system is substantial. From a public health perspective, the key impact associated with adult obesity is more frequent use of healthcare services due to increased risk for several chronic conditions (e.g., Type 2 diabetes, hypertension, and cardiovascular disease).[3] In 2014, the WHO reported that globally, approximately 3.4 million adults die each year as a result of being overweight or obese. In addition, in 2014 the WHO estimated that globally, overweight and obesity accounted for approximately 44 per cent of the diabetes burden, 23 per cent of the ischemic heart disease burden, and between seven and 41 per cent of certain cancer burdens.[13] In Canada, overweight and obesity have been associated with an increased use of healthcare services and increased financial cost to the healthcare system. In

[vi] Similar increases in overweight and obesity have been observed in youth populations in Canada. The focus of this report is on adult populations.

[vii] After the data were adjusted to correct for respondent bias, the HQCA data indicated that in 2014 nearly 70 per cent of adult Albertans were categorized as overweight (36.6%) or obese (30.7%). Self-reported data tend to underestimate the prevalence of obesity. The greater observed prevalence of obesity (adjusted versus unadjusted BMI prevalence) is most likely due to the fact that the adjustment equation corrects for self-report bias.

2006, the national total direct cost[viii] of illness attributable to obesity was an estimated $6 billion, representing 4.1 per cent of total Canadian healthcare expenditures.[4] In Alberta in 2005, the total direct and indirect cost of illnesses attributable to obesity was estimated at $1.27 billion, representing 5.6 per cent of healthcare expenditures for the province.[5] These costs continue to rise with increasing prevalence of obesity in the population. Three approaches for targeting obesity have been noted by the Canadian Institute for Health Information, including health service and clinical interventions at the individual level, community interventions, and public policies.[3] Although the prevention and reduction of obesity needs to be supported by multiple public policy sectors (i.e., education and civic planning),[ix] this report focuses on the role of the healthcare system, and in particular that of primary healthcare in Alberta.

Figure 1: Overweight and obesity in the Canadian provinces and territories (2014)[x]



[viii] The direct costs were extracted from the National Health Expenditure Database and allocated to each of 18 comorbidities using weights primarily from the Economic Burden of Illness in Canada Report, 2005-2008 (found at http://www.phac-aspc.gc.ca/publicat/ebic-femc/2005-2008/assets/pdf/ebic-femc-2005-2008-eng.pdf).

[ix] It is important to note that the etiology, prevention and treatment of overweight and obesity is complex and heterogenous and goes well beyond making this a simple problem of diet and exercise. Recent topics highlighting this complexity include the role of genetics, epigenetics, gut-bacteriome, environmental toxins (endocrine disrupters), lack of sleep, ambient temperature, and many other factors in the development and treatment of overweight and obesity. Some of these issues will be discussed later in this report.

[x] Modified from Statistics Canada. CANISM Table 105-0501: Health indicator profile, annual estimates, by age group and sex, Canada, provinces, territories, health regions (2014) and peer groups. Ottawa: The Government of Canada; 2014.

Overweight and obesity result from a complex interaction of individual and societal risk factors, and are linked to decreased quality of life, increased comorbidity, and increased use of the healthcare system (Sections 4 and 5). As a result, mitigating overweight and obesity, through weight management in the Alberta population, represents a priority area for the current healthcare system. For the purposes of this report, weight management refers to an individual's efforts to achieve and maintain body weight and body fat percentage at a level that optimally reduces the risk of weight-related health complications. Weight-management efforts may include healthy eating, exercise, weight maintenance, and weight loss. Which area of the healthcare system is best suited to effectively influence weight management in the Alberta population is yet to be determined, however.

Because of the unique role primary healthcare plays in health promotion, disease prevention, and coordination of patient care, primary healthcare may be well positioned within the healthcare system to manage overweight and obesity. Specifically, primary care physicians are most often patients' first contact with the healthcare system and are the ones who direct patients towards appropriate resources and social supports (e.g., public health nurse, dietician, or nutritionist). They also coordinate patient care across multiple healthcare disciplines, including care for many of the diseases and/or illnesses associated with obesity.[xi] For example, the HQCA's *2014 Satisfaction and Experience with Healthcare Services* survey showed an increased utilization of healthcare services – specifically, a significantly higher number of visits to primary care physician offices and emergency departments – among Albertans with obesity as compared to Albertans who are either normal-weight or overweight (see Section 5). In addition, the primary healthcare team is involved with patient care across all stages of life, providing opportunities for primary care physicians and other primary healthcare providers to engage in preventative measures against overweight and obesity and to use a long-term, patient-centred approach to address obesity in patients struggling with weight management. Consistent with this notion, several healthcare reports have identified primary healthcare as the focal point for the management of chronic diseases – including conditions associated with obesity[xii] – within the Alberta healthcare system.[14,15,16]

Recommendations on the clinical management of obesity have been provided by several Canadian clinical practice guidelines.[17,18,19,20] Specifically, Canadian clinical practice guidelines[17,xiii] suggest that a comprehensive strategy for managing obesity should include a multifaceted approach to address both societal and individual factors, and to build links between public policy sectors that would otherwise act independently (e.g., education and healthcare). Guidelines also call for enhanced research, surveillance, and population-based data collection to identify the most effective treatment strategies to prevent further increases in the prevalence of overweight and obesity in Canada.[17]

[xi] Due to the current structure of the Alberta healthcare system, the HQCA uses in-person contact between the patient and a primary care physician (e.g., as a referral source, to periodically discuss weight-loss progress, and/or to highlight the importance of the weight-management intervention for the patient) as an indicator of involvement with the primary healthcare system.

[xii] Although increasing consensus is that obesity, once established, becomes a life-long chronic disease (e.g., AMA declaration, World Obesity Federation, Obesity Society, WHO), some researchers and clinicians argue that the classification of obesity as a chronic disease may have adverse effects on our understanding, treatment, and prevention of obesity in that it may emphasize conventional medical model thinking and undervalue the population and societal changes that are needed to prevent obesity.

[xiii] The Public Health Approaches to the Prevention of Obesity Working Group of the International Obesity Task Force

To this end, the objective of this report is to present data from the HQCA's *2014 Satisfaction and Experience with Healthcare Services* survey and to provide an in-depth analysis of the prevalence, burden, rates of use of a number of key healthcare services, as well as primary healthcare management of overweight and obese adults in Alberta.[xiv] Two important characteristics distinguish this report from other reports: first, this report is among the first to provide detailed results of overweight and obesity prevalence, comorbidities, health-related quality of life, and healthcare system usage in Alberta; and second, this report uses current data as evidence to support the need for primary healthcare providers to engage further in weight management with their patient populations.

2.1 Methodology

In 2014, the HQCA surveyed 4,424 adult Albertans about their individual socio-demographic characteristics (e.g., age, gender, ethnicity, education, and income) as well as their use and satisfaction with healthcare services within the previous 12 months. Self-reported height and weight were also collected from individuals (n = 4,287, 96.9%) in order to calculate their BMI. This report examines the unadjusted[xv], self-reported prevalence of overweight and obesity (see Section 4) as well as the association between BMI category and key demographic variables, including gender, age, and AHS zone. All analyses presented in this report were weighted for age, gender, and AHS zone, such that values presented reflect estimates for the entire Alberta adult population (those aged 18 years and older). Full details of the *2014 Satisfaction and Experience with Healthcare Services* survey methodology and data can be found in the HQCA's *Satisfaction with Healthcare Services: A Survey of Albertans 2014* technical report.[6]

In addition to the HQCA survey data, online literature searches were conducted to identify reports (e.g., from Statistics Canada, the WHO, and other provincial health quality councils) that would validate the HQCA survey data. Additionally, three structured literature reviews were conducted in OvidSP Medline and selected OvidSP Evidence-Base Medicine Reviews databases (e.g., Cochrane Database of Systematic Reviews) to identify studies published within the last 10 years (January 1, 2004 to June 30, 2014) that addressed any of the following three questions:

1. What is the current understanding of the epidemiology, etiology, and risk factors associated with overweight and obese populations?
2. What is the burden of disease (morbidity, mortality, healthcare utilization, and costs) locally (Alberta), nationally (Canada), and in select western countries (Australia, the United Kingdom, and the United States)?
3. What is the reported effectiveness of strategies for managing overweight and obese adults within primary healthcare settings?

[xiv] Although there are recognized links between pediatric and adult obesity – specifically, that pediatric obesity represents a risk factor for obesity in adulthood – the HQCA data do not measure pediatric populations. As a result, the focus of this report is on adult populations only.

[xv] Self-reported data are subject to respondent bias (people tend to underestimate their weight and overestimate their height, resulting in an overall underestimation of BMI) and therefore adjustment equations can be applied to account for this bias. Unadjusted data are presented here. Adjusted data are presented in Appendix I.

2.2 Structure of the report

The remainder of the report is organized in the following sections:

- What is overweight and obesity?
- Prevalence, risk factors, comorbidities, and health-related quality of life in overweight and obesity: the Alberta context
- Overweight- and obesity-related use of the healthcare system in Alberta
- Weight management in healthcare: a role for primary healthcare
- Environmental scan of obesity interventions in Alberta
- Literature review of the effectiveness of behavioural and cognitive-behavioural weight-management interventions in primary healthcare

3.0 WHAT IS OVERWEIGHT AND OBESITY?

Overweight and obesity are defined based on BMI, which is calculated as [weight (kg)/height (m)^2]. A normal BMI for an adult (male and female) is 18.5 to 24.9. Overweight is defined as a BMI of 25 to 29.9 and obese is defined as a BMI of 30 or more (see Box 1). Within the obese BMI category, there are three sub-categories. These are: Obese Class I (BMI = 30.0–34.9), Obese Class II (BMI = 35.0–39.9), and Obese Class III (BMI ≥ 40). BMI category cut-offs are based on mortality risk, with increasing risk of premature mortality below a BMI of 18.5 (i.e., underweight) and above 24.9 (i.e., overweight and obese[xvi]).[21] Although underweight represents a BMI category (estimated 1.9% of the Alberta population) with its own set of risks for illness and disease, this topic falls outside the focus of this report.

Box 1. Body Mass Index (BMI)[1]: Calculated by dividing an individual's weight (kilograms) by height (meters) squared (≥18 years).

Category	BMI
Underweight	< 18.5
Normal	18.5 – 24.9
Overweight	25.0 – 29.9
Obese Class I	30.0 - 34.9
Obese Class II	35.0 – 39.9
Obese Class III	≥ 40.0

Although BMI is a commonly used measure of overall body fat and associated health risks in population-level studies, it is not without its limitations. For instance, BMI measures excess weight rather than excess body fat and therefore, does not account for muscle mass (e.g., athletes and muscular individuals may have a higher BMI) or fat distribution. In addition, BMI is influenced by several other factors including age, sex, and ethnicity, which may limit its utility as a measure of weight-related health.[22] Some obesity researchers have argued that BMI alone does not account for comorbidities associated with excess weight; changes in BMI do not always translate into changes in a person's overall health, and similarly, changes in a person's overall health may not be reflected in a change in BMI.[23]

In terms of its benefits, BMI allows for tracking and comparison of the prevalence of obesity in large populations over time.[11] BMI can be either measured or self-reported. The most reliable method for collecting BMI data is directly measuring an individual's height and weight and then using these data to calculate a BMI. Although this method works well in studies with small samples, it lacks feasibility in large population-based studies due to the time and cost associated with taking individual measurements across a large sample. As a result, the most widely used method for collecting BMI data is via self-report (i.e., BMI is calculated using self-reported height and weight information). Although self-reported data permit larger samples at a lower cost, this approach is subject to response bias. People tend to overestimate their height and underestimate their weight, resulting in an overall underestimation of the most at-risk BMI categories (i.e., obese categories).[2] An adjustment equation can be applied to self-

[xvi] Rather than BMI, the Edmonton Obesity Staging System (EOSS) ranks the severity of obesity based on weight-related health problems, mental health, and health-related quality of life measures. Evidence shows that higher EOSS stages have substantially higher mortality rates than "simple" or "uncomplicated" obesity (see Padwal et al, CMAJ 2013). This system is now being increasingly recommended as a better way to identify and classify obesity related morbidity and risk than BMI alone and is included in obesity assessment algorithms by the American Society of Bariatric Physicians, the Canadian Obesity Network, and the World Obesity Federation's SCOPE series (see Dietz et al. Lancet 2015).

reported data to help account for this response bias and to better approximate BMI. The resultant rate of overweight or obesity is referred to as the adjusted prevalence.[xvii]

In addition to BMI, waist circumference is also a risk factor for premature mortality and is sometimes used as a measure of overweight and obesity.[24,25,26] Waist circumference represents a risk factor that is related to, but independent of BMI. For example, men with a waist circumference of 94 cm or more and women with a waist circumference of 80 cm or more are shown to be at increased risk of developing health problems.[27,28] Waist circumference measurements have similar limitations as those for BMI measurements. For example, waist circumference is not a direct measure of excess body fat, and does not account for variation in body fat distribution.

[xvii] All data reported in the body of this report is unadjusted. Adjusted data is reported in Appendix I.

4.0 PREVALENCE, RISK FACTORS, COMORBIDITIES, AND HEALTH-RELATED QUALITY OF LIFE IN OVERWEIGHT AND OBESITY: The ALBERTA CONTEXT

Overweight and obesity are a growing concern in Alberta and result from complex interactions of personal and societal risk factors.[7] Individual risk factors include those relating to a person's biology and genetics,[29,30,31,32,33,34,35] perinatal and early childhood factors,[36,37,38,39,40,41,42,43] and an individual's environment and lifestyle.[30,32,39,40,44,45,46,47,48,49,50,51] Other risk factors can be attributed more broadly to socio-demographic influences. These include geographical region,[52,53] age, gender, education, income, and ethnicity.[36,37,39,40,54,55] Also important to an individual's relative risk (RR) of overweight and obesity is the person's own unique health status, including diseases and conditions that may be present in addition to overweight/obesity (i.e., comorbidities; see Appendix II for a more detailed review of the literature on this topic).

The HQCA's *2014 Satisfaction and Experience with Healthcare Services* survey collected self-reported information on prevalence, several personal and societal risk factors, personal health status, and quality of life. The following section presents findings from the HQCA's *2014 Satisfaction and Experience with Healthcare Services* survey. Specifically, this section reports the prevalence of overweight and obesity in Alberta along with the risk factors, comorbidities, and health-related quality of life in overweight and obese populations in the province.

4.1 Prevalence of overweight and obesity in Alberta

4.1.1 Provincial estimate

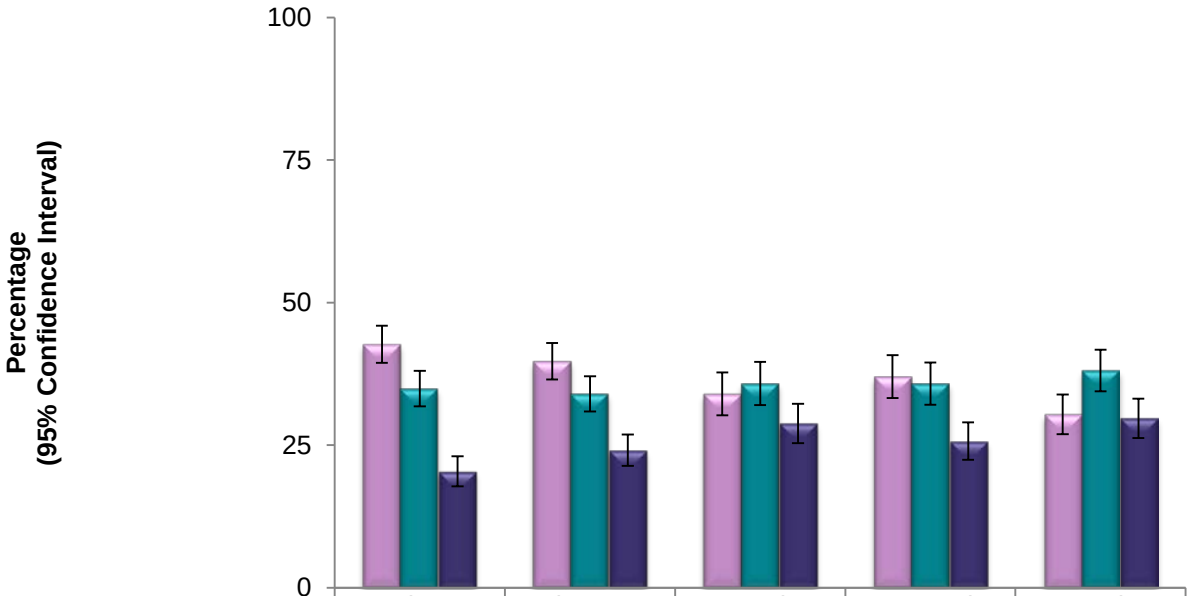
According to the HQCA's *2014 Satisfaction and Experience with Healthcare Services* survey results, nearly three out of five Albertans over the age of 18 are either overweight or obese. The estimated provincial prevalence of adults with overweight and obesity is 35.2 per cent and 23.9 per cent, respectively. There were no significant changes in the prevalence of overweight and obesity in the province over the two-year period from 2012 to 2014.[56]

4.1.2 Regional variation

Significant regional variation was seen in the prevalence of obesity, but not overweight, across the province (Figure 2): rural-dominated zones (i.e., those zones without a major population centre) were estimated to have a higher prevalence of obesity as compared to more urban-dominated zones.

Obesity estimates for the Calgary Zone (20.4%) were significantly lower than the obesity estimates for all other zones (Edmonton: 24.1%; South: 28.8%; Central: 25.7%; and North: 29.7%; all *p*s < 0.05). Similarly, obesity estimates for the Edmonton Zone were significantly lower than those for the South and North zones (*p*s < 0.05), but were not significantly lower than those of the Central Zone (25.7%). No significant differences were observed in obesity estimates for the North, Central, and South zones (all *p*s > 0.05).

Figure 2: Prevalence of self-reported BMI categories by Alberta Health Services zone (HQCA, 2014)



	Calgary	Edmonton	South	Central	North
Normal BMI 18.5-24.9	42.7	39.7	34.0	37.0	30.4
Overweight BMI 25-29.9	34.9	34.0	35.8	35.8	38.1
Obese BMI ≥ 30	20.4	24.1	28.8	25.7	29.7

Other jurisdictions have also reported that rural-dominated regions experience a higher prevalence of obesity than do more urban areas.[57] For example, a 2011 report outlining the prevalence, associations, and outcomes of adult obesity in Manitoba found that obesity in Manitoba was lowest in urban areas, higher in rural areas, and highest in the northern regions of the province.

4.2 Risk factors of overweight and obesity in Alberta

The literature identified a number of socio-demographic risk factors for overweight and obesity. These include age, gender, income, geographical region, ethnicity, and education. Table 1 presents the prevalence of normal-weight, overweight, and obesity in Alberta, by socio-demographic risk factor (e.g., percentage of the male population of Alberta that is normal-weight, overweight, or obese).

Table 1: Percentage of Albertans in each weight category, by demographic risk factor (HQCA, 2014)

		Normal (%) (BMI 18.5-24.9)	Overweight (%) (BMI 25-29.9)	Obese (%) (BMI ≥ 30)	*Alberta (%) (N =4,424)*
BMI		39.0	35.2*	23.9*‡	
Gender					
	Male	30.5	42.4*	25.6*‡	*50.1*
	Female	48.0	27.5*	22.1*‡	*49.9*
Age					
	Age 18-24	61.1	24.5*	9.5*‡	*12.3*
	Age 25-44	40.9	32.5*	24.4*‡	*40.0*
	Age 45-64	31.3	39.3*	28.6‡	*33.4*
	Age > 65	32.8	42.3*	24.1*‡	*14.3*
Income					
	Less than $30,000	35.5	32.4	30.1	*11.5*
	$30,000 to just under $60,000	36.7	38.1	23.6*‡	*20.5*
	$60,000 to just under $100,000	38.6	33.9	25.7*‡	*25.7*
	$100,000 or more	39.6	35.8	22.8*‡	*42.3*
Zone					
	Central	37.0	35.8	25.8*‡	*11.8*
	Edmonton	39.7	34.0	24.1*‡	*31.8*
	South	34.0	35.8	28.8	*7.5*
	Calgary	42.7	34.9*	20.4*‡	*37.6*
	North	30.4	38.1*	29.7‡	*11.4*
Ethnicity					
	Caucasian	38.1	35.1	25.1 *‡	*82.0*
	Non-Caucasian	43.3	34.7	19.3*‡	*18.0*
Education					
	Grade school or some high school	33.0	35.2	30.4	*9.1*
	Completed high school	36.0	35.3	26.7*‡	*20.3*
	Post-secondary technical school (including trade school)	30.3	36.2	31.5	*12.4*
	Some university or college	47.7	28.3*	21.3*	*12.5*
	Completed college diploma	34.1	37.9	26.4*‡	*14.7*
	Completed university degree	46.2	35.0*	17.5*‡	*22.4*
	Post-grad degree (master's or doctorate)	42.9	37.8	16.9*‡	*8.7*

*Significantly different from normal BMI individuals ($p < 0.05$)

‡ Significantly different from overweight individuals ($p < 0.05$; comparing obese and overweight groups)

4.2.1 Modelling the socio-demographic risk factors for overweight and obesity in Alberta

To evaluate the strength and significance of risk factors for overweight and obesity in Alberta, socio-demographic factors (geographical region, age, gender, education, income, and ethnicity), were entered into a regression model. The model compared the influence of each socio-demographic factor on the relative risk (RR) of having an overweight or obese BMI as compared to the baseline risk of a normal-weight BMI (see Table 2).

4.2.1.1 Risk factors for overweight in Alberta

The model revealed that compared to normal-weight BMI, the factors associated with an increased risk of overweight BMI were gender (males had a 2.8 times greater risk of being overweight as compared to females), age (compared to Albertans aged 18–25 years, those aged 25–44 years were at 2.3 times greater risk of being overweight, increasing to 3.8 for those aged 65+ years), and living in the AHS North Zone as compared to the Calgary Zone (1.6 times greater risk of being overweight; see Table 2). Income, ethnicity, and education were not significantly associated with being overweight in Alberta.

4.2.1.2 Risk factors for obesity in Alberta

The model revealed that compared to normal-weight BMI, the factors associated with an increased risk of obesity were gender (males were at 2.0 times greater risk of being obese as compared to females), age (compared to Albertans aged 18–25 years, those 25–44 years old were at 4.8 times greater risk of being obese, increasing to 5.6 for those aged 65+ years old), living in the North or South zones of the province compared to the Calgary Zone (1.8 times greater risk in the North and 1.7 times greater risk in the South), and having no post-secondary education (1.4 times greater risk of being obese compared to those with having post-secondary education; see Table 2). Income and ethnicity were not significantly associated with obesity in Alberta.

Table 2: Multinomial modelling of demographic risk factors by BMI category (HQCA, 2014)

Demographic		Relative Risk (RR)	
		Overweight (BMI 25-29.9)	Obese (BMI ≥ 30)
Gender	Female		
	Male	2.8*	2.0*
Age group	18–25 years		
	25–44 years	2.3*	4.8*
	45–64 years	3.7*	7.2*
	65+ years	3.8*	5.6*
Ethnicity	Caucasian		
	Non-Caucasian	1.0	0.9
Education	No Post-secondary		
	Post-secondary	0.9	0.7*
Income	< $30,000		
	$30,000–60,000	1.2	0.8
	$60,000–$100,000	1.0	0.9
	$100,000+	1.0	0.8
Zone	Calgary		
	South	1.3	1.7*
	Central	1.1	1.3
	Edmonton	1.0	1.2
	North	1.6*	1.8*

* Significantly different from normal BMI individuals ($p < 0.05$)

ǂ Significantly different from overweight individuals ($p < 0.05$; comparing obese and overweight groups)

4.3 Comorbidities associated with overweight and obesity in Alberta

Research in overweight and obesity has shown an association with increased negative health effects, increased comorbid burden, and reduced health-related quality of life.[8,9,58,59,60,61] For example, there are numerous epidemiological studies that suggest a link between BMI and a wide range of illnesses. These include cardiovascular disease (e.g., hypertension), respiratory disorders (e.g., asthma), musculoskeletal disorders (e.g., osteoporosis, osteoarthritis), disease of the endocrine system (e.g., Type 2 diabetes), as well as several types of cancer and various psychological conditions.[58,59,60,61]

To evaluate potential associations between BMI and concomitant illness (i.e., comorbid burden) in the Albertan population, the HQCA's *2014 Satisfaction and Experience with Healthcare Services* survey asked Albertans to report their current health status on 15 obesity-related health conditions: diabetes, chronic obstructive pulmonary disease (COPD), asthma, high blood pressure (BP), high cholesterol, sleep apnea, congestive heart failure, depression/anxiety, chronic pain, osteoarthritis, heart disease, stroke, kidney disease, and bowel disorder/Crohn's disease or colitis. Findings from the HQCA's *2014 Satisfaction and Experience with Healthcare Services* survey health status questions are reported below.

Table 3 displays the relative risk of no comorbidities, one comorbidity, two comorbidities, and three or more comorbidities for those Albertans with overweight versus normal-weight BMIs, obese versus normal-weight BMIs, and obese versus overweight BMIs (controlling for all other BMI categories, Alberta Health Services zone, age, gender, education, income, and ethnicity). Consistent with the

literature, the HQCA findings showed that individuals with overweight and obesity were significantly *less* likely to report an absence of other health concerns and significantly *more* likely to report multiple comorbidities than were normal-weight individuals (*p*s < 0.05; Table 3). In addition, individuals with obesity were significantly *less* likely to report an absence of other health concerns and significantly *more* likely to report multiple comorbidities as compared to those with an overweight BMI (*p*s < 0.05; Table 3), suggesting an increasing negative health effect of excess weight as BMI increases from overweight to obese.

Table 3: Prevalence of multimorbidity by BMI category (HQCA, 2014)

	OVERWEIGHT *versus normal*		**OBESE** *versus normal*		**OBESE** *versus overweight*	
	RR	**95% CI**	**RR**	**95% CI**	**RR**	**95% CI**
No morbidities	0.8*	(0.7, 0.9)	0.6*	(0.5, 0.7)	0.8*	(0.7, 0.9)
One morbidity	1.2*	(1.0, 1.4)	1.0	(0.8, 1.2)	0.9	(0.7, 1.0)
Two morbidities	1.1	(0.9, 1.4)	1.2	(1.0, 1.5)	1.1	(0.9, 1.4)
Three or more morbidities	1.4*	(1.2, 1.6)	2.0*	(1.7, 2.3)	1.4*	(1.2, 1.6)

*Significantly different from comparator group ($p < 0.05$); 95% CI = 95 per cent confidence interval

To better understand the relative burden of various health conditions among individuals with overweight and obesity, Table 4 stratifies the prevalence of 15 recognized comorbidities by BMI category. The prevalence of diabetes, high blood pressure, high cholesterol, and sleep apnea were significantly higher in individuals with overweight and obesity than they were in normal-weight individuals (all *p*s < 0.05). Obesity, but not overweight, was further associated with increased prevalence of congestive heart failure, depression/anxiety, chronic pain, osteoarthritis, and heart disease as compared to normal-weight (all *p*s > 0.05). Compared to overweight, obesity was associated with a greater prevalence of diabetes, high blood pressure, high cholesterol, sleep apnea, depression/anxiety, chronic pain, and osteoarthritis (all *p*s < 0.05).

Table 4: Prevalence of comorbidities by BMI category (HQCA, 2014)

	Normal Weight (BMI 18.5-24.9)		Overweight (BMI 25-29.9)		Obese (BMI ≥ 30)	
	%	95% CI	%	95% CI	%	95% CI
Diabetes	3.0	(2.2, 4.1)	7.9*	(6.5, 9.4)	14.6*ǂ	(12.5, 17.1)
COPD	1.6	(1.1, 2.3)	3.2*	(2.4, 4.3)	2.5	(1.8, 3.6)
Asthma	8.4	(6.9, 10.2)	7.8	(6.4, 9.5)	10.2	(8.4, 12.4)
High blood pressure	10.1	(8.6, 11.7)	20.9*	(18.8, 23.2)	30.7*ǂ	(27.7, 33.8)
High cholesterol	6.5	(5.3, 7.9)	14.0*	(12.3, 16.0)*	19.0*ǂ	(16.5, 21.8)*
Sleep apnea	3.1	(2.3, 4.2)	6.4*	(5.1, 8.0)	16.9*ǂ	(14.5, 19.6)
Congestive heart failure	0.6	(0.3, 1.1)	0.8	(0.5, 1.4)	1.9*	(1.2, 2.9)
Depression or anxiety	13.5	(11.6, 15.5)	16.0	(14.0, 18.2)	21.5*ǂ	(18.8, 24.4)
Chronic pain	13.8	(12.0, 15.7)	17.0	(15.0, 19.3)	23.2*ǂ	(20.6, 26.1)
Osteoarthritis	15.2	(13.4, 17.2)	23.2*	(21.0, 25.6)	30.6*ǂ	(27.6, 33.8)
Heart disease	3.6	(2.7, 4.7)	5.4	(4.3, 6.7)	7.5*	(5.9, 9.4)
Stroke	1.0	(0.6, 1.7)	1.5	(1.0, 2.3)	2.1	(1.4, 3.2)
Cancer	3.1	(2.3, 4.1)	4.7	(3.7, 6.0)	5.1	(3.8, 6.8)
Kidney disease	2.3	(1.6, 3.3)	1.7	(1.1, 2.6)	2.3	(1.5, 3.4)
Bowel disorder/Crohn's disease or colitis	3.9	(3.0, 5.0)	4.8	(3.8, 6.1)	5.4	(4.0, 7.1)

* Significantly different from normal BMI individuals ($p < 0.05$)

ǂ Significantly different from overweight individuals ($p < 0.05$; comparing obese and overweight groups)

Regression models were used to assess the relative risk of being afflicted with each health condition in individuals with overweight and obesity (controlling for all other BMI categories, AHS zone, age, gender, education, income, and ethnicity). Table 5 illustrates the relative risk for each health condition in individuals with overweight compared to normal-weight BMI, obese compared to normal-weight BMI, and obese compared to overweight BMI.

The relative risk of diabetes, high blood pressure, high cholesterol, sleep apnea, depression/anxiety, and osteoarthritis were significantly higher in individuals with overweight as compared to a normal-weight BMI, controlling for all other BMI categories, AHS zone, age, gender, education, income, and ethnicity (all *p*s < 0.05; Table 5). In addition, individuals with an obese BMI were at greater risk than individuals with a normal-weight BMI for asthma and depression/anxiety, and at greater risk than individuals with either a normal-weight or overweight BMI for diabetes, high blood pressure, high cholesterol, sleep apnea, congestive heart failure, chronic pain, and heart disease (all *p*s < 0.05; Table 5). These findings are consistent with the literature in obesity, which suggests an association between weight and a number of other health conditions (e.g., cardiovascular disease, respiratory disorders, musculoskeletal disorders, disease of the endocrine system, as well as various psychological conditions).[58,59,60,61] Specifically, as BMI increases, so too does the risk of developing a number of chronic illnesses and diseases. These findings provide evidence of the negative health effects of having an overweight BMI and the additional negative health effects associated with obesity.

Table 5: Relative risk (RR) of individual comorbidities by BMI category (HQCA, 2014)

Comorbidity	OVERWEIGHT *versus normal*		OBESE *versus normal*		OBESE *versus overweight*	
	RR	95% CI	RR	95% CI	RR	95% CI
Diabetes	**1.9***	(1.3, 2.8)	**3.8***	(2.6, 5.5)	**2.0***	(1.6, 2.6)
COPD	**1.6**	(0.9, 2.6)	**1.0**	(0.6, 1.7)	**0.6**	(0.4, 1.0)
Asthma	**1.2**	(0.9, 1.6)	**1.4***	(1.0, 1.9)	**1.2**	(0.9, 1.6)
High blood pressure	**1.6***	(1.3, 1.9)	**2.3***	(1.9, 2.8)	**1.5***	(1.3, 1.7)
High cholesterol	**1.6***	(1.2, 2.0)	**2.1***	(1.7, 2.7)	**1.4***	(1.1, 1.7)
Sleep apnea	**1.7***	(1.1, 2.7)	**4.8***	(3.3, 7.1)	**2.8***	(2.1, 3.7)
Congestive heart failure	**0.9**	(0.4, 2.2)	**2.7***	(1.2, 5.8)	**3.0***	(1.3, 7.1)
Depression or anxiety	**1.3***	(1.1, 1.6)	**1.5***	(1.3, 1.9)	**1.2**	(1.0, 1.4)
Chronic pain	**1.1**	(0.9, 1.4)	**1.4***	(1.2, 1.7)	**1.2***	(1.1, 1.5)
Osteoarthritis	**1.3***	(1.1, 1.5)	**1.6***	(1.3, 1.8)	**1.2***	(1.1, 1.4)
Heart disease	**1.1**	(0.7, 1.6)	**1.7***	(1.1, 2.5)	**1.5***	(1.1, 2.2)
Stroke (or related)	**1.3**	(0.6, 2.8)	**1.5**	(0.7, 3.1)	**1.1**	(0.6, 2.1)
Cancer	**1.1**	(0.7, 1.7)	**1.3**	(0.8, 2.0)	**1.1**	(0.7, 1.7)
Kidney disease	**0.6**	(0.3, 1.2)	**0.8**	(0.4, 1.4)	**1.2**	(0.6, 2.3)
Bowel disorder/Crohn's disease or colitis	**1.2**	(0.8, 1.7)	**1.1**	(0.7, 1.7)	**0.9**	(0.6, 1.4)

*Significantly different from comparator group ($p < 0.05$)

4.4 Perceived health-related quality of life in overweight and obesity in Alberta

In addition to information on comorbid health conditions, the HQCA's *2014 Satisfaction and Experience with Healthcare Services* survey collected information on self-reported health-related quality of life. This was accomplished using EuroQol Group's EQ-5D™, a standardized instrument used as a measure of health outcome. The EQ-5D's five-level tool (EQ-5D-5L) is a questionnaire in which individuals are asked to rate their perceived quality of life (from level 1 'no problems' to level 5 'extreme problems') across five domains: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression.[xviii]

For all domains, severity of the problem (e.g., walking, anxiety/depression) worsened with increasing BMI. Albertans with overweight and obesity were significantly less likely to report 'no problems' with walking, usual activity, and pain/discomfort as compared to normal-weight Albertans (*p*s < 0.05). In addition, Albertans with obesity were significantly less likely to report 'no problems' with self-care as compared to normal-weight Albertans (*p*s < 0.05). Finally, Albertans with overweight and obesity were more likely to report 'slight' or 'moderate' problems with walking, usual activity, and pain/discomfort than were normal-weight Albertans (*p*s < 0.05).

[xviii] For further information about the EQ-5D-5L please refer to the HQCA's *2014 ALBERTA POPULATION NORMS FOR EQ-5D-5L* report: https://d10k7k7mywg42z.cloudfront.net/assets/542f01f2edb2f37083002e54/2014_EQ_5D_5L_report_FINALFINAL.pdf

Table 6: Self-reported perceptions of EQ-5D domains, by BMI category (HQCA, 2014)

	Normal (BMI 18.5-24.9)		Overweight (BMI 25-29.9)		Obese (BMI ≥ 30)	
	%	95% CI	%	95% CI	%	95% CI
Walking						
No problems walking?	84.8	(82.8, 86.6)	76.6*	(74.1, 78.9)	65.0*‡	(61.7, 68.1)
Slight problems walking?	10.4	(8.9, 12.2)	14.5*	(12.7, 16.6)	21.0*‡	(18.5, 23.8)
Moderate problems walking?	2.9	(2.2, 3.9)	5.9*	(4.8, 7.3)	9.7*‡	(8.0, 11.9)
Severe problems walking?	1.5	(0.9, 2.3)	2.3	(1.6, 3.3)	3.9*	(2.8, 5.3)
Are you unable to walk?	0.3	(0.1, 1.0)	0.7	(0.4, 1.4)	0.4	(0.2, 1.0)
Self-care						
No problems washing or dressing yourself?	96.1	(94.9, 97.0)	95.0	(93.7, 96.1)	92.9*	(91.0, 94.3)
Slight problems washing or dressing yourself?	2.6	(1.9, 3.6)	3.0	(2.2, 4.1)	4.7	(3.5, 6.2)
Moderate problems washing or dressing yourself?	0.8	(0.5, 1.4)	1.5	(0.9, 2.4)	2.0	(1.2, 3.2)
Severe problems washing or dressing yourself?	0.3	(0.1, 0.8)	0.1	(0.1, 0.4)	0.1	(0.0, 0.3)
Are you unable to wash or dress yourself?	0.2	(0.0, 1.0)	0.3	(0.1, 0.9)	0.4	(0.1, 1.0)
Usual activities						
No problems doing your usual activities?	82.4	(80.2, 84.5)	77.2*	(74.7, 79.6)	69.5*‡	(66.3, 72.5)
Slight problems doing your usual activities?	11.2	(9.6, 13.0)	14.4	(12.5, 16.6)	17.7*	(15.3, 20.4)
Moderate problems doing your usual activities?	4.4	(3.4, 5.7)	6.4	(5.2, 8.0)	8.7*	(7.1, 10.6)
Severe problems doing your usual activities?	1.0	(0.6, 1.8)	1.2	(0.7, 1.9)	2.4	(1.6, 3.7)
Are you unable to do your usual activities?	0.9	(0.5, 1.7)	0.7	(0.4, 1.3)	1.7	(1.1, 2.7)
Pain/discomfort						
No pain or discomfort?	50.0	(47.2, 52.9)	41.9*	(39.0, 44.9)	33.0*‡	(29.7, 36.5)
Slight pain or discomfort?	33.5	(30.9, 36.3)	38.5	(35.7, 41.4)	37.4	(34.1, 40.8)
Moderate pain or discomfort?	12.3	(10.6, 14.2)	14.8	(13.0, 16.9)	21.6*‡	(19.0, 24.4)
Severe pain or discomfort?	2.8	(2.1, 3.9)	3.5	(2.6, 4.7)	5.5*	(4.2, 7.2)
Extreme pain or discomfort?	1.3	(0.8, 2.2)	1.2	(0.8, 2.0)	2.5	(1.6, 3.9)
Anxiety/depression						
Not anxious or depressed?	67.1	(64.3, 69.8)	70.3	(67.5, 72.9)	62.7‡	(59.2, 66.0)
Slightly anxious or depressed?	23.1	(20.8, 25.7)	19.7	(17.4, 22.2)	21.2	(18.5, 24.1)
Moderately anxious or depressed?	7.5	(6.1, 9.2)	7.2	(5.9, 8.8)	12.6*‡	(10.5, 15.1)
Severely anxious or depressed?	1.5	(1.0, 2.3)	1.7	(1.1, 2.7)	2.4	(1.5, 3.8)
Extremely anxious or depressed?	0.7	(0.4, 1.4)	1.1	(0.7, 1.9)	1.1	(0.5, 2.3)

* Significantly different from normal BMI individuals ($p < 0.05$)

‡ Significantly different from overweight individuals ($p < 0.05$; comparing obese and overweight groups)

The EQ-5D also provides a measure of overall health-related quality of life, using a visual analogue scale (VAS), by which respondents rate their health status on a scale of 0 (worst imaginable health state) to 100 (best imaginable health state). Findings from the HQCA's *2014 Satisfaction and Experience with Healthcare Services* survey showed that individuals with overweight and obesity self-reported a significantly lower mean EQ-5D VAS rating as compared to normal-weight individuals (i.e., individuals with overweight and obesity reported having significantly worse overall health-related quality of life than did normal-weight individuals; all *p*s < 0.05). In addition, individuals with obesity self-reported a

significantly lower mean EQ-5D VAS rating as compared to individuals with overweight ($p < 0.05$). EQ-5D VAS scores for the three BMI categories are:

- Normal weight BMI: 81.0 (95% CI: 80.1–81.8)
- Overweight BMI: 78.6 (95% CI: 77.8–79.5)
- Obese BMI: 72.7 (95% CI: 71.5–73.8)

The results of the VAS scores are shown in Figure 3; these scores were consistent with the limited literature available on BMI and self-reported quality of life as measured by the EQ-5D, which has shown lower self-rated quality of life among those with a higher BMI.[8,9]

Figure 3: Mean score for EQ-5D VAS health-related quality-of-life measures, by BMI category (HQCA, 2014)

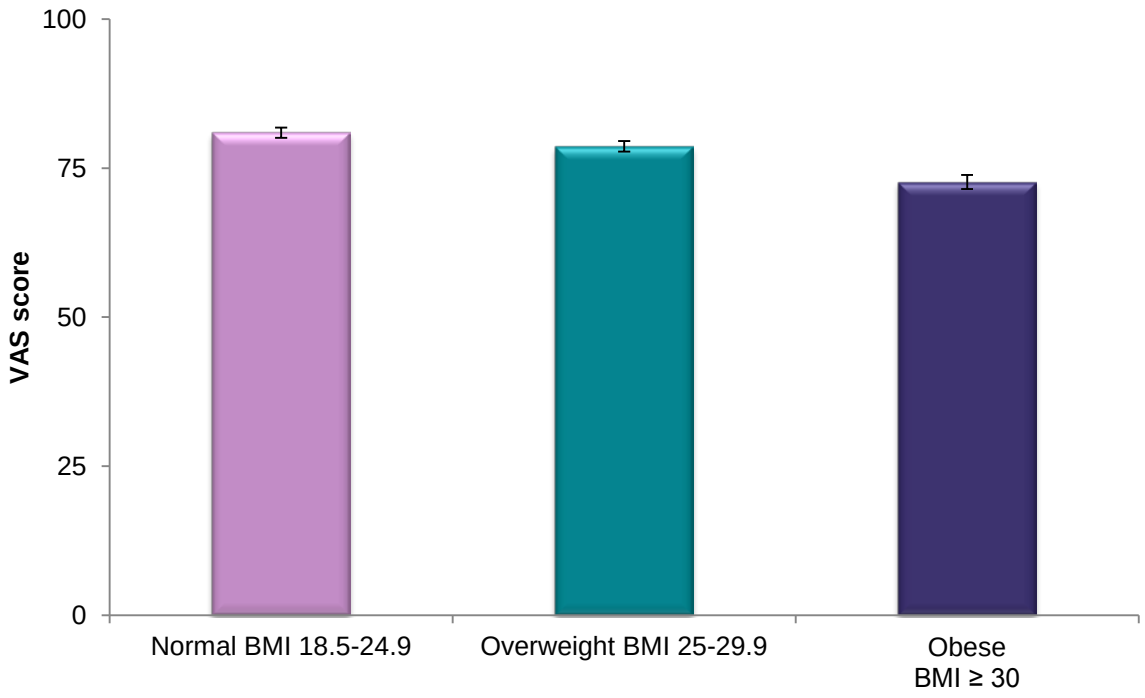


Table 7 illustrates the change in relative risk for each unit change in VAS for individuals with an overweight BMI as compared to a normal-weight BMI, for individuals with an obese BMI as compared to a normal-weight BMI, and for individuals with an obese BMI as compared to an overweight BMI (controlling for all other BMI categories, geographical region, age, gender, education, income, and ethnicity). The results showed evidence for a decrease in self-reported, health-related quality of life in individuals with an overweight BMI as compared to a normal-weight BMI, and also in individuals with an obese BMI as compared to both normal-weight and overweight BMIs (*p*s < 0.05; Table 7).

Table 7: Relative risk for EQ-5D VAS health-related quality-of-life measures, by BMI category (HQCA, 2014)

	OVERWEIGHT *versus normal*		**OBESE** *versus normal*		**OBESE** *versus overweight*	
	RR	**95% CI**	**RR**	**95% CI**	**RR**	**95% CI**
VAS health-related quality of life	**0.98***	(0.97, 1.00)	**0.92***	(0.90, 0.94)	**0.94***	(0.92, 0.96)

* Significantly different from comparator group ($p < 0.05$)

4.5 Mortality associated with overweight and obesity

In addition to increased prevalence of comorbid illnesses and decreased quality of life, an association between obesity and increased mortality rates has been suggested in several studies. Calculating mortality attributable to obesity is complicated. The risk of death as reported in the studies varies, depending on the population characteristics (e.g., age) and risk factors included in the analyses. Additionally, there exists the challenge of isolating the contribution of excess body weight from that of other related risk factors, comorbidities, and confounding variables. Given the complexities of understanding mortality associated with excess weight, paired with the fact that mortality data were not collected as part of the HQCA's *2014 Satisfaction and Experience with Healthcare Services* survey, this section provides only a brief discussion of pertinent literature.

A review of the literature identified 16 studies that reported mortality rates in overweight and obesity;[58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75] however, only one of these studies was Canadian.[68] Full evidence tables of the included studies are provided in Appendix II.

To date, the literature suggests that BMI is associated with mortality, although not consistently across all categories (i.e., the risk does not increase in a linear fashion as BMI increases). For example, a Canadian study used population-health survey data over a 12-year time period to compare the risk of mortality across BMI categories, using normal-weight as the reference category. This study[68] showed that the individuals' risk of mortality varied by BMI category compared to normal-weight:

- Risk significantly decreased for overweight (RR = 0.8, $p < 0.05$).
- No increased risk for obesity class I (BMI 30 – 34.9; RR = 1.0, $p > 0.05$).
- Risk significantly increased for obesity class II and higher (BMI ≥ 35; RR = 1.4, $p < 0.05$).

The risk of mortality reported in the Canadian study[44] was similar to other recent American and European studies,[60,62,64,65,66,67,68,76] with several studies reporting no increased risk of mortality among

overweight individuals.[58,62,64,67] In contrast, another American study noted that mortality in the United States between 1986 and 2006 was significantly associated with overweight and obesity (Class I, II, and III).[71] Signifying the complexity of the question of excess weight on mortality, the study also reported that the strength of the association between BMI and mortality varied greatly by age, sex, and race/ethnicity.[71] Several additional studies explored the differences in cause-specific mortality (e.g., all-cause mortality versus mortality due to cardiovascular disease, cancer, diabetes, or stroke) across BMI groups, noting the risks for cause-specific mortality varied by BMI.[60,62,66,70,73]

4.6 Summary

Overweight and obesity result from complex interactions of personal and societal risk factors, along with an individual's health status.[6] According to data from the HQCA's *2014 Satisfaction and Experience with Healthcare Services* survey, these risk factors include age (compared to those 18–25 years, those 25–44 were at greater risk of being overweight and obese), gender (males were at greater risk of being overweight and obese compared to females), living in the AHS North or South zones compared to the Calgary Zone, and having no post-secondary education. Income and ethnicity were not significantly associated with overweight or obesity in Alberta's population.

Examining the health burden of overweight and obesity in Alberta (HQCA's *2014 Satisfaction and Experience with Healthcare Services* survey) showed that the prevalence of diabetes, high blood pressure, high cholesterol, sleep apnea, congestive heart failure, depression/anxiety, chronic pain, osteoarthritis, and heart disease is higher in those who have overweight or obese BMIs than in those of normal BMI (significant at $p < 0.05$). Regression modelling showed that the risk of experiencing asthma, diabetes, high blood pressure, high cholesterol, sleep apnea, congestive heart failure, chronic pain, depression/anxiety, and heart disease were significantly higher for Albertans with an obese as compared to normal-weight BMI. In addition, the risk of experiencing diabetes, high blood pressure, high cholesterol, sleep apnea, congestive heart failure, chronic pain, and heart disease were significantly higher for Albertans with an obese as compared to overweight BMI. This suggests that, as BMI increases so too does the burden of illness associated with excess weight. In addition, results of the HQCA's *2014 Satisfaction and Experience with Healthcare Services* survey further showed evidence of decreased health-related quality of life among those Albertans with a higher BMI.[8,9]

5.0 OVERWEIGHT- AND OBESITY-RELATED USE OF THE HEALTHCARE SYSTEM IN ALBERTA

The obesity literature suggests that, from a public health perspective, one of the key impacts associated with adult obesity is a more frequent use of healthcare services due to increased risk for several chronic conditions (e.g., Type 2 diabetes, hypertension, and cardiovascular disease).[3] The following section briefly examines overweight- and obesity-related use of the healthcare system in Alberta.

The HQCA's *2014 Satisfaction and Experience with Healthcare Services* survey collected information on self-reported use of the healthcare system, including level of system use and severity of health issues requiring attention. Findings from this set of questions are presented here.

5.1 Healthcare system usage in Alberta

Individuals with obesity were significantly more likely to have used the healthcare system within the two months prior to responding to the survey than were individuals with normal-weight (58.7% versus 51.5%, respectively; $p < 0.05$) or overweight BMIs (53.2%; $p < 0.05$). Individuals with a normal-weight BMI and individuals with an overweight BMI were equally likely to have used the healthcare system in the last two months ($p > 0.05$). Over the previous year, however, there were no significant differences among the three weight classes in their use of the healthcare system ($p > 0.05$).

Table 8: Most recent contact with Alberta healthcare system, by BMI category (HQCA, 2014)

	Normal (BMI 18.5-24.9)		Overweight (BMI 25-29.9)		Obese (BMI ≥ 30)	
	%	95% CI	%	95% CI	%	95% CI
0 to 2 months	51.5	(48.6, 54.4)	53.2	(50.3, 56.2)	58.7*	(55.2, 62.2)
3 to 4 months	16.7	(14.7, 19.0)	17.2	(15.0, 19.6)	18.6	(16.0, 2.1)
5 to 6 months	9.7	(8.1, 11.5)	9.8	(8.1, 11.7)	7.2	(5.5, 9.3)
7 to 8 months	3.3	(2.4, 4.4)	3.7	(2.7, 5.0)	2.9	(2.0, 4.3)
9 to 10 months	3.7	(2.8, 5.0)	2.1	(1.4, 3.1)	3.4	(2.3, 5.1)
11 to 12 months	4.3	(3.2, 5.7)	4.1	(3.1, 5.6)	1.9	(1.1, 3.3)
Used the healthcare system in the past 12 months	89.2	(87.2, 91.0)	90.1	(88.1, 91.8)	92.7	(90.5, 94.5)

* Significantly different from normal BMI individuals ($p < 0.05$)

ǂ Significantly different from overweight individuals ($p < 0.05$; comparing obese and overweight groups)

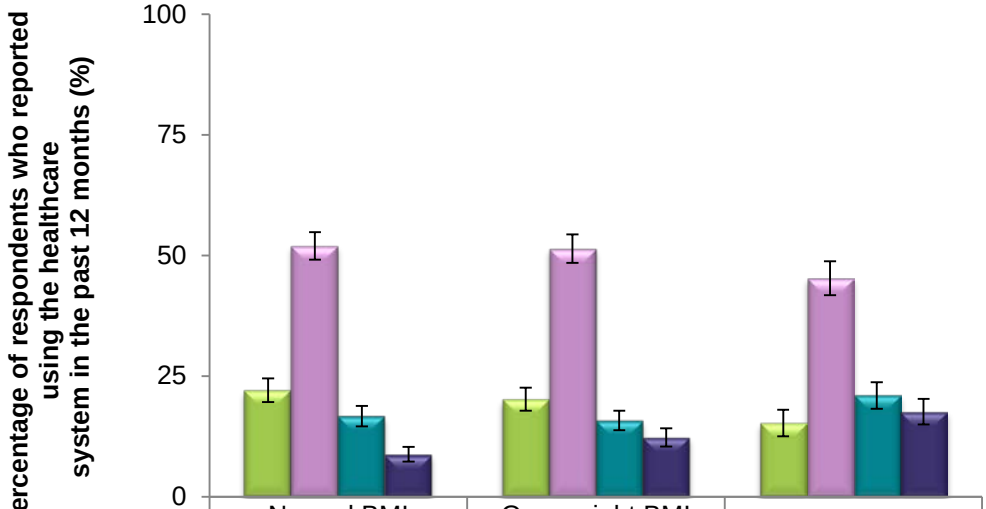
5.1.1 Severity of health issues requiring attention for overweight and obesity in Alberta

Survey participants were asked to describe their level of involvement with the healthcare system over the past 12 months according to one of four scenarios: (1) no health issues and have never or hardly used health services; (2) minor health issues that resolved quickly, were not life-threatening, or used routine healthcare services; (3) more serious health issues that might have required a surgery, hospitalization, overnight hospital procedure, or care and treatment by a specialist; or (4) serious ongoing or long-term health issues, which require frequent use of health services, and which affect quality of life.

Overall, as compared to Albertans with overweight and normal-weight BMIs, Albertans with obesity self-reported more severe issues that required use of health services (Figure 4):

- No health issues and have never or hardly used health services:
  - 22.1 per cent normal-weight, 20.2 per cent overweight, and 15.3 per cent obese (significant difference between normal-weight and obese; $p < 0.05$)
- Minor health issues that resolved quickly, were not life-threatening, or used routine healthcare services (this might include a routine visit or check-up):
  - 52.0 per cent normal-weight, 51.4 per cent overweight, and 45.3 per cent obese (significant difference between normal-weight and obese; $p < 0.05$)
- More serious health issues that might have required a surgery, hospitalization, overnight hospital procedure, or care and treatment by a specialist:
  - 16.7 per cent normal-weight, 15.9 per cent overweight, and 21.0 per cent obese (significant difference between overweight and obese; $p < 0.05$)
- Serious ongoing or long-term health issues, which require frequent use of health services, and which affect their quality of life:
  - 8.9 per cent normal-weight, 12.3 per cent overweight, and 17.6 per cent obese (significant differences across all BMI categories, $ps < 0.05$)

Figure 4: Involvement with the healthcare system in the previous 12 months by BMI category (HQCA, 2014)

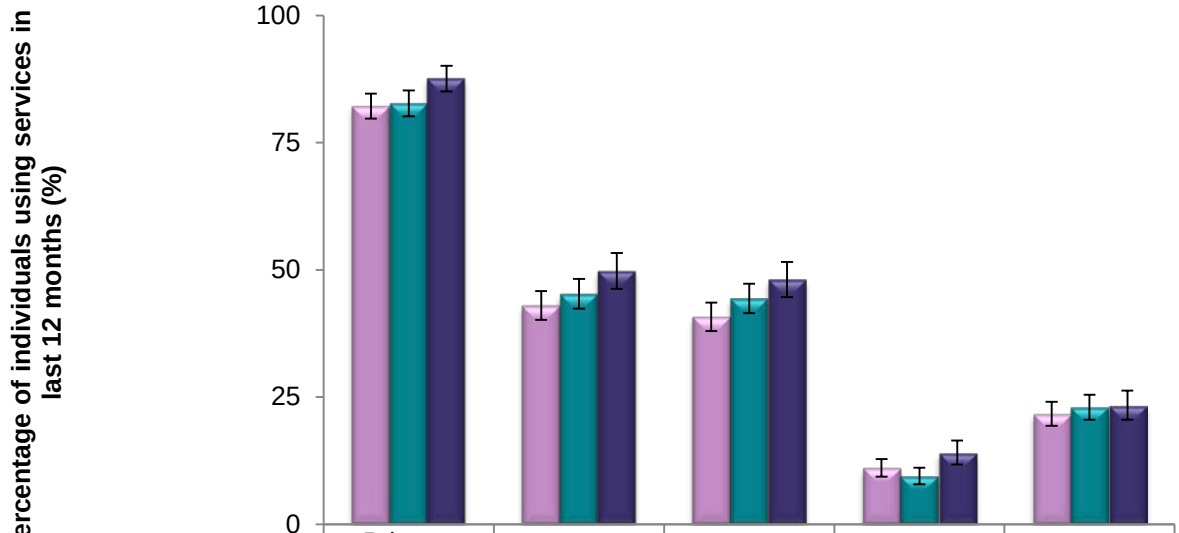


	Normal BMI 18.5-24.9	Overweight BMI 25-29.9	Obese BMI ≥ 30
No health issues	22.1	20.2	15.3
Minor health issues	52.0	51.4	45.3
More serious health issues	16.7	15.8	21.0
Serious ongoing or long-term health issues	8.8	12.3	17.6

5.2 Hospital, emergency department, and physician visits among Albertans with overweight and obesity

Although no greater use of healthcare services was evident overall, a significantly greater number of Albertans with an obese BMI reported that they had visited their primary care physician within the past 12 months compared to normal-weight individuals (87.6% and 82.2%, respectively; $p < 0.05$). Additionally, a significantly greater number of Albertans with obesity reported that they had used an emergency department and/or a specialist office than did normal-weight Albertans (emergency department use: 43.0% of Albertans with a normal-weight BMI versus 49.8% of Albertans with an obese BMI; specialist use: 40.8% of Albertans with a normal-weight BMI versus 48.1% of Albertans with an obese BMI; *p*s < 0.05). There were no significant differences between individuals with overweight and normal-weight BMIs in whether they had visited a primary care physician, emergency department, or specialist in the past 12 months ($p > 0.05$). There were no significant differences in inpatient or outpatient service usage among the three weight categories (inpatient: 11.1% of normal-weight, 9.5% of overweight, and 14.1% of Albertans with obesity; outpatient: 21.7% of normal-weight, 23.0% of overweight, and 23.4% of Albertans with obesity; all *p*s > 0.05; Figure 5).

Figure 5: Percentage of Albertans reporting healthcare services use by BMI categories (HQCA, 2014)



	Primary Care Physician	Emergency department	Specialist	Inpatient	Outpatient
Normal BMI 18.5-24.9	82.2	43.0	40.8	11.1	21.7
Overweight BMI 25-29.9	82.7	45.3	44.4	9.5	23.0
Obese BMI ≥ 30	87.6	49.8	48.1	14.1	23.4

In terms of the actual number of medical visits, individuals with obesity visited a primary care physician significantly more frequently than did normal-weight individuals over the 12-month period ($p < 0.05$; Table 9). Across primary care physician, emergency department, and specialist visits, individuals with obesity made an average of 12.4 visits in the previous year; significantly more than the 10.5 visits made by normal-weight individuals ($p < 0.05$), and the 10.1 by overweight individuals ($p < 0.05$). There was no significant difference in the average number of medical visits between individuals with overweight BMI and normal-weight BMI ($p > 0.05$).

Table 9: Number of visits to primary care physician, emergency department, specialist by BMI category (HQCA 2014)

Within the last year, number of visits to…	Normal (BMI 18.5-24.9)		Overweight (BMI 25-29.9)		Obese (BMI ≥ 30)	
	visits	95% CI	visits	95% CI	visits	95% CI
Primary care physician	5.9	(5.3, 6.6)	6.2	(5.6, 6.8)	7.6*	(6.8, 8.4)
Emergency department	1.0	(0.9, 1.2)	1.1	(0.9, 1.2)	1.2	(1.0, 1.4)
Specialist	3.6	(3.0, 4.2)	2.8	(2.6, 3.1)	3.5	(3.0, 4.1)

* Significantly different from normal BMI individuals ($p < 0.05$)

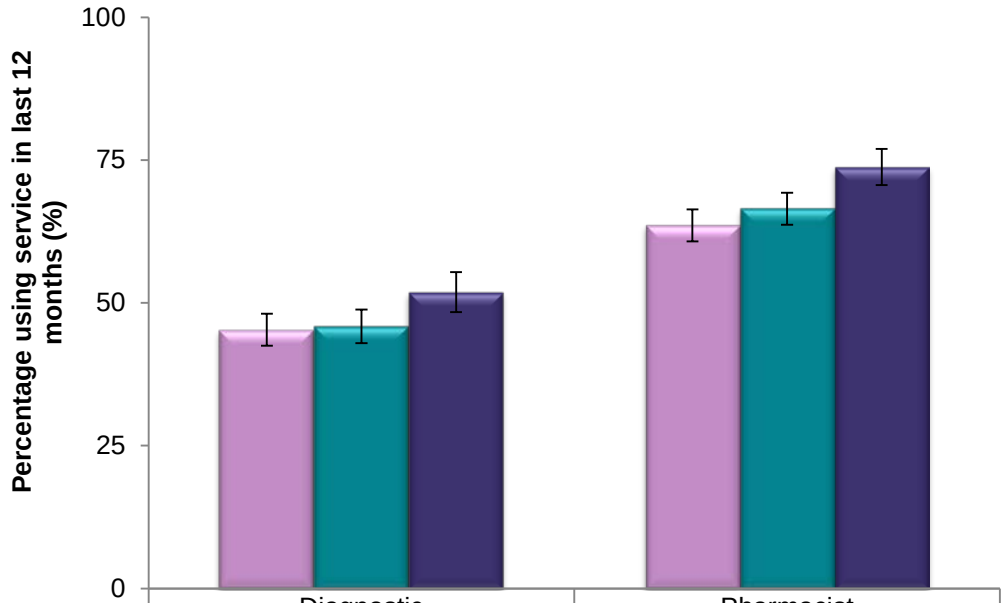
ǂ Significantly different from overweight individuals ($p < 0.05$; comparing obese and overweight groups)

5.3 Pharmacy and diagnostic services use among Albertans with overweight and obesity

Studies exploring prescription and laboratory use across BMI categories have generally found that drug expenses and laboratory use increase as BMI increases (and increase steeply among those with a BMI ≥ 30), suggesting an increased use of these types of healthcare services in individuals with an obese as compared to normal-weight BMI.[77,78,79,80,81]

Consistent with findings from the literature, the HQCA's *2014 Satisfaction and Experience with Healthcare Services* survey results showed a greater use of diagnostic services among those Albertans with an obese BMI as compared to those having a normal-weight BMI ($p < 0.05$; Figure 6), and a greater use of pharmaceutical services among those Albertans with an obese BMI as compared to those having either overweight or normal-weight BMIs ($ps < 0.05$). There were no significant differences between normal and overweight BMI patients with respect to self-reported use of pharmacy and diagnostic services ($p > 0.05$).

Figure 6: Percentage of Albertans reporting diagnostic or pharmacist services use by BMI categories (HQCA 2014)



	Diagnostic	Pharmacist
Normal BMI 18.5-24.9	45.3	63.6
Overweight BMI 25-29.9	45.9	66.5
Obese BMI ≥ 30	51.9	73.8

5.4 Summary

Results of the HQCA's *2014 Satisfaction and Experience with Healthcare Services* survey showed significant variation in the use of healthcare services by Albertans with obesity (and in some cases overweight) as compared to normal-weight Albertans. For example, there were significant differences across BMI categories for those who reported that they use the healthcare system for 'more serious' and 'serious ongoing/long-term problems'. Specifically, compared to normal-weight and overweight individuals, a higher percentage of Albertans with obesity self-reported using the healthcare system for 'more serious' and 'serious ongoing/long-term problems' ($ps < 0.05$). Compared to normal-weight and overweight individuals, a significantly greater percentage of Albertans with obesity self-reported using primary care physicians, emergency departments, specialists, diagnostic services, and pharmaceuticals in the previous12 months. Of particular note, the number of primary care physician visits, but not emergency department or specialist visits, was significantly higher for Albertans with an obese BMI as compared to those having a normal-weight BMI ($p < 0.05$).

Together with findings outlined in previous sections of this report, these findings highlight the notion that overweight and obesity pose an important health issue for all Albertans; overweight and obesity are related to a significant health burden, decreased health-related quality of life, and more frequent use of primary care services in the province. The Alberta healthcare system may have an important role in providing preventive and weight-management services for overweight and obese patients[xix]. The following sections provide a discussion of weight management in the Alberta healthcare system, again drawing on data from the HQCA's *2014 Satisfaction and Experience with Healthcare Services* survey.

[xix] Although this report defines "obesity" as BMI greater than 30 kg/m^2, there is also evidence to suggest that there is an incremental increase in morbidity and mortality with more severe BMI levels (35 and greater) with the highest levels of morbidity and mortality at higher BMIs. This is of concern as the latest Canadian data show that there is a disproportionate growth in excessive weight categories (BMI ≥ 35; see Twells et al, CMAJ 2014). This subset of obese patients will account for a major proportion of obesity related costs, and prevention or treatment of severe of obesity may be an area of focus that could result in the greatest benefit to the individual and to the healthcare system.

6.0 WEIGHT MANAGEMENT IN THE HEALTHCARE SYSTEM: A ROLE FOR PRIMARY HEALTHCARE

The Alberta healthcare system can be grouped into three levels of care: primary, secondary, and tertiary. Primary healthcare[xx] provides person-focused care over time, including health and wellness promotion, disease and injury prevention, diagnosis and treatment of short-term acute health issues, referral of more complex issues, ongoing management of chronic conditions, and co-ordination with other levels of care.[14,82] Primary healthcare encompasses a range of services and models of care that rely on primary care physicians, other healthcare professionals, and non-medical healthcare providers. Primary healthcare places strong emphasis on the healthcare team and factors influencing health, such as addressing social determinants of health by connecting people with social supports that influence their health status.[83,84]

Compared to primary healthcare, secondary and tertiary care services are more complex and specialized, and care is typically provided over a shorter time frame. For example, secondary care normally involves short-term, periodic consultation from a specialist to provide expert opinion and/or surgical or other advanced interventions that primary care physicians are not equipped to perform.[85] Secondary care may include hospitalization, routine surgery, specialty consultation, or rehabilitation. Tertiary care is an even more complex level of care, most often needed for conditions that are relatively uncommon or unusual. Typically, tertiary care is institution based, highly specialized, and technology driven.[85] Examples include trauma care, burn treatment, neonatal intensive care, tissue transplants, and open-heart surgery.

As discussed in previous sections of this report, obesity results from a complex interaction of individual and societal risk factors, and is linked to decreased quality of life, increased comorbidity, and increased healthcare system use. As a result, mitigating overweight and obesity in the Albertan population represents an important area of focus for the current healthcare system. The question remains: Which area of the healthcare system is best suited to effectively influence weight management in the Albertan population?

Because of the unique role primary healthcare plays in health promotion, disease prevention, and co-ordination of patient care, primary healthcare may be well positioned within the healthcare system to manage overweight and obesity. Specifically, primary care physicians are most often patients' first contact with the healthcare system and the provider who helps to direct patients toward appropriate resources and social supports (e.g., public health nurse, dietician, nutritionist), and who coordinate patient care across multiple healthcare disciplines, including care for many of the diseases and/or illnesses that have been shown to be associated with obesity. Primary healthcare is involved with patients across all stages of their lifespan, allowing primary healthcare providers to engage in preventive measures against overweight and obesity and to use a long-term, patient-centred approach to address obesity in patients struggling with weight management.

[xx] In contrast to primary healthcare, primary care refers to the same level of health system, but is traditionally organized around healthcare services provided by a primary care physician.

Indeed, there has been a considerable amount of research into the effects of primary healthcare on health and the health system. A literature review that considered international research found:[14]

- An association between access to primary care and improved health outcomes (i.e., all-cause mortality, heart disease mortality, stroke mortality, infant mortality, infant low birth weight, life expectancy, and self-rated health).
- An association between greater access to primary care physicians and disease-focused (e.g., early detection of common cancers such as breast, colon, cervical, and melanoma) and general preventive care (e.g., breast-feeding, smoking cessation, physical activity, healthy eating).
- Lower overall healthcare costs and generally better health outcomes in countries with strong primary healthcare systems.
    - Primary care was consistently associated with lower rates of hospitalization for conditions that should be preventable by exposure to primary care (e.g., ambulatory care-sensitive conditions).
    - Care for illnesses common in the population was less costly when patients were cared for by a primary care physician rather than a specialist.
- Primary care physicians are effective in delivering person-focused rather than disease-focused care, which is important for patients who have multiple conditions.

This section of the report focuses on the role of the primary healthcare team (e.g., primary care physician and/or medical assistants, nurses, nurse practitioners, lifestyle coaches, nutritionists, exercise specialists, dieticians, counsellors, and community health educators) in addressing weight management in the population. Due to current limitations of the health data systems in Alberta, as well as a limitation in the overweight and obesity literature in general, the following analysis was limited to the use of in-person contact between the patient and a primary care physician as an indicator of involvement with the primary healthcare system. Following this discussion, the relationship between team-based care – including physicians, nurses, care co-ordinators, dieticians, exercise therapists, etc. – and care focused on overweight and obesity in Alberta is examined.

6.1 Relationship between use of primary care services and overweight and obesity in Alberta

As reported in the HQCA's *2014 Satisfaction and Experience with Healthcare Services* survey, individuals with obesity were 1.07 times as likely to have had an appointment with their primary care physician within the previous 12 months as compared to individuals with a normal-weight BMI ($p < 0.05$), and 1.05 times as likely to have had an appointment with their primary care physician as compared to individuals with an overweight BMI ($p < 0.05$), controlling for all other BMI categories, geographical region, age, gender, education, income, and ethnicity.

Table 10: Primary care physician use, by BMI category (HQCA 2014)

Within the past year:	OVERWEIGHT *versus Normal*		OBESE *versus Normal*		OBESE *versus Overweight*	
	RR	95%CI	RR	95%CI	RR	95%CI
Appointment with primary care physician	1.01	(0.97, 1.06)	1.07*	(1.02, 1.11)	1.05*	(1.01, 1.10)

*Significantly different from comparator group ($p < 0.05$)

The HQCA's survey looked at the availability of the personal primary care physician (for those who indicated they had one) when required for the individual's healthcare. The percentage of Albertans who felt that, when needed, their personal primary care physician was available, at least to some extent, was not significantly different based on weight class (93.8% of normal BMI, 94.6% of overweight, 94.2% of obese), indicating the general availability of personal primary care physicians to assist in their patients' care when needed.

Table 11: Availability of personal primary care physician to assist in their patients' care when needed, by BMI category (HQCA 2014)

Personal primary care physician was available:	Normal (BMI 18.5-24.9)		Overweight (BMI 25-29.9)		Obese (BMI ≥ 30)	
	%	95% CI	%	95% CI	%	95% CI
Yes	62.6	(59.3, 65.7)	64.8	(61.5, 68.0)	62.5	(58.7, 66.1)
Yes, to some extent	31.2	(28.2, 34.3)	29.8	(26.8, 33.0)	31.7	(28.3, 35.4)
No	6.2	(4.9, 7.9)	5.4	(4.0, 7.1)	5.8	(4.3, 7.8)

* Significantly different from normal BMI individuals ($p < 0.05$)

ǂ Significantly different from overweight individuals ($p < 0.05$; comparing obese and overweight groups)

Despite a relatively high availability of personal primary care physicians to assist in their patients' care when needed across all BMI categories, there exists a gap in the care for individuals with overweight and obesity with regard to the advice received during such appointments. Table 12 shows the percentage of individuals for each weight category who felt their primary care physician had discussed elements directly relevant to their weight management. Although individuals with overweight and obesity were significantly more likely to report that their primary care physician had talked to them about exercise, physical activity, diet, and healthy eating during their appointments than were individuals with a

normal-weight BMI (all *ps* < 0.05), approximately one-half to one-third of individuals with overweight and obesity still reported that their primary care physician did not talk to them about those factors that are strongly linked to weight loss (i.e., exercise, physical activity, diet, and healthy eating habits).

Table 12: Topic of discussion between respondent and primary care physician by BMI category (HQCA 2014)

Personal primary care physician…	Normal (BMI 18.5-24.9)		Overweight (BMI 25-29.9)		Obese (BMI ≥ 30)	
	%	95% CI	%	95% CI	%	95% CI
Talked about exercise and physical activity	48.7	(45.4, 52.1)	63.3*	(60.0, 66.5)	67.8*	(64.2, 71.3)
Talked about diet and healthy eating habits	36.0	(32.9, 39.2)	51.6*	(48.2, 55.0)	61.4*‡	(57.6, 65.1)

* Significantly different from normal BMI individuals ($p < 0.05$)

‡ Significantly different from overweight individuals ($p < 0.05$; comparing obese and overweight groups)

It has been shown that overweight and obesity are associated with an increased burden of comorbidity and a decrease in quality of life (see Section 4). As a result, health maintenance and illness prevention for this population are of particular importance; aiming to mitigate potential issues before any need for secondary and tertiary care.

In the HQCA's *2014 Satisfaction and Experience with Healthcare Services* survey, Albertans were asked questions about their personal primary care physician's role in maintaining health and preventing illness, shown in Table 13. Whereas the overall healthcare system usage statistics indicated that 92.7 per cent of individuals with obesity used the healthcare system in the previous year (Table 8), only 44.6 per cent of these individuals indicated that they needed their personal primary care physician's help in illness prevention in the previous year. For the same time period, although 90.1 per cent of individuals with an overweight BMI had some degree of system contact in the year, only 35.4 per cent of these individuals indicated that they felt they needed their primary care physician's help (Table 8).

Where respondents indicated they needed their personal primary care physician's help in making changes to prevent illness, the vast majority indicated that their physician provided the necessary assistance (93.6% of overweight individuals, 92.4% of obese individuals; Table 13). This indicates that when their help is needed, primary care physicians are providing the assistance that individuals with overweight and obesity feel they need to make changes to prevent illness.

Table 13: Topic of discussion between respondent and primary care physician, by BMI category (HQCA 2014)

Personal primary care physician…	Normal (BMI 18.5-24.9)		Overweight (BMI 25-29.9)		Obese (BMI ≥ 30)	
	%	95% CI	%	95% CI	%	95% CI
Was needed to help in making changes to prevent illness	32.7	(29.7, 35.9)	35.4	(32.3, 38.7)	44.6*‡	(40.8, 48.4)
Provided needed help	93.4	(90.3, 95.6)	93.6	(90.0, 95.9)	92.4	(88.4, 95.0)
Encouraged discussion of all health concerns	71.3	(68.2, 74.2)	73.5	(70.4, 76.3)	76.5	(73.2, 79.6)

* Significantly different from normal BMI individuals ($p < 0.05$)

‡ Significantly different from overweight individuals ($p < 0.05$; comparing obese and overweight groups)

6.2 Relationship between team-based care and overweight and obesity in Alberta

Team-based care co-ordination may be particularly important for overweight and obese patients who are more likely than normal-weight individuals to have multiple comorbidities and require treatment by a team of professionals to effectively manage their health.

In the HQCA's *2014 Satisfaction and Experience with Healthcare Services* survey, 22.9 per cent of individuals with a normal-weight BMI, 28.7 per cent of individuals with an overweight BMI, and 33.8 per cent of individuals with an obese BMI reported receiving regular healthcare from a coordinated team of healthcare providers within the previous 12 months. Individuals with overweight and obesity were 1.4 and 1.5 times as likely to have regularly received healthcare from a coordinated team of healthcare providers as compared to individuals with a normal-weight BMI (controlling for all other BMI categories, geographical region, age, gender, education, income, and ethnicity, $p < 0.05$).

Table 14: Healthcare team use by BMI category (HQCA 2014)

Within the past year:	OVERWEIGHT *versus Normal*		OBESE *versus Normal*		OBESE *versus Overweight*	
	RR	95% CI	RR	95% CI	RR	95% CI
Regularly received healthcare from a coordinated team of healthcare providers	1.4*	(1.1, 1.6)	1.5*	(1.3, 1.8)	1.1	(1.0, 1.3)

* Significantly different from comparator group ($p < 0.05$)

The HQCA's 2014 survey asked Albertans who had access to a healthcare team if their healthcare team effectively coordinated care as a team. The percentage of Albertans who agreed did not differ significantly based on weight category (88.6% of normal-weight, 92.4% of overweight, 93.0% of obese; all *p*s > 0.05), indicating that Albertans using healthcare teams were generally happy with the effectiveness of their team in coordinating care.

Table 15: Healthcare team coordination by BMI category (HQCA 2014)

Healthcare team effectively coordinated care:	Normal (BMI 18.5-24.9)		Overweight (BMI 25-29.9)		Obese (BMI ≥ 30)	
	%	95% CI	%	95% CI	%	95% CI
Agree (4 or 5 out of 5)	88.6	(82.9, 92.5)	92.4	(86.7, 95.8)	93.0	(87.5, 96.2)
Disagree (1 or 2 out of 5)	11.4	(7.5, 17.1)	7.6	(4.2, 13.3)	7.0	(3.9, 12.6)

* Significantly different from normal BMI individuals ($p < 0.05$)

ǂ Significantly different from overweight individuals ($p < 0.05$; comparing obese and overweight groups)

Similarly, the percentage of Albertans who felt that all members of the healthcare team were fully informed and up to date on their healthcare plan (Table 16) did not differ significantly based on weight category ($ps > 0.05$). In addition, the percentage of Albertans who felt that the team worked together with the patient toward the same treatment goal (Table 17) did not differ significantly based on weight category ($ps > 0.05$).

Table 16: Healthcare team informed and up to date on care plan, by BMI category (HQCA 2014)

Healthcare team informed and up to date on care plan:	Normal (BMI 18.5-24.9)		Overweight (BMI 25-29.9)		Obese (BMI ≥ 30)	
	%	95% CI	%	95% CI	%	95% CI
Agree (4 or 5 out of 5)	88.0	(82.4, 92.0)	91.8	(86.7, 95.1)	87.6	(81.1, 92.1)
Disagree (1 or 2 out of 5)	12.0	(8.0, 17.6)	8.2	(4.9, 13.4)	12.4	(7.9, 18.9)

* Significantly different from normal BMI individuals ($p < 0.05$)

ǂ Significantly different from overweight individuals ($p < 0.05$; comparing obese and overweight groups)

Table 17: Worked together with patient toward same treatment goal, by BMI category (HQCA 2014)

Worked together with patient toward same treatment goal:	Normal (BMI 18.5-24.9)		Overweight (BMI 25-29.9)		Obese (BMI ≥ 30)	
	%	95% CI	%	95% CI	%	95% CI
Agree (4 or 5 out of 5)	93.0	(88.2, 95.9)	95.8	(91.3, 98.0)	93.9	(88.9, 96.8)
Disagree (1 or 2 out of 5)	7.0	(4.1, 11.8)	4.2	(2.0, 8.7)	6.1	(3.2, 11.1)

* Significantly different from normal BMI individuals ($p < 0.05$)

ǂ Significantly different from overweight individuals ($p < 0.05$; comparing obese and overweight groups)

There were significant differences between weight categories in whether individuals said that all members of their healthcare team were located in the same clinic. Specifically, significantly fewer individuals with obese BMIs reported that their healthcare team was centralized (40.0%) as compared to individuals with normal-weight and overweight BMIs (56.6% and 56.2%, respectively; $p < 0.05$, Table 18). It is possible that the needs of individuals with obesity span a broader range of healthcare services, such as primary healthcare (e.g., physician, nurse, care co-ordinator, dietician, exercise therapist, etc.),

secondary care (e.g., specialist), and tertiary (acute) care, requiring these patients to travel to different locations to visit their healthcare team members.

Table 18: Members of the healthcare team were located in the same clinic, by BMI category (HQCA 2014)

Members of the healthcare team were located in the same clinic:	Normal (BMI 18.5-24.9)		Overweight (BMI 25-29.9)		Obese (BMI ≥ 30)	
	%	95% CI	%	95% CI	%	95% CI
Agree (4 or 5 out of 5)	56.6	(48.9, 64.1)	56.2	(48.9, 63.2)	40.0*‡	(33.4, 47.0)
Disagree (1 or 2 out of 5)	43.4	(36.0, 51.1)	43.8	(36.8, 51.1)	60.0*‡	(53.0, 66.6)

* Significantly different from normal BMI individuals ($p < 0.05$)

‡ Significantly different from overweight individuals ($p < 0.05$; comparing obese and overweight groups)

6.3 Summary

Because of the unique role primary healthcare plays in health promotion, disease prevention, and co-ordination of patient care, primary healthcare may be well positioned within the healthcare system to manage overweight and obesity. Yet, findings show that although Alberta's primary care physicians provide support for those patients who want help with weight management, physicians are not discussing the factors that are strongly linked to weight loss and control (e.g., diet and exercise) with approximately one-half to one-third of individuals with overweight and obesity. There remain opportunities to engage more Albertans in these discussions. Although the rates of obesity counselling in Alberta have not yet been well studied, the obesity literature suggests that low rates of obesity counselling in primary care may result from a number of barriers, including a lack of time to provide multiple preventative services,[86] a lack of training in effective counselling strategies,[87,88] the perceived ineffectiveness of counselling for weight management,[89] and/or a failure to involve other non-physician primary healthcare providers.[88] As previously stated, team-based care co-ordination may be particularly important for patients with overweight and obesity who are more likely than normal-weight individuals to have multiple comorbidities and require treatment by a team of professionals. Although findings from the HQCA survey suggest that individuals with overweight and obesity were more likely to regularly receive healthcare from a coordinated team of healthcare providers, as compared to normal-weight individuals, it is still only a small percentage of Albertans with overweight and obesity who are being engaged in team-based care (22.9% of normal-weight, 28.7% of overweight, and 33.8% of obese individuals). The following section examines the current state of weight-management interventions for overweight or obesity in Alberta (including primary healthcare initiatives).

7.0 ENVIRONMENTAL SCAN OF OBESITY INTERVENTIONS IN ALBERTA

Weight-management interventions most often used in healthcare settings have included surgical, pharmaceutical, behavioural, and cognitive-behavioural strategies. Although surgical[90] and pharmaceutical[91] treatments have been identified as potentially effective methods for weight reduction, these interventions are costly and are not indicated for use in most patients struggling with weight. In contrast, behavioural interventions and cognitive-behavioural interventions promoting increased exercise and dietary restrictions can be more widely applied and have shown moderate but favourable outcomes for weight reduction in some patients.[92] Behavioural weight-loss interventions target specific behaviours, primarily diet and exercise. Strategies include goal setting, self-monitoring, providing dietary and exercise advice, and teaching patients to limit cues associated with eating and increase cues associated with exercise. Cognitive-behavioural weight-loss interventions target both thoughts and behaviours – changing how individuals think about themselves, how they act, and the circumstances that surround how they act. Strategies centre on motivational interviewing techniques designed to identify, challenge, and address barriers to change, enhance readiness to change, and support behavioural changes in overweight and obese patients.[xxi]

This section examines the current state of weight management, including but not limited to, behavioural and cognitive-behavioural interventions, among patients who are at risk of overweight or obesity in Alberta. This includes weight management in primary healthcare as well as in other areas of the healthcare system and the private sector.

7.1 Methods

An online environmental scan was conducted between January and March 2014 to identify research projects and healthcare system initiatives and programs intended for overweight and obese populations in Alberta. The search included the Ministry of Health (Alberta Health), Alberta Health Services (AHS), primary care networks, and universities in Alberta. The findings are summarized below, and are explained in detail in Appendix IV: Environmental Scan of Weight Management in Alberta.

Certain limitations to the findings from the online environmental scan are noted: several primary care networks' websites were unavailable, several websites had outdated content, details of certain programs were unavailable, and for many programs, only basic details were publicly available. Therefore, several experts from numerous levels of the healthcare system and universities were interviewed to gain additional insights and information regarding initiatives, programs, and research projects intended for overweight and obese populations in Alberta.

[xxi] One option for weight management of overweight and obesity is through referral to a commercial weight-management or weight-loss program. Although commercial programs may prove to be effective in reducing overweight and obesity, the focus of this report is on weight management *within* the primary healthcare setting. A review of the effectiveness of commercial weight-management programs falls outside the scope of this report.

7.2 Findings

7.2.1 The Canadian Obesity Network

The Canadian Obesity Network is a national organization based in Edmonton, Alberta. Of the 10,000 members, 1,200 are based in Alberta, including obesity researchers, health professionals, trainees, and other professionals with an interest in obesity prevention and management. The Network is responsible for a number of Alberta-based initiatives, including the International School for Obesity Research and Management (ISORAM); the National Student Meeting; the Annual Obesity Research Bootcamp; the launch of the 5A's of Obesity Management; and the development of obesity conversation cards.

7.2.2 University research studies and programs

The University of Alberta has published numerous studies, including *Promoting Optimal Weights through Ecological Research (POWER)* study*; Healthy Alberta Communities (HAC)* project; *Raising Healthy Eating and Active Living Kids Alberta (REAL Kids Alberta) Evaluation*; and *Alberta Project Promoting active Living and Healthy Eating (APPLE Schools)*.

The Healthy Alberta Communities project was affiliated with the school of public health at the University of Alberta. This project involved four communities selected by Alberta Health: Bonnyville, St. Paul, Norwood/North Central Edmonton, and Medicine Hat. The main objective of this community-based intervention was to reduce risk factors for chronic diseases by fostering healthier lifestyles among community residents. Data collection took place in 2006 and 2009, pre- and post-intervention, and involved self-reports, physical measurements, and gathering information to address environment-level risks for obesity. Likewise, the POWER study considers the social and environmental determinants of obesity. Other studies aimed at the adult population include the Alberta population-based prospective evaluation of the quality-of-life outcomes and economic impact of bariatric surgery (APPLES) study, which assesses bariatric surgery using an Alberta sample. The *Outcome Assessment to Optimize Patient Selection for Bariatric Surgery* (OASIS) program looks at factors for triaging patients for bariatric surgery, and can be used to streamline access for patients to the Edmonton Weight Wise program. Finally, the *Evaluating Self-Management and Educational Support in Severely Obese Patients Awaiting Multidisciplinary Bariatric Care (EVOLUTION)* study assesses cost-effectiveness and patient outcomes of an educational intervention designed to enhance self-management skills in people on the wait list for bariatric care.

7.2.3 Government of Alberta: Alberta Health

The Healthy U social marketing campaign and website (www.healthyalberta.com) was developed in 2002 as a long-term public information and education initiative to support and encourage Albertans to lead healthier lifestyles. Healthy U strategies have included media campaigns; resources for families and practitioners; community outreach through Healthy U Crews; and the healthyalberta.com website, which shares healthy-eating and active-living information, resources, and programs with Albertans and with healthy-living practitioners in schools, workplaces, and communities. A recent Healthy U social marketing campaign had two main themes: 'Be a Health Champion' (introduced in July 2012) encourages parents and caregivers of 0- to 5-year-olds to become healthy -living role models for their children. The 'Healthy U 5&1 Experiment' (introduced in April 2013) helps parents and their 6- to 12-year-olds get the recommended five servings of vegetables and fruit and one hour of activity each day by

presenting healthy eating and active living in a fun way that encourages kids to try new foods and activities.

UWALK is a provincial initiative (funded by the Government of Alberta), designed by the faculty of physical education and recreation at the University of Alberta, to encourage Albertans to partake in physical activity through walking. UWALK's interactive website offers Albertans information, individual and group challenges, goal-setting assistance, and a tool to log steps and time spent being active.

Communities ChooseWell is an initiative run by the Alberta Recreation and Parks Association (funded by Alberta Health), which focuses on developing healthy communities and citizens through education, community capacity building, and fostering environments that are supportive of healthy eating, active living, and social well-being. Communities ChooseWell allows communities to register for free, and provides them with the opportunity to apply for funding grants, a tool kit of available resources, webinars, newsletters, and educational opportunities.

The Alberta Centre for Active Living is funded by the Alberta Sport, Recreation, Parks & Wildlife Foundation; Alberta Tourism; and Parks and Recreation and is affiliated with the University of Alberta. The centre is involved in a number of projects across the province including the Alberta Survey on Physical Activity; articles for the Healthy U website; creation of the Physical Activity Counselling Toolkit, a resource for practitioners; a study of after-school programs in Alberta; development of Home Support Exercise Program training videos; evaluation of Sacred Circle Aboriginal Diabetes Initiative; and a community walking project.

The Government of Alberta supports healthy children and youth initiatives, which include healthy weights initiatives, such as the Alberta Nutrition Guidelines for Children and Youth, and the Alberta Healthy School Community Wellness Fund. The Wellness Fund has provided support to 54 out of 61 school districts to promote healthy eating, physical activity, and positive social environments using a comprehensive school health approach.

Supporting more than 700 school communities in Alberta, the Ever Active School initiative is run by the Health and Physical Education Council of the Alberta Teachers Association, and is supported by Alberta Health, Alberta Education, and Culture and Tourism. This program helps school communities create healthy environments by focusing on physical activity, healthy eating, and positive mental health.

7.2.4 Alberta Health Services: Obesity, Diabetes, and Nutrition Strategic Clinical Network

The AHS Diabetes, Obesity, and Nutrition (DON) Strategic Clinical Network (SCN) was established in June 2012 and provides health-policy guidance by developing strategies for chronic-disease prevention, management, and treatment. The DON SCN emphasizes obesity prevention and management from the perspective of broader disease prevention and management. To that end, the DON SCN examines evidence-based interventions in primary healthcare and population health promotion.

To date, most of the focus in AHS has been on building infrastructure for the treatment of obesity (e.g., specialty clinics and bariatric surgery). Key partnerships with other SCNs within AHS are driving forward obesity services, interventions, and care pathways for patients to get equitable access to quality care. For example, Surgery SCN collaboration is supporting the provincial program for bariatric surgery, and the Primary Care and the Chronic Disease SCN will work closely with the DON SCN. The goal for collaboration is to provide primary care with the best prevention and management strategies for

overweight and obese patients that align with other chronic conditions (i.e., not a separate set of recommendations for each condition).

The DON SCN has also identified a broad variety of educational resources and tools for providers and patients in the province. The DON SCN is co-leading, with the Provincial Chronic Disease Management portfolio, a Pan-SCN initiative that will standardize the source(s) and accessibility of education resources and tools in chronic-disease management for patients and providers across Alberta. The SCN aims to standardize an evidence-based set of recommendations for obesity management with a pan-SCN committee.

7.2.5 Alberta Health Services obesity programs and initiatives

AHS operates numerous programs and initiatives for obesity management and prevention. In 2011, AHS announced the AHS Obesity Initiative, a five-year plan that includes a range of services, from community-based programs to intensive medical intervention. Planned community-based services include school-based programs and new programming targeting adults who are ready to adopt a healthier lifestyle; as well as the establishment of a new specialty care clinic in Grande Prairie to serve northern populations. Metabolic clinics are also run for clients of AHS Mental Health and Addictions who require weight management and do not have a primary care physician; these clinics provide basic testing and counselling on healthy choices.

Community-based programs offered through AHS for individuals with chronic conditions, including obesity, comprise the Alberta Healthy Living Program and Better Choices, Better Health. There are also geographically specific programs, including the Weight Wise Adult Community Program in Edmonton, as well as the Alberta Healthy Living programs in the Calgary area (formerly Living Well with a Chronic Condition), in the Lethbridge area (formerly Building Healthy Lifestyles), in the Medicine Hat and Brooks area (formerly Living Healthy Program), as well as in the North Zone of AHS.

Better Choices, Better Health: This program involves workshops, which are generally run weekly for two-and-a-half hours over six weeks and offer skill development for people with ongoing chronic health conditions, such as high blood pressure, asthma, heart disease, osteoarthritis, obesity, chronic pain, and diabetes.

Alberta Healthy Living Program: This program is a provincial model for community-based chronic disease management, which is aimed at a number of chronic diseases, including cardiovascular disease, respiratory diseases, diabetes, and obesity. The program involves three parts: (1) patient education, (2) self-management support (through Better Choices, Better Health workshops – described below), and (3) supervised exercises.

Weight Wise Adult Community Program – Edmonton: This program provides weight-management education and support to patients (through group education workshops, an information line, and a post-bariatric surgery support group) and healthcare professionals (through weight-management education and training).

7.2.6 Population, public, and aboriginal health programs

There are several initiatives and programs offered by AHS Population and Public Health that promote healthy eating and active lifestyles through collaboration with many internal and external stakeholders of AHS. A website (www.healthyeatingstartshere.ca) for external members has been established to

promote key messages around healthy eating habits in multiple settings (e.g., childcare, schools, and workplaces). One of the key settings is the workplace environment, where AHS aims to model policy on healthy eating environments at all its sites, including healthy food options for meetings, vending machines, and cafeterias. Patient food services also follow nutritional guidelines for providing healthy food choices at AHS sites.

AHS Nutrition and Food Services provides evidence-based nutritional guidelines for healthcare providers to support patients and clients long term and for a range of concerns (e.g., allergies).

The nutrition guidelines are available online at http://www.albertahealthservices.ca/3505.asp.

7.2.7 Alberta Health Services – chronic disease management research

Clinical Effectiveness of Adult Bariatric Specialty Care Clinics in Alberta: This study examines clinical effectiveness, changes in health-related quality of life, and patient satisfaction associated with the management of obesity among both medically and surgically managed patients from the five bariatric specialty care centres in the province. Additionally, among surgical patients, post-operative complications are assessed.

7.2.8 Primary care networks

Primary care networks provide a number of programs and initiatives related to weight management and dealing with chronic diseases, including obesity. A number of primary care networks use AHS programming, including Chronic Disease Management, Weight Wise, and Better Choices, Better Health. Other primary care networks offer different programming, some of which use aspects of AHS programs. Full details of the primary care networks' programs are listed in Appendix IV.

7.2.9 Private clinics

Aside from programs and clinics run through AHS, there are independent medical weight-loss clinics in the province, which were not surveyed here.

7.3 Summary

The environmental scan identified a number of programs and initiatives offered by the Ministry, Alberta Health Services, primary care networks, and universities, which focus on weight management and/or management of chronic diseases like obesity. The majority of the programs identified offer educational support to patients through lifestyle or behavioural interventions, including patient education, lifestyle counselling, self-management support, and/or supervised exercises; however, there is little information on the effectiveness of these programs in helping Albertans achieve and maintain healthy weight (Appendix IV).

8.0 LITERATURE REVIEW OF THE EFFECTIVENESS OF BEHAVIOURAL AND COGNITIVE-BEHAVIOURAL WEIGHT-MANAGEMENT INTERVENTIONS IN PRIMARY HEALTHCARE

Despite the availability of weight-management programs, and clinical guidelines that recommend weight-reduction counselling in primary healthcare, numerous studies show that a significant proportion of physicians do not recommend weight loss or counsel patients with overweight and obesity on weight management.[89,93,94] For example, in Alberta, 2013–14 claims data show that obesity accounted for only 0.9 per cent of all billing codes in primary care.[xxii] In addition, the HQCA's *2014 Satisfaction and Experience with Healthcare Services* survey data showed that only a small proportion of Albertans with overweight and obesity reported that their primary care physician had talked to them about diet and exercise.[xxiii] Although the rates of obesity counselling in Alberta have not yet been well studied, the obesity literature suggests that low rates of obesity counselling in primary care may result from a number of barriers in primary care, including a lack of time to provide multiple preventive services,[86] a failure to involve other non-physician primary healthcare providers,[88] a lack of training in effective counselling strategies,[87,88] and/or the perceived ineffectiveness of counselling for weight management.[89] Motivating physicians to provide weight counselling may require evidence of its feasibility and effectiveness in a primary healthcare setting. To this end, a literature review was carried out to examine the feasibility and effectiveness of behavioural and cognitive-behavioural weight management interventions in primary healthcare.

The primary healthcare system in Alberta is currently organized around the primary care physician and individually directed medical advice. Alberta has been in transition, however, to a more comprehensive primary healthcare system – the medical home model – since the introduction of primary care networks in 2003. In the medical home model, patient care is delivered by a number of providers (e.g., physicians, nurses, social workers, pharmacists, and dietitians); teams are formed and reformed as required to fit the patient's needs at any given time.[95] To account for the different models of care in Alberta, the findings of the literature review are organized as follows: (1) interventions delivered by a primary care physician; and (2) interventions delivered by a non-physician member of a multi-disciplinary primary healthcare team.

8.1 Methods

A literature search was conducted in the OvidSP Medline and selected OvidSP Evidence Based Medicine Review (EBMR) databases (e.g., Cochrane Database of Systematic Reviews) to identify studies published within the last 10 years (January 1, 2004 to June 30, 2014) that report strategies for managing high-risk, overweight, and/or obese populations within primary healthcare. The population of interest included

[xxii] The HQCA's administration health data (i.e., data from physician claims, Discharge Abstract Database [DAD], and the National Ambulatory Care Reporting System [NACRS]). Although billing codes may not represent a complete or accurate summary of the physician visit, this value may represent either a lack of billing (i.e., underreported) for specific obesity-related issues, a lack of provision of preventive services for overweight obesity, or some combination of both.

[xxiii] Approximately 32 per cent of Albertans with an obese BMI and 37 per cent of Albertans with an overweight BMI reported that their primary care physician had not spoken to them about exercise or physical activity, and 39 per cent of Albertans with an obese BMI and 48 per cent of Albertans with an overweight BMI reported that their primary care physician had not spoken to them about diet and eating habits.

any adult patients who were clinically diagnosed as high-risk, overweight, or obese. Exclusion criteria were as follows: studies focusing on child/youth populations; studies published prior to 2004 (> 10 years old); non-English language studies; review articles (though bibliographies may be searched); editorials; commentaries; papers published from non-westernized countries (non-applicable to western weight goals and diets); studies investigating clinical effectiveness of pharmaceutical, surgical, dietary, or exercise interventions; studies focused on populations not specifically defined as high-risk, overweight, or obese (e.g., other chronic conditions, where obesity may be a characteristic of the population rather than the condition of focus); and any studies outside of primary healthcare settings (i.e., academic trials, acute care, or commercial). In total, 16 papers met the inclusion criteria of the literature review.[96,97,98,99,100,101,102,103,104,105,106,107,108,109,110]

Full evidence tables for all of the studies identified in this literature review can be found in Appendix V, *Literature Review Methodology and Evidence Tables – Strategies in Primary Healthcare*. Of the 16 studies identified in an adult population, 14 studies were randomized controlled trials and two were mixed-study designs; study details can be found in Table 19.

8.2 Interventions delivered by a primary care physician

Five studies examined the effectiveness of behavioural and cognitive-behavioural weight-management interventions delivered by a primary care physician (see Table 19 for study details).[96,97,98,99,100] In all five studies, physicians received training that addressed topics including: (1) how to assess a patient's current stage of change, (2) motivational interviewing to enhance readiness to change, decision-making, and self-efficacy to make lifestyle changes, and (3) techniques for the behavioural treatment of obesity. In each study, patients were provided with the opportunity to identify self-management goals for nutrition and physical activity, and to revisit and alter their goals as needed during brief one-on-one counselling sessions (four to six 15 minute sessions) with a primary care physician (trained in motivational counselling techniques) over the course of up to a year. Topics covered during physician-led brief counselling sessions included ways to decrease dietary fat, ways to increase physical activity, and identifying and dealing with barriers to weight loss. In all studies, patient weight loss was monitored at various intervals throughout the study protocol.

Overall, each of the five studies showed favourable outcomes for weight reduction (see Table 19). Specifically, the studies showed that, as compared to care as usual[xxiv], brief counselling (four to six sessions) by a primary care physician trained in motivational counselling strategies resulted in modest (2–3 kg), but significant ($p < 0.05$), weight loss in both overweight and obese patients.[96,97,98,99,100] One study[100] further examined weight-loss maintenance at nine, 12, and 18 months following a six-month intervention and found that patients were able to maintain their weight loss for up to three to six months following treatment. By the 18-month follow-ups, however, patients who received the intervention had regained their weight and did not differ in weight from those in the care-as-usual group (owing to weight regain by intervention patients, rather than weight loss by care as usual patients).

[xxiv] *Care as usual* is a term used to describe the full spectrum of patient care practices in which physicians have the opportunity to individualize patient care as they see fit. Care as usual is commonly used as a control arm of a study, wherein a patient receives care as they would normally receive from his or her treating physician.

Kumanyik et al. (2012) collected information on patient perceptions of the physician-delivered weight-management program, which provided some key insights into activities that primary healthcare providers could employ to keep participants motivated towards their weight-management goals. These included keeping patients up to date on weight-related changes to their health, encouraging patients to continue following the program, helping patients manage stress, and making it easy for patients to schedule appointments. Together, these findings suggest that a patient's weight management can be accomplished in primary healthcare using several 15-minute behavioural and cognitive-behavioural interventions by a primary care physician, and highlight that weight management in primary healthcare requires constant and continuous follow-up to obtain successful long-term weight loss maintenance.

8.3 Interventions delivered by non-physician primary healthcare providers in a multidisciplinary primary healthcare team

Eleven studies reported on the effectiveness of behavioural and cognitive-behavioural weight-management interventions delivered primarily by a non-physician primary healthcare provider, with support from a primary care physician (see Table 19 for study details).[101,102,103,104,105,106,107,108,109,110,111] Non-physician providers delivering the interventions were medical assistants, nurses, nurse practitioners, lifestyle coaches, nutritionists, exercise specialists, dieticians, master's-level counsellors, and community health educators. The types of weight-loss interventions included goal setting, providing patients with educational materials on diet and exercise, and brief motivational counselling by trained non-physician healthcare providers. In addition, all studies involved in-person contact between the patient and a primary care physician (e.g., as a referral source, to periodically discuss weight-loss progress, and/or to highlight the importance of the weight-management intervention for the patient). In six of the 11 studies, weight-loss support was offered through in-person providers in one-on-one and/or group sessions with a non-physician healthcare provider[105,106,107,109,110,111] and in five of the 11 studies weight-loss support was provided remotely – through telephone, study-specific websites, and/or email.[101,102,103,104,108]

In eight of the 11 studies, behavioural and cognitive-behavioural interventions by a non-physician healthcare provider resulted in significant weight loss in overweight and obese patients (as compared to care as usual; $p < 0.05$).[101,102,103,105,106,107,109,110] Three of the 11 studies failed to show significant weight loss as compared to care as usual.[104,108,111] In these particular three studies, however, the 'care as usual' condition included education on diet and exercise, goal setting, and information on community resources for weight loss support. Possibly as a result, patients in both study conditions (weight-loss intervention and care as usual) demonstrated modest (2–3 kg), but significant, weight loss. Together, findings from these 11 studies show that effective weight-management interventions can be delivered by a non-physician primary healthcare provider in the context of a multidisciplinary primary healthcare team. In addition, these findings suggest that web-based, email, and telephone weight-loss interventions can be successfully offered in a primary healthcare setting and result in weight loss in overweight and obese patient populations.

Table 19: Evidence table of literature review studies

Author	Interventions	Provider	Age (Mean, SD), Years / Gender (% Male) / Weight Characteristics	Follow Up & Measures Used	Results
Interventions delivered by a primary care physician					
Bolognesi, M., et al. 2006[96] Italy intervention n=48; usual care n=48	Patient-centered Assessment and Counseling for Exercise (PACE) protocol (versus usual-care control) PACE uses motivational interviewing techniques to support individuals appropriately for their current stage of change.	physician	**Age -** range: 21–70 **Gender -** total: 46.9% male (control: 37.5% male; experimental group: 56.3% male) **Weight -** overweight (BMI ≥ 25), obese (BMI ≥ 30), and severely obese (BMI ≥ 35)	Five to six months; BMI, abdominal girth	Significant differences between the intervention and control groups after controlling for baseline differences ($p < 0.05$). Both male and female patients in the control group increased their BMI, whereas individuals in the intervention group decreased their BMI ($ps < 0.05$).
Christian, JG., et al. 2008[97] United States intervention n=135; usual care n=155	Brief health lifestyle counselling (versus usual-care control) At each three-month visit, control patients received care as usual, whereas intervention patients set and reviewed weight-loss goals and barriers to change with a primary care physician who had been trained (three-hour training session) to provide motivational interviewing counselling to reinforce the patient's change goals.	physician	**Age -** usual care: 53.4 (10.70) versus intervention: 53.0 (11.25) **Gender -** usual care: 32% male; intervention: 35% male **Weight -** overweight and obese (BMI ≥ 25) with Type 2 diabetes	Three, six, and nine months; weight change	Significantly more patients in the intervention group lost greater than six pounds at 12 months as compared with control patients (32% versus 18.9%; $p = 0.006$).
Kumanyika SK, et al. 2012[98] United States basic n=137; basic plus n=124	Behavioural weight-loss program ("basic" versus "basic plus") **Basic:** Physicians were trained to deliver brief counselling sessions where they delivered weight-loss information, measured weight change, revisited program goals, and helped the patient set short-term, realistic goals to accomplish prior to the next visit. Visits were scheduled once every four months for a period of one year. **Basic Plus:** Visits with trained primary care physicians as described above, plus monthly visits with a lifestyle coach.	physician along with support from a health coach	**Age -** all: 47.2 (11.7) [basic: 46.8 (11.6); basic plus: 47.6 (11.9)] **Gender -** all: 16% male [basic: 17.5% male; basic plus: 13.7% male] **Weight -** BMI ≥ 27 kg/m2 and ≤ 55 kg/ m2	12 months; weight change	**Mean weight reduction [mean (95% CI) at 12 months:** basic plus -1.61 kg (-2.68, -0.53) versus basic -0.62 kg (-1.45, 0.20); between groups difference $p = 0.15$ Only basic plus showed significant weight loss over a one-year period. Groups did not differ significantly from each other in overall weight loss.

Author	Interventions	Provider	Age (Mean, SD), Years / Gender (% Male) / Weight Characteristics	Follow Up & Measures Used	Results
Interventions delivered by a primary care physician					
Martin, P.D., et al. 2006[99] United States usual care n=73; tailored intervention n=71	Brief, physician-delivered weight-loss intervention (versus usual care). Physicians delivering the intervention were given seven hours of training, which addressed the assessment of stage of change, motivational interviewing, and techniques for the behavioural treatment of obesity. At each monthly visit, control patients received care as usual, whereas intervention patients were given individually tailored motivational counselling by a trained physician.	physician	**Age -** usual care: 42.97 (11.38) versus tailored intervention: 40.69 (12.59) **Gender -** 0% male (i.e., 100% female) **Weight -** overweight and obese (BMI ≥ 25)	Six months; weight change	**Mean (SD) weight reduction at six months :** Usual care gained 0.2 (2.9) kg versus intervention lost 2.0 (3.2) kg (p = 0.03) More participants in the tailored group lost weight (79% versus 47%; p = 0.04).
Martin PD, et al. 2008[100] United States usual care n=69; tailored intervention n=68	Brief, physician-delivered weight-loss intervention (versus usual care) See above	physician	**Age -** all: 41.8 (12.0) [intervention: 40.8 (12.7); usual care: 42.6 (11.4)] **Gender -** 0% male (i.e., 100% female) **Weight -** overweight and obese (BMI ≥ 25)	12 and 18 months; weight change	**Mean (SD) weight reduction at nine months :** Usual care 0.61 (3.37) kg versus intervention -1.52 (3.72) kg (p = 0.01) 12 and 18 months: no difference between the groups
Interventions delivered by non-physician primary healthcare providers in a multidisciplinary primary healthcare team					
Appel L, et al. 2011[101] United States control n=138; remote support n=139; in-person support n=138	Two behavioural interventions (remote-support or in-person support versus control group) Remote and in-person behavioural interventions focused on key weight-management behaviours using motivational interviewing techniques.	weight loss coach in a primary care clinic	**Age -** all: 54.0 (10.2) [control: 52.9 (10.1); remote support: 55.8 (9.7); in-person support: 53.5 (10.5)] **Gender -** all: ~36.4% male [control: 36.2 male; remote support: 36.7 male, in-person support:36.2 male] **Weight -** obese (with at least one cardiovascular risk factor)	24 months; weight change	**Mean weight reduction at 24 months:** Control: -0.8 kg Remote-support: -4.6 kg (p < 0.001 for the comparison with the control group) In-person support: -5.1 kg (p < 0.001 for the comparison with the control group)

Author	Interventions	Provider	Age (Mean, SD), Years / Gender (% Male) / Weight Characteristics	Follow Up & Measures Used	Results
Interventions delivered by non-physician primary healthcare providers in a multidisciplinary primary healthcare team					
Bennett, G., et al. 2010[102] United States intervention n=51; usual care n=50	Web-based behavioural weight-loss intervention plus four counselling sessions with a health coach (versus usual care). Behavioural intervention included setting behaviour-change goals, web-based self-monitoring, and two in-person and two telephone motivational coaching sessions with a registered dietician.	health coach (registered dietitian) and primary care physician	**Age -** all: 54.4 (8.1) [intervention: 54.4 (7.4); usual care: 54.5 (8.9)] **Gender -** all: 52.5% male [intervention: 58.8% male; usual care: 46% male] **Weight -** obese (with hypertension) (BMI of 30–40)	Three months; weight change	**Mean (SD) weight reduction at three months:** Intervention participants: -2.28 (3.21) kg; usual care: 0.28 (1.87) kg Relative difference (-2.56 kg; 95% CI: -3.60, -1.53)
Bennett GG, et al. 2012[103] United States intervention n=180; usual care n=185	Behavioral intervention that promoted weight loss and hypertension self-management using eHealth components (versus usual care). The intervention promoted weight loss through setting tailored behaviour-change goals, self-monitoring, and skills training, 18 telephone motivational counselling sessions, 12 optional group sessions, and links to community resources.	trained community health educator with the support of a primary care physician	**Age -** usual care: 54.67 (11.03); intervention: 54.58 (10.77) **Gender -** usual care 34.1% male; intervention 28.9% male **Weight -** obese (receiving hypertension treatment; BMI 30 to 50)	24 months; weight change	**Weight reduction (95% CI) at 24 months:** Intervention group versus usual care group: -1.03 kg (-2.03 to -0.03 kg) **24-month change in BMI (95% CI):** Intervention group versus usual care group: -0.38 kg (-0.75 to -0.004 kg)
Ely AC., et al. 2008[104] United States active arm n=48; control arm n=53	Behavioural Intervention: Chronic Care Model program (versus usual care). The intervention included three face-to-face assessments, patient educational materials, and telephone-based motivational counselling.	master's level counsellor with the support of a primary care physician	**Age -** active arm: 49 (14), Control: 50 (15) **Gender -** active arm: 29% male, control: 17% male **Weight -** overweight or obese (BMI ≥ 25)	90 and 180 days; weight change	**Mean weight reduction from baseline:** 90-day mean (SD) weight change: active arm: -4.5 (7.7) pounds versus control: -2.4 (8.1) pounds (*p* =.27 for difference) 180-day mean (SD) weight change: active arm: -9.4 (10.3) pounds versus control: -2.1 (10.7) pounds (*p* = 0.01 for difference)
Laws, R. et al. 2004[105] United Kingdom n=1,256	Behavioural intervention (non-randomized controlled trial study): Counterweight Programme	nurse	**Age -** 50.6 (14) years **Gender -** 26% male **Weight -** mean BMI = 36.9 ± 5.4	Three, six, and 12 months; weight change	34% of patients achieved a clinically meaningful weight loss of 5% or more at 12 months; 43% of patients who attended all three appointments achieved weight loss of 5% or more.

Author	Interventions	Provider	Age (Mean, SD), Years / Gender (% Male) / Weight Characteristics	Follow Up & Measures Used	Results
Interventions delivered by non-physician primary healthcare providers in a multidisciplinary primary healthcare team					
McTigue KM, et al. 2009[106] United States total n=155; enrolled n=72; non-enrolled (control) n=82	Behavioural interventions (versus usual care): 12-session WiLLoW intervention. The intervention included dietary and exercise recommendations, patient education, and behavioural techniques including goal setting, self-monitoring, and problem solving.	nurse educator	**Age -** enrolled: 50.01 (1.34); non-enrolled: 47.18 (1.46) **Gender -** enrolled: 17% male; non-enrolled: 16% male **Weight -** overweight or obese (BMI ≥25)	One year; weight change	**Mean 1-year weight change:** enrolled: -5.19 kg (-7.71 to -2.68) non-enrolled: +0.21 kg (-1.0 to 1.93) Significant weight loss in enrolled versus non-enrolled ($p < 0.001$)
Molenaar EA., et al. 2010[107] Netherlands intervention n=134; control n=70	Nutritional counselling (D) versus Nutritional Dietary/nutritional counselling (D) versus Dietary/nutritional counselling and exercise counselling (D+E) (versus usual care).	dietitian, dietitian and physiotherapist	**Age -** intervention group: 43 (10), control group: 43(9) **Gender -** intervention: 58% male; control group: 63% male **Weight -** overweight (BMI 28-35)	Six and 12 months; weight change, waist circumference	**Change in weight (kg) (95% CI):** Six months : D: -2.2 (-3.1 to -1.4) kg versus D + E: -3.0 (-4.0 to -2.0) kg 12 months : D: -2.0 (-3.1 to -1.4) kg versus D+E: -3.1 (-4.5 to -1.6) kg **Change in waist circumference (cm) (95% CI):** Six months: D: -2.1 (-3.3 to -0.8) cm versus D+E: -3.7 (-5.1 to -2.3) cm; 12 months: D: -2.1 (-3.5 to -0.7) cm versus D+E: -4.2 (-6.0 to -2.5) cm Participants in both the D and D + E group lost significantly more weight than those in the control group ($p < 0.05$).

Author	Interventions	Provider	Age (Mean, SD), Years / Gender (% Male) / Weight Characteristics	Follow Up & Measures Used	Results
Interventions delivered by non-physician primary healthcare providers in a multidisciplinary primary healthcare team					
Sherwood et al., 2006[108] United States mail n=600; phone n=601; usual care n=600	Non-clinic-based weight-loss interventions (mail and phone) in a healthcare delivery system (versus usual care). Interventions involved educational materials and advice about how to improve/maintain lifestyle, behaviours, and goal setting.	health counsellor Patients were referred to the program by a primary care physician.	**Age -** mail: 50.6 (0.5), phone: 50.7 (0.5), usual care: 50.8 (0.5) **Gender -** mail: 31% male, phone: 26.5% male, usual care: 27.2% male **Weight -** overweight (BMI>27)	24 months; weight change	**Weight reduction at 18 months:** mail: 2.2 kg versus phone: 2.4 kg versus usual care: 1.9 kg Mail and phone group weight changes were not significantly different from usual care ($p < 0.35$). Weight losses at 24 months did not differ by condition (0.7 kg mail, 1.0 kg phone, and 0.6 kg usual care, $p = 0.55$).
ter Bogt, N.C.W., 2009[109] Netherlands intervention n=255; usual care n=232	Four individual visits to a nurse practitioner and one feedback session by telephone were scheduled for lifestyle counselling with guidance of the nurse practitioner using a standardized computerized software program (versus usual care from a primary care physician).	nurse practitioner	**Age -** nurse practitioner group 55.3(7.7); usual care group 56.9(7.8) **Gender -** nurse practitioner group = 50.2% male; usual care group = 46.1% male **Weight -** overweight or obese (BMI 25-40)	One year; weight change, waist circumference	There were more weight losers and stabilizers in the nurse practitioner group than in the usual care group (77% versus 65%; $p < 0.05$). In men, mean weight losses were 2.3% for the nurse practitioner group and 0.1% for the usual care group ($p < 0.05$). Significant reductions occurred also in waist circumference. In women, mean weight losses were in both groups 1.6%. In the nurse practitioner group, obese people lost more weight (-3.0%) than the non-obese (-1.3%; $p < 0.05$).
Tsai, A.G., et al. 2010[110] United States control n=26; brief counseling n=24	Quarterly visits with primary care physicians plus brief weight-management education counselling (eight visits with a medical assistant over six months; versus usual care).	medical assistant (with the support of a primary care physician)	**Age -** control 47.6 (2.5); brief counselling 51.3 (2.3) **Gender -** 12% male (88% female) **Weight -** BMI of 27–50	Six and 12 months; weight change	**Mean (SD) weight reduction at six months:** Brief counselling 4.4 (0.6) kg (5.1 ± 0.7% of initial weight) versus control group 0.9 (0.6) kg (1.0 ± 0.7%; $p < 0.001$)

Author	Interventions	Provider	Age (Mean, SD), Years / Gender (% Male) / Weight Characteristics	Follow Up & Measures Used	Results
Interventions delivered by non-physician primary healthcare providers in a multidisciplinary primary healthcare team					
Wadden TA., et al. 2011[111] United States usual care n=130; brief n=131; enhanced n=129	Brief lifestyle counselling (versus usual care). All participants were prescribed the same weight-loss (diet and exercise) goals but were given different levels of support to achieve them. Brief counselling involved a review of goals and progress, instructions in self-monitoring, and telephone counselling. **Excluded from the analysis** was a third condition, which provided brief lifestyle counselling along with meal replacements or weight-loss medication (Orlistat or Sibutramine), chosen by patients in consultation with the primary care physicians, to potentially increase weight loss.	lifestyle coach (with the support of a primary care physician)	**Age -** all: 51.5 (11.5) years [usual care: 51.7 (12.1); brief lifestyle: 52.0 (12.2); enhanced brief lifestyle: 51.0 (10.1)] **Gender -** all: 20.3% male [usual care: 24.6%; brief lifestyle: 16.0%; enhanced brief lifestyle: 20.2%] **Weight -** obese (BMI of 30 to 50)	Two years; weight change	**Mean (± SE) weight reduction:** Usual care 1.7 (0.7) kg versus brief lifestyle counselling 2.9 (0.7) kg versus enhanced brief lifestyle counselling 4.6 (0.7) kg, (p = 0.003) **Initial weight decrease at least 5%:** Usual care (21.5%) versus brief lifestyle counselling (26.0%) versus enhanced brief lifestyle counselling (34.9%; p = 0.02)

SD = standard deviation; SE = standard error; CI = confidence interval; kg = kilograms; cm = centimetres

8.4 Summary

Primary healthcare may be well positioned to manage overweight and obesity in the Alberta population. The environmental scan identified a number of programs and initiatives offered by primary care networks that focus on weight management and/or management of chronic diseases, including obesity. Although the effectiveness of interventions in primary healthcare has not yet been widely evaluated, evidence shows that management of overweight and obese populations within primary healthcare can lead to benefits in weight management as compared to usual care. The most effective mix of providers, interventions, and duration as well as generalizability to larger populations requires further evaluation, however. Of particular note, a review of the literature suggests that brief (e.g., 15 minute) behavioural and cognitive-behavioural weight-management interventions, delivered by a primary care physician or a non-physician primary healthcare provider in a multidisciplinary primary healthcare team, can promote modest, but significant, weight loss in patient populations with overweight and obesity. Although speculative, similar interventions may help to reduce the weight gain often associated with aging and help to prevent the progression of overweight patients to obesity, and its corresponding health risk factors.[89] Despite the moderate effect size of behavioural and cognitive-behavioural interventions, in a large population, weight counselling by primary care physicians or a non-physician primary healthcare provider in a multidisciplinary primary healthcare team (trained in motivational interviewing techniques) may help to reduce weight-related comorbidities, thereby providing an overall benefit to public health and the healthcare system.

9.0 CONCLUSION

The findings from this report highlight the notion that overweight and obesity pose an important health issue for all Albertans; overweight and obesity is associated with an increased risk of multiple comorbidities and more frequent use of primary care services, and is a detriment to individual health-related quality of life. Because of the unique role primary healthcare plays in health promotion, disease prevention, and co-ordination of patient care, primary healthcare may be well positioned within the healthcare system to manage overweight and obesity.

Evidence shows that diverse strategies for the management of overweight and obesity within primary healthcare are associated with benefits in weight management as compared to usual care. However, despite clinical guidelines that recommend weight-reduction counselling in primary healthcare, a substantial proportion of Albertans with overweight and obesity are not receiving weight-loss recommendations or weight-loss counselling by their primary care physician.[89,93,94] Evidence comes from Alberta claims data which show that in 2013–14, obesity accounted for only 0.9 per cent of all billing codes in primary care.[xxv] In addition, the HQCA's *2014 Satisfaction and Experience with Healthcare Services* survey data show that although primary care physicians in Alberta provide help with weight management to individuals with overweight and obesity who seek help, a substantial proportion of Albertans with overweight and obese BMIs do not currently receive any form of diet or exercise counselling from their primary care physician (see Section 6). Finally, the literature in obesity suggests that even when primary care physicians do intervene with counselling, they rely primarily on health education techniques that have been shown to be ineffective in altering behaviours, such as providing information on various health topics in the absence of support for behavioural changes. Physicians rely much less on more effective behaviour-change treatments, such as motivational interviewing and counselling strategies, which would include goal setting, identifying stages of change, and addressing barriers to change.[112,113] The exact nature of obesity counselling in primary healthcare has not yet been well studied in the Alberta context, however.

According to the literature, there are a number of barriers to obesity counselling in primary care, including a lack of time to provide multiple preventive services,[86] a failure to involve other non-physician primary healthcare providers,[88] a lack of training in effective counselling strategies,[87,88] and/or the perceived ineffectiveness of counselling for weight management.[89] Some of these barriers can be overcome with appropriate professional and organizational support and training. To increase the involvement of primary healthcare in the management of overweight and obesity in the province, however, it is vital that the support and training offered address barriers and gaps in knowledge or skills specifically identified by primary care physicians and non-physician primary healthcare providers in Alberta. Thus, studies that examine the barriers to providing effective weight management in Alberta's primary healthcare environment are needed. In addition, studies are needed to better understand primary care physicians' perspectives about their role and the role of non-physician primary healthcare

[xxv] The HQCA's administration health data (i.e., data from physician claims, Discharge Abstract Database [DAD], and the National Ambulatory Care Reporting System [NACRS]). Although billing codes may not represent a complete or accurate summary of the physician visit, this value may represent either a lack of billing (i.e., underreported) for specific obesity-related issues, a lack of provision of preventive services for overweight obesity, or some combination of both.

providers in weight-loss interventions, thereby gaining insight to inform best practices in practice-based weight-management strategies in Alberta.

To better address the challenges of weight management in the province, Alberta may benefit from working towards a more unified strategy for weight management. Within primary healthcare, there is an opportunity to engage more Albertans in conversations with their physicians about weight management, and to increase the use of team-based care across all weight categories. At minimum, primary healthcare in Alberta should strive towards the routine collection of BMI and health-related quality-of-life indicators (i.e., EQ-5D) in addition to key chronic disease indicators e.g. diabetes, hypertension etc., which will give primary healthcare providers the means to monitor changes in BMI across a patient's lifetime and to examine the effect of a patient's weight on self-reported health status and quality of life. In addition, an evaluation of new or ongoing weight-management strategies in the province is needed to better identify those programs that are working well and benefitting the health of Albertans. These suggestions are aligned with the most recent set of recommendations released by the Canadian Task Force on Preventative Health Care.[114]

APPENDICES

APPENDIX I: ADJUSTED DATA

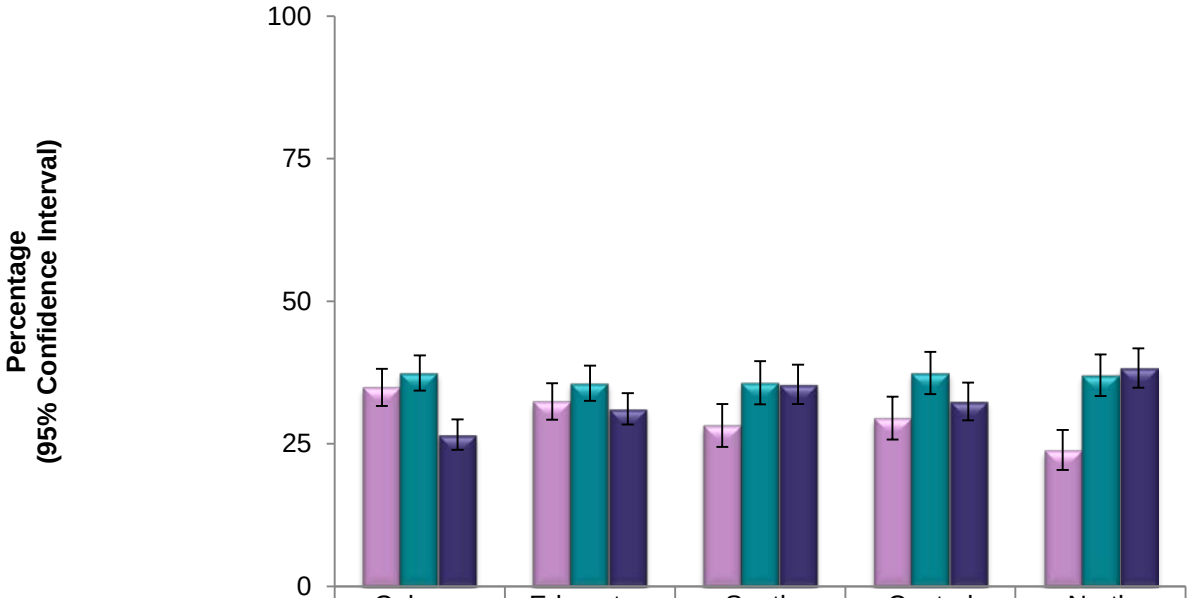
Self-reported data are subject to respondent bias (people tend to underestimate their weight and overestimate their height, resulting in an overall underestimation of BMI) and therefore adjustment equations can be applied to account for this bias. All tables and figures presented in the body of this report are replicated using the Statistics Canada adjustment equation.

The correction equations used were developed by Gorber et al. using the *2005 Canadian Community Health Survey*. This survey assessed both self-reported and measured height and weight data. These results were then compared to assess the level of bias between self-reported and measured data. The resulting correction equations were published in:

> *"The feasibility of establishing correction factors to adjust self-reported estimates of obesity" by Sarah Connor Gorber, Margot Shields, Mark S. Tremblay and Ian McDowell, Health Reports, September 2008, Statistics Canada Catalogue no. 82-003-X*[115]

The following uses the 'Reduced Model 4' equations.[2]

Figure 7: Prevalence of self-reported BMI categories by Alberta Health Services zone (HQCA, 2014)



	Calgary	Edmonton	South	Central	North
Normal BMI 18.5-24.9	34.9	32.4	28.2	29.5	23.9
Overweight BMI 25-29.9	37.4	35.6	35.7	37.4	37.0
Obese BMI ≥ 30	26.6	31.1	35.4	32.4	38.3

Table 20: Percentage of Albertans by demographic risk-factor category (HQCA, 2014)

		Normal (BMI 18.5-24.9)	Overweight (BMI 25-29.9)	Obese (BMI ≥ 30)	*Alberta (N = 4424)*
BMI		31.7	36.6*	30.7	
Gender					
	Male	39.8	30.9*	28.4*	*50.1*
	Female	24.1	42.1*	32.9*‡	*49.9*
Age					
	Age 18–24	55.8	30.0*	12.2*‡	*12.3*
	Age 25–44	33.3	34.6	30.9	*40.0*
	Age 45–64	25.0	38.1*	36.3*	*33.4*
	Age > 65	22.2	44.7*	32.7*‡	*14.3*
Income					
	Less than $30,000	28.1	30.9	39.8*	*11.5*
	$30,000 to just under $60,000	28.7	38.9*	31.7	*20.5*
	$60,000 to just under $100,000	30.6	36.5	31.8	*25.7*
	$100,000 or more	33.0	37.0	29.2‡	*42.3*
Zone					
	South	28.2	35.7	35.3	*7.5*
	Calgary	34.9	37.4	26.6*‡	*37.5*
	Central	29.5	37.4*	32.4	*11.8*
	Edmonton	32.4	35.6	31.1	*31.8*
	North	23.9	37.0*	38.3*	*11.4*
Ethnicity					
	Caucasian	30.7	36.3*	32.1‡	*82.0*
	Non-Caucasian	36.5	37.2	24.7*‡	*18.0*
Education					
	Grade school or some high school	27.1	35.7	36.9	*9.1*
	Completed high school	29.6	35.5	34.0	*20.3*
	Post-secondary technical school (including trade school)	24.1	37.4*	37.3*	*12.4*
	Some university or college	38.8	33.1	27.0*	*12.5*
	Completed college diploma	28.5	37.2*	33.3	*14.7*
	Completed university degree	37.2	37.9	24.1*‡	*22.3*
	Post-grad degree (master's or doctorate)	33.8	39.3	25.4‡	*8.7*

* Significantly different from normal BMI individuals ($p < 0.05$)

‡ Significantly different from overweight individuals ($p < 0.05$; comparing obese and overweight groups)

Table 21: Multinomial modelling of demographic risk factors by BMI category (HQCA 2014)

Demographic		Relative Risk Ratio	
		Overweight (BMI 25-29.9)	Obese (BMI ≥ 30)
Gender	Female		
	Male	2.6*	2.1*
Age group	< 25 years		
	25–44 years	2.4*	4.9*
	45–64 years	3.5*	7.4*
	65+ years	4.2*	7.3*
Ethnicity	Caucasian		
	Non-Caucasian	1.0	0.9
Education	No post-secondary		
	Post-secondary	0.9	0.7*
Income	<$30,000		
	$30,000–60,000	1.3	0.9
	$60,000–$100,000	1.2	0.9
	$100,000+	1.1	0.7
Zone	Calgary		
	South	1.2	1.5*
	Central	1.2	1.3
	Edmonton	1.0	1.1
	North	1.5*	2.0*

*Significantly different from normal BMI individuals ($p < .05$)

Table 22: Prevalence of multimorbidity by BMI category (HQCA 2014)

	OVERWEIGHT *vs. Normal*		**OBESE** *vs. Normal*		**OBESE** *vs. Overweight*	
	RR	**95% CI**	**RR**	**95% CI**	**RR**	**95% CI**
No morbidities	0.9*	(0.8, 1.0)	0.6*	(0.5, 0.7)	0.7*	(0.6, 0.9)
One morbidity	1.1	(0.9, 1.3)	1.0	(0.9, 1.2)	0.9	(0.8, 1.1)
Two morbidities	1.0	(0.8, 1.3)	1.2	(1.0, 1.5)	1.2	(0.9, 1.4)
Three or more morbidities	1.3*	(1.1, 1.6)	1.9*	(1.6, 2.3)	1.4*	(1.2, 1.6)

*Significantly different from comparator group ($p < .05$)

Table 23: Prevalence of comorbidities by BMI category (HQCA 2014)

	Normal Weight (BMI 18.5-24.9)		Overweight (BMI 25-29.9)		Obese (BMI ≥ 30)	
	%	95% CI	%	95% CI	%	95% CI
Diabetes	2.6	(1.8, 3.7)	6.5*	(5.3, 8.0)	13.9*‡	(12.0, 15.9)
COPD	1.6	(1.1, 2.4)	2.9	(2.1, 3.9)	2.6	(1.9, 3.6)
Asthma	9.6	(7.9, 11.7)	6.4	(5.1, 8.0)	10.1‡	(8.5, 12.0)
High BP	9.1	(7.6, 10.9)	18.0*	(16.0, 20.1)	29.8*‡	(27.2, 32.5)
High cholesterol	5.8	(4.6, 7.3)	11.7*	(10.1, 13.5)	19.2*‡	(17.0, 21.6)
Sleep apnea	2.6	(1.8, 3.7)	5.9*	(4.7, 7.4)	14.9*‡	(12.9, 17.2)
Congestive heart failure	0.7	(0.4, 1.3)	0.5	(0.3, 1.0)	1.8‡	(1.2, 2.7)
Depression/anxiety	14.4	(12.3, 16.7)	13.9	(12.0, 16.0)	21.4*‡	(19.1, 24.0)
Chronic pain	13.3	(11.4, 15.5)	16.1	(14.1, 18.3)	22.9*‡	(20.6, 25.4)
Arthritis	14.4	(12.5, 16.5)	21.8*	(19.6, 24.1)	29.5*‡	(26.9, 32.2)
Heart disease	3.0	(2.2, 4.2)	5.0	(3.9, 6.3)	7.5*	(6.1, 9.1)
Stroke	1.0	(0.6, 1.9)	1.2	(0.8, 2.0)	2.1	(1.4, 3.0)
Cancer	3.1	(2.2, 4.2)	4.1	(3.2, 5.3)	5.2	(4.1, 6.7)
Kidney disease	2.4	(1.6, 3.5)	1.7	(1.1, 2.6)	2.2	(1.6, 3.2)
Bowel disorder/Crohn's disease or colitis	4.1	(3.1, 5.5)	4.4	(3.5, 5.7)	5.4	(4.2, 6.9)

* Significantly different from normal BMI individuals ($p < .05$)

‡ Significantly different from overweight individuals ($p < 0.05$; comparing obese and overweight groups)

Table 24: Relative risk of individual comorbidities by BMI category (HQCA 2014)

Comorbidity	OVERWEIGHT *vs. Normal*		OBESE *vs. Normal*		OBESE *vs. Overweight*	
	RR	95% CI	RR	95% CI	RR	95% CI
Diabetes	**1.8***	(1.2, 2.9)	**4.1***	(2.7, 6.2)	**2.1***	(1.6, 2.8)
COPD	**1.5**	(0.9, 2.6)	**1.0**	(0.6, 1.7)	**0.6***	(0.3, 0.9)
Asthma	**0.8**	(0.6, 1.1)	**1.2**	(0.9, 1.6)	**1.3**	(0.9, 1.7)
High blood pressure	**1.5***	(1.2, 1.9)	**2.3***	(1.9, 2.9)	**1.5***	(1.3, 1.7)
High cholesterol	**1.5***	(1.1, 2.0)	**2.3***	(1.7, 3.0)	**1.5***	(1.2, 1.8)
Sleep apnea	**1.9***	(1.2, 3.2)	**5.2***	(3.3, 8.2)	**2.7***	(2.0, 3.8)
Congestive heart failure	**0.4**	(0.2, 1.2)	**1.8**	(0.8, 3.8)	**3.4***	(1.3, 8.7)
Depression or anxiety	**1.1**	(0.9, 1.3)	**1.5***	(1.2, 1.8)	**1.3***	(1.1, 1.6)
Chronic pain	**1.1**	(0.9, 1.4)	**1.4***	(1.2, 1.7)	**1.3***	(1.1, 1.6)
Arthritis	**1.2***	(1.0, 1.4)	**1.5***	(1.2, 1.7)	**1.2**	(1.0, 1.4)
Heart disease	**1.2**	(0.8, 1.9)	**1.9***	(1.3, 2.9)	**1.7***	(1.2, 2.4)
Stroke (or related)	**1.0**	(0.5, 2.2)	**1.3**	(0.6, 2.8)	**1.1**	(0.6, 2.1)
Cancer	**0.9**	(0.6, 1.4)	**1.1**	(0.7, 1.8)	**1.2**	(0.8, 1.8)
Kidney disease	**0.7**	(0.4, 1.4)	**0.8**	(0.4, 1.4)	**1.2**	(0.6, 2.5)
Bowel disorder/Crohn's disease or colitis	**1.0**	(0.6, 1.5)	**1.0**	(0.7, 1.6)	**1.0**	(0.7, 1.5)

*Significantly different from comparator group ($p < .05$)

Table 25: Self-reported perceptions of EQ-5D domains, by BMI category (HQCA 2014)

	Normal (BMI 18.5-24.9		Overweight (BMI 25-29.9)		Obese (BMI ≥ 30)	
	%	95% CI	%	95% CI	%	95% CI
Walking						
No problems walking?	86.0	(83.8, 88.0)	78.2*	(75.9, 80.4)	66.3*‡	(63.5, 69.1)
Slight problems walking?	9.7	(8.1, 11.7)	13.3	(11.5, 15.3)	20.5*‡	(18.2, 23.0)
Moderate problems walking?	2.5	(1.7, 3.5)	5.5*	(4.4, 6.8)	9.4*‡	(7.9, 11.2)
Severe problems walking?	1.5	(0.9, 2.5)	2.1	(1.5, 3.2)	3.5*	(2.6, 4.6)
Are you unable to walk?	0.2	(0.0, 1.3)	0.9	(0.5, 1.5)	0.3	(0.1, 0.8)
Self-care						
No problems washing or dressing yourself?	96.1	(94.8, 97.1)	94.9	(93.5, 96.0)	93.4*	(91.9, 94.6)
Slight problems washing or dressing yourself?	2.6	(1.8, 3.7)	3.2	(2.3, 4.3)	4.3	(3.4, 5.6)
Moderate problems washing or dressing yourself?	0.8	(0.4, 1.5)	1.3	(0.8, 2.2)	1.9	(1.3, 2.8)
Severe problems washing or dressing yourself?	0.2	(0.1, 0.7)	0.2	(0.1, 0.6)	0.1	(0.0, 0.3)
Are you unable to wash or dress yourself?	0.2	(0.0, 1.3)	0.4	(0.2, 0.1)	0.3	(0.1, 0.8)
Usual activities						
No problems doing your usual activities?	82.6	(80.2, 84.9)	79.0	(76.6, 81.2)	70.2*‡	(67.4, 72.8)
Slight problems doing your usual activities?	10.6	(8.9, 12.7)	13.3	(11.5, 15.3)	17.8*‡	(15.6, 20.2)
Moderate problems doing your usual activities?	4.5	(3.4, 5.9)	5.9	(4.6, 7.4)	8.5*	(7.0, 10.2)
Severe problems doing your usual activities?	1.2	(0.7, 2.1)	1.1	(0.7, 1.9)	2.2	(1.5, 3.2)
Are you unable to do your usual activities?	1.0	(0.5, 2.0)	0.7	(0.4, 1.3)	1.4	(0.9, 2.2)
Pain/discomfort						
No pain or discomfort?	51.7	(48.5, 54.9)	43.9*	(41.0, 46.9)	33.1*‡	(30.1, 36.1)
Slight pain or discomfort?	30.9	(28.1, 33.9)	38.3*	(35.6, 41.2)	38.9*	(36.0, 41.9)
Moderate pain or discomfort?	12.4	(10.5, 14.6)	13.7	(11.9, 15.7)	20.7*‡	(18.4, 23.1)
Severe pain or discomfort?	3.4	(2.5, 4.7)	3.0	(2.2, 4.1)	5.2	(4.1, 6.7)
Extreme pain or discomfort?	1.6	(0.9, 2.6)	1.1	(0.6, 1.8)	2.2	(1.4, 3.3)
Anxiety/depression						
Not anxious or depressed?	66.2	(63.1, 69.2)	71.4	(68.7, 74.0)	62.6‡	(59.6, 65.6)
Slightly anxious or depressed?	23.5	(20.9, 26.4)	18.8	(16.6, 21.2)	22.6	(20.1, 25.2)
Moderately anxious or depressed?	7.8	(6.2, 9.8)	7.1	(5.7, 8.7)	11.6‡	(9.8, 13.7)
Severely anxious or depressed?	1.8	(1.2, 2.8)	1.6	(1.1, 2.5)	2.1	(1.4, 3.3)
Extremely anxious or depressed?	0.7	(0.3, 1.5)	1.1	(0.7, 1.8)	1.1	(0.6, 2.0)

*Significantly different from normal BMI individuals ($p < .05$)

‡ Significantly different from overweight individuals ($p < 0.05$; comparing obese and overweight groups)

Figure 8: Mean score for EQ-5D VAS health-related quality-of-life measures, by BMI category (HQCA 2014)

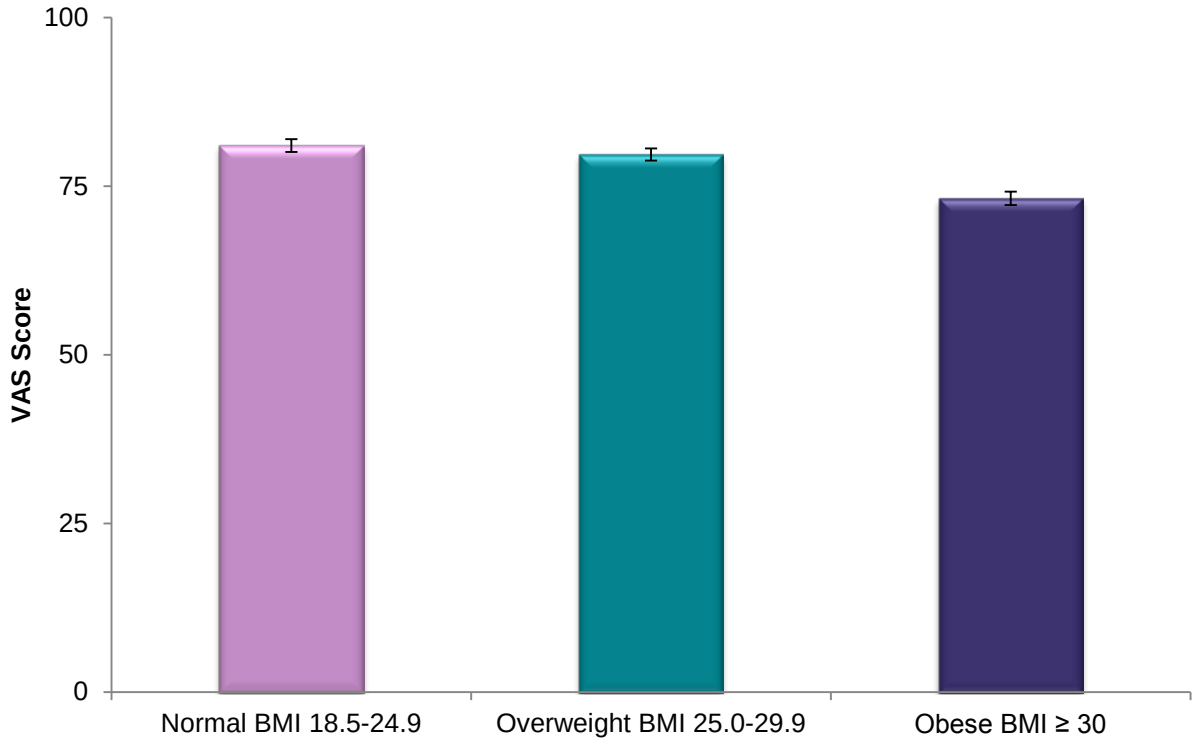


Table 26: Relative risk ratios for EQ-5D VAS health-related quality-of-life measures, by BMI category (HQCA 2014)

Demographic		Relative Risk	95% CI		*p*-value
			lower bound	upper bound	
BMI	**Normal**	Reference			
	Overweight	1.0	1.0	1.0	0.26
	Obese	0.9*	0.9	1.0	< 0.05

*Significantly different from normal BMI individuals ($p < .05$)

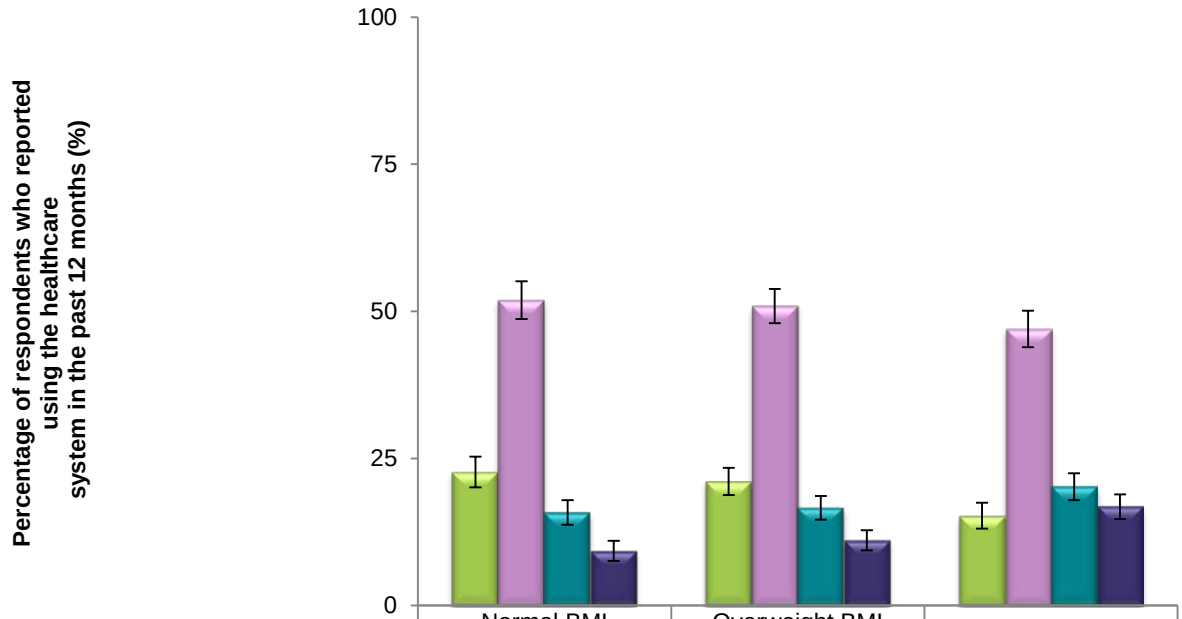
Table 27: Most recent contact with Alberta healthcare system, by BMI category (HQCA 2014)

	Normal (BMI 18.5-24.9)		Overweight (BMI 25-29.9)		Obese (BMI ≥ 30)	
	%	95% CI	%	95% CI	%	95% CI
0 to 2 months	51.0	(47.8, 54.2)	53.0	(50.1, 56.0)	58.0*	(55.0, 61.1)
3 to 4 months	17.1	(14.8, 19.7)	16.2	(14.2, 18.5)	18.8	(16.5, 21.3)
5 to 6 months	9.6	(7.9, 11.7)	9.8	(8.1, 11.7)	7.9	(6.3, 9.8)
7 to 8 months	3.2	(2.3, 4.5)	3.7	(2.8, 5.0)	2.8	(2.0, 4.0)
9 to 10 months	3.9	(2.8, 5.3)	2.0	(1.4, 3.0)	3.4	(2.3, 4.9)
11 to 12 months	4.5	(3.3, 6.1)	4.2	(3.1, 5.6)	2.2	(1.4, 3.4)
Used the healthcare system in the past 12 months	89.3	(87.1, 91.3)	89.0	(86.9, 90.8)	93.1	(91.1, 94.6)

*Significantly different from normal BMI individuals ($p < .05$)

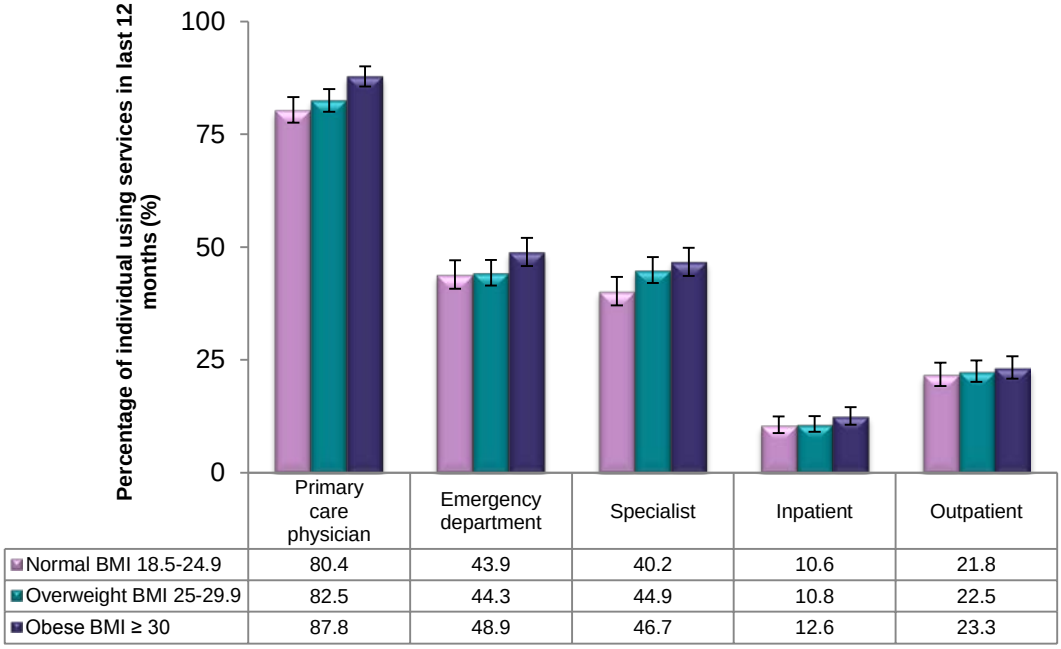
ǂ Significantly different from overweight individuals ($p < 0.05$; comparing obese and overweight groups)

Figure 9: Involvement with the healthcare system in the previous 12 months, by BMI category (HQCA 2014)



	Normal BMI 18.5-24.9	Overweight BMI 25-29.9	Obese BMI ≥ 30
No health issues	22.7	21.1	15.3
Minor health issues	51.9	50.9	47.0
More serious health issues	15.8	16.6	20.2
Serious ongoing or long-term health issues	9.3	11.1	16.8

Figure 10: Percentage of Albertans reporting healthcare services use, by BMI category (HQCA 2014)



	Primary care physician	Emergency department	Specialist	Inpatient	Outpatient
Normal BMI 18.5-24.9	80.4	43.9	40.2	10.6	21.8
Overweight BMI 25-29.9	82.5	44.3	44.9	10.8	22.5
Obese BMI ≥ 30	87.8	48.9	46.7	12.6	23.3

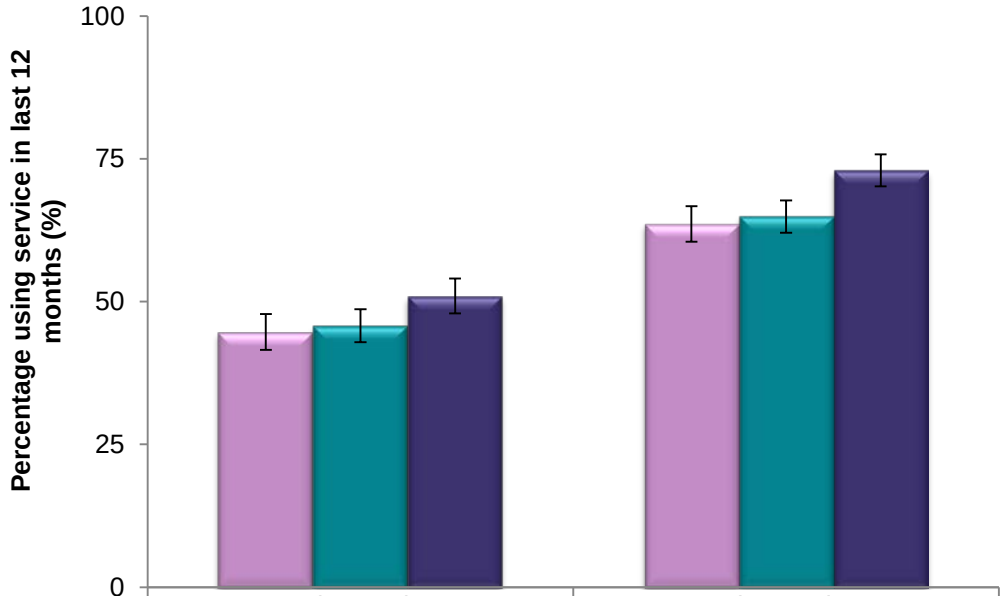
Table 28: Number of visits to primary care physician, emergency department, specialist, by BMI category (HQCA 2014)

Within the last year, number of visits to…	Normal (BMI 18.5-24.9)		Overweight (BMI 25-29.9)		Obese (BMI ≥ 30)	
	visits	95% CI	visits	95% CI	visits	95% CI
Primary care physician	6.2	(5.4, 7.1)	6.0	(5.4, 6.6)	7.3*	(6.6, 8.0)
Emergency department	1.0	(0.8, 1.1)	1.1	(1.0, 1.2)	1.2	(1.0, 1.3)
Specialist	3.8	(3.1, 4.6)	2.8	(2.5, 3.1)	3.4	(3.0, 3.8)

*Significantly different from normal BMI individuals ($p < .05$)

ǂ Significantly different from overweight individuals ($p < 0.05$; comparing obese and overweight groups)

Figure 11: Percentage of Albertans reporting diagnostic or pharmacist services use, by BMI category (HQCA 2014)



	Diagnostic	Pharmacist
Normal BMI 18.5-24.9	44.7	63.6
Overweight BMI 25-29.9	45.8	64.9
Obese BMI ≥ 30	51.0	73.0

Table 29: Primary care physician use, by BMI category (HQCA 2014)

Within the past year:	OVERWEIGHT *vs. Normal*		OBESE *vs. Normal*		OBESE *vs. Overweight*	
	RR	95% CI	RR	95% CI	RR	95% CI
Appointment with primary care physician	1.1*	(1.0, 1.1)	1.1*	(1.1, 1.2)	1.1*	(1.0, 1.1)

*Significantly different from comparator group ($p < .05$)

Table 30: Availability of personal primary care physician to assist in care, by BMI category (HQCA 2014)

Personal primary care physician was available:	Normal (BMI 18.5-24.9)		Overweight (BMI 25-29.9)		Obese (BMI ≥ 30)	
	%	95% CI	%	95% CI	%	95% CI
Yes	63.1	(59.5, 66.6)	64.0	(60.7, 67.1)	62.6	(59.2, 65.8)
Yes, to some extent	30.6	(27.3, 34.1)	30.4	(27.4, 33.6)	32.0	(28.9, 35.2)
No	6.3	(4.8, 8.2)	5.6	(4.2, 7.4)	5.5	(4.2, 7.1)

*Significantly different from normal BMI individuals ($p < .05$)

Table 31: Topic of discussion between respondent and primary care physician, by BMI category (HQCA 2014)

Personal primary care physician…	Normal (BMI 18.5-24.9)		Overweight (BMI 25-29.9)		Obese (BMI ≥ 30)	
	%	95% CI	%	95% CI	%	95% CI
Talked about exercise and physical activity	48.4	(44.7, 52.1)	59.9*	(56.5, 63.1)	66.8*‡	(63.5, 69.8)
Talked about diet and healthy eating habits	35.0	(31.6, 38.6)	48.3*	(44.9, 51.6)	59.8*‡	(56.4, 63.0)

*Significantly different from normal BMI individuals ($p < .05$)

‡ Significantly different from overweight individuals ($p < 0.05$; comparing obese and overweight groups)

Table 32: Topic of discussion between respondent and primary care physician, by BMI category (HQCA 2014)

Personal primary care physician…	Normal (BMI 18.5-24.9)		Overweight (BMI 25-29.9)		Obese (BMI ≥ 30)	
	%	95% CI	%	95% CI	%	95% CI
Was needed to prevent illness	32.3	(28.9, 35.8)	35.6	(32.5, 38.8)	42.4*‡	(39.1, 45.7)
Provided needed help	93.6	(90.0 , 96.0)	92.6	(88.9, 95.1)	93.1	(89.8, 95.4)
Encouraged discussion of all health concerns	71.2	(67.6, 74.5)	73.4	(70.3, 76.3)	75.2	(72.2, 78.0)

*Significantly different from normal BMI individuals ($p < .05$)

‡ Significantly different from overweight individuals ($p < 0.05$; comparing obese and overweight groups)

MEDLIOR
HEALTH OUTCOMES RESEARCH

APPENDIX 2: Literature Review Methodology and Evidence Tables - *Epidemiology and Etiology*

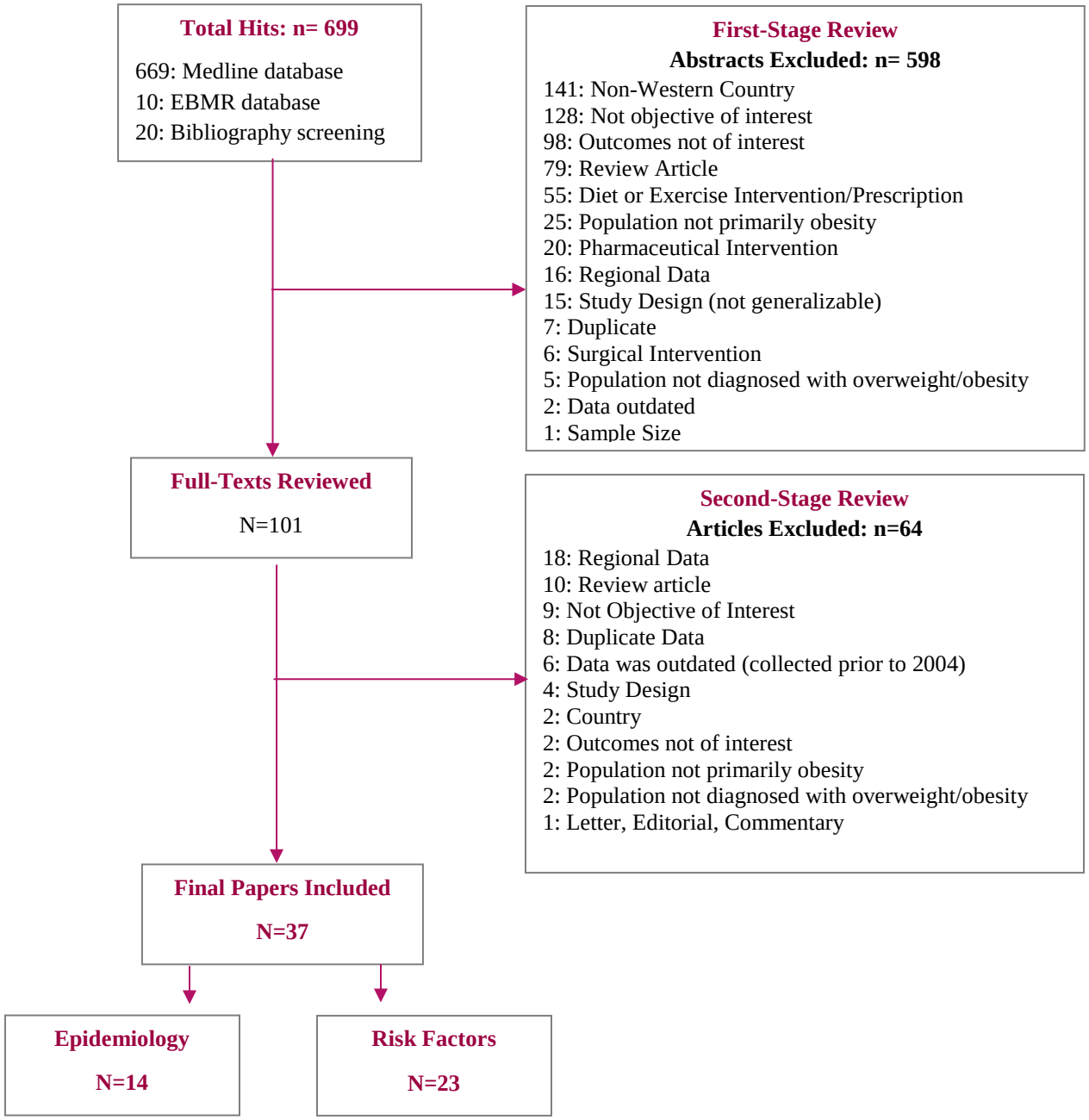
1 Table of Contents

2 Methodology

A literature search in the OvidSP Medline and selected Evidence Based Medicine Review (EBMR) databases was conducted on March 9th 2014 (and updated on June 30th 2014) in order to identify peer-reviewed literature for the following objective: W*hat is the current understanding of the epidemiology, etiology and risk factors associated with overweight and obese populations?*

This literature review examines the literature in ***both*** adult and pediatric populations.

2.1 Study Selection



2.2 Literature Search Strategy

Search Strategy: OvidSP MEDLINE

Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) and Ovid OLDMEDLINE(R) 1946 to present – **accessed March 26th 2014**

	Searches	Results
1	Obesity {Including Limited Related Terms}	10816
2	Overweight {Including Limited Related Terms}	4792
3	**1 OR 2**	**15051**
4	epidemiology{Including Limited Related Terms}	11943
5	prevalence {Including Limited Related Terms}	16290
6	incidence{Including Limited Related Terms}	9524
7	Life time risk{Including Limited Related Terms}	2229
8	**4 OR 4 OR 6 OR 7**	**39501**
9	Etiology {Including Limited Related Terms}	10550
10	Causality {Including Limited Related Terms}	15976
11	Diagnosis {Including Limited Related Terms}	31703
12	Mental health {Including Limited Related Terms}	10110
13	Risk factors {Including Limited Related Terms}	18417
14	**9 OR 10 OR 11 OR 12 OR 13**	**81389**
15	3 AND 8	361
16	3 AND 14	457
17	15 OR 16	795
18	Limit 17 to (English language and humans and yr="2004–Current")	646
19	**Total references for screening**	**646**
	Additional References Identified June 30th 2014	**23**
	Total references for screening	**669**

Search Strategy: OvidSP Evidence Based Medicine Review

EBM Reviews - ACP Journal Club 1991 to March 2014, [Database Field Guide] EBM Reviews - Cochrane Database of Systematic Reviews 2005 to February 2014 – **accessed March 26th 2014**

	Searches	Results
1	obesity.m_titl. (title)	26
2	overweight.m_titl. (title)	31
3	**1 OR 2**	**46**
4	epidemiology{Including Limited Related Terms}	124
5	prevalence {Including Limited Related Terms}	334
6	incidence{Including Limited Related Terms}	1258
7	Life time risk{Including Limited Related Terms}	2
8	**4 OR 4 OR 6 OR 7**	**1659**
12	3 AND 8	10
15	Limit 14 to (English language and humans and yr="2004–Current")	8
16	**Total references for screening**	**8**
	Additional References Identified June 30th 2014	**2**
	Total references for screening	**10**

2.3 Inclusion and Exclusion Criteria

Inclusion criteria

- Population: any adult or pediatric patients; clinically classified as high-risk, overweight or obese included in studies from westernized countries.
- Interventions: not applicable
- Comparator: not applicable
- Outcomes: epidemiology (prevalence, incidence and life-time risk) and etiology (causality and risk factors)
- Study design: any

Exclusion criteria

- Studies published prior to 2004 (>10 years);
- Non-English language studies;
- Review articles (though bibliographies may be searched),
- Editorials, commentaries, letters
- Papers published from non-westernized countries (non-applicable to western weight goals/diets);
- Studies focused on populations not specifically defined as high-risk, overweight or obese (e.g. other chronic conditions, where obesity may be a characteristic of the population rather than the condition of focus)
- Studies which included data prior to 2004, or studies for populations in which more recent data was available.
- Non-Canadian regional studies

Excluded Full Text Papers

Citation	Reason for exclusion
Farrant B, 2013[1]	Regional Data
Haby MM, 2012[2]	Regional Data
Larsen LM, 2012[3]	Regional Data
Juliusson PB, 2010[4]	Regional Data
Salanave B, 2009[5]	Regional Data
Vuorela N, 2009[6]	Regional Data
Hickie M, 2013[7]	Regional Data
Taveras EM, 2013[8]	Regional Data
Schultz R, 2012[9]	Regional Data
Vuorela N, 2011[10]	Regional Data
Thibault H, 2010[11]	Regional Data
Krue S, 2010[12]	Regional Data
Koebnick C, 2010[13]	Regional Data
Vazquez FL, 2010[14]	Regional Data

Citation	Reason for exclusion
Bergstrom, 2009[15]	Regional Data
Balaban, 2010[45]	Regional Data
Odegaard, 2013[46]	Regional Data
Smith DT, 2009[49]	Regional Data
Milgrom J, 2012[16]	Review Article
Gutierrez-Fisac JL, 2012[17]	Review Article
Quelly SB, 2011[18]	Review Article
Olds T, 2011[19]	Review Article
Orsi CM, 2011[20]	Review Article
Kuhle S, 2010[21]	Review Article
Singh, A. S., 2008[22]	Review Article
Naukkarinen J, et al[23]	Review Article
Nielsen LS, 2011[24]	Review Article
Wang F, 2013[25]	Review Article
Binkin N, 2010[26]	Not objective of interest
Singh GK, 2010[27]	Not objective of interest
de Onis M, 2010[28]	Not objective of interest
Sardinha LB, 2011[29]	Not objective of interest
Reilly JJ, 2010[30]	Not objective of interest
Feng J, 2010[31]	Not objective of interest
Hilbert A, 2009[32]	Not objective of interest
Sharma, A. M, 2010[33]	Not objective of interest
Watanabe Y, 2013[34]	Not objective of interest
Ogden CL, 2012[35]	Duplicate Data
Flegal KM, 2012[36]	Duplicate Data
Heeb JL, 2011[37]	Duplicate Data
Micciolo R, 2010[38]	Duplicate Data
Olds TS, 2010[39]	Duplicate Data
Pigeot I, 2009[40]	Duplicate Data
Berghofer A, 2008[41]	Duplicate Data
Wang, Y., 2007[42]	Duplicate Data
Harringon, 2009[43]	Data Collected Prior to 2004 (from 1991 Census)
Janssen, 2006[44]	Data Collected Prior to 2004 (from 2001-2002)
Dubois L, 2006[48]	Data Collected Prior to 2004 (from 1998-2002)
Bethell C, 2009[54]	Data Collected Prior to 2004 (from 2003)
Janssen, 2005[55]	Data Collected Prior to 2004 (from 2001-2002)

Citation	Reason for exclusion
Flegal KM, 2010[56]	Data Outdated (more recent data available in a subsequent paper)
Creemers JW, 2012[50]	Study Design (animal study)
Trasande L, 2012[51]	Study Design (hypothetical)
Bourque SL, 2012[52]	Study Design (animal study)
O'Connell JK, 2010[53]	Study Design (one clinic)
Fernandes RA, 2011[57]	Country
Bingham DD, 2013[58]	Country
Iversen L, 2012[59]	Outcomes not of interest
Blok D, 2013[60]	Outcomes not of interest
Maiano C, 2011[61]	Population not primarily obesity (other disease included)
Pal A, 2012[62]	Population not primarily obesity (other disease included)
Barbadoro P, 2013[63]	Population not diagnosed with overweight/obesity
Catalano PM, 2009[47]	Population not diagnosed with overweight/obesity
Hume C, 2009[64]	Letter, editorial, commentary

3 Epidemiology Literature Evidence Tables

Evidence Table of Included Epidemiology Studies: Study and Patient Characteristics

Author, Year / Country / Sample Size	Study Objective	Age / Gender (% Male)	Study Population Characteristics (including Socio-economic Data & Baseline Comorbidities)	BMI Definition or Range / Other Weight Measures
Ogden, C.L. et al., 2014[65] US n = 9120 (5181 adults)	To provide the most recent national estimates of childhood obesity, analyze trends in childhood obesity between 2003 and 2012, and provide detailed obesity trend analyses among adults.	All ages, birth > 60 years NR	NR	Adult obesity was defined as a BMI greater than or equal to 30. Infants and toddler less than 2 years, high weight for recumbent length was defined as weight for length above the 95th percentile of the sex-specific CDC growth charts. In children and adolescents aged 2 to 19 years, obesity was defined as BMI at or above the 95th percentile of the sex-specific CDC BMI for age growth charts.
Twells, L.K. et al., 2014[66] Canada n=NR	The objective of this paper is to present the data for the past and current prevalence of adult obesity in Canada, together with future estimates.	NR	NR	BMI categories normal to obese
Schmidt Morgen, C. et al., 2013 [67] Europe n=16,557	We aimed to examine the trends in prevalence of infant, childhood and adolescent overweight and obesity in a Danish setting using the most recent available data.	Infants, Children and Adolescents NR	NR	According to the WHO Child Growth references, infants are classified as overweight if their age- and sex-specific Body Mass Index (BMI) for age value is greater than 2 standard deviation scores (SDS) above the mean. Infants were classified as obese if their age- and sex-specific BMI is greater than 3 SDSs above the mean. Children and adolescents are classified as overweight if their age- and sex-specific BMI for age value is greater than 1 SDS above the mean and obese if their age and sex-specific BMI for age value is greater than 2 SDSs above the mean [24,25]. The prevalence rates for overweight include both overweight and obesity.
Gallus, S. et al., 2013[68] Europe	To provide updated information on trends and determinants of underweight, overweight and obesity in Italian adults.	Mean age (Years), Males vs Females Underweight: 38.1 vs 37.7; Normal weight:	Characteristics including: education, income, marital status, geographic area, area of residence, smoking and alcohol use reported by BMI category (Table 2)	BMI categorized in four levels, according to the standard classification by the World Health Organization.

Author, Year / Country / Sample Size	Study Objective	Age / Gender (% Male)	Study Population Characteristics (including Socio-economic Data & Baseline Comorbidities)	BMI Definition or Range / Other Weight Measures
n = 14,135		42.4 vs 45.1; Overweight: 50.1 vs 56.3; Obesity: 54.3 vs 59.6 48.3% male		
Frizzell, L.M. & Canning, P.M. 2013[69] Canada born in 1984, n=3,857 born in 1997, n=4,161 born in 2005, n=1,305	To determine the prevalence of overweight and obesity in preschool aged children in Newfoundland and Labrador in 2009/10. Secondly, to assess trends from previously reported data.	51.3 months (SD=3.5) NR	NR	Body mass index was calculated using WHO growth charts.
Pan, L. et al., 2013[70] US n = 1, 204, 839	In this study, we used the longitudinal data from PedNSS to examine the incidence and reverse of obesity in 2010–2011 and variations in risk of obesity across gender, baseline age, and racial/ethnic subgroups among US children living in low-income families who were aged 0 to 23 months in 2008.	Baseline Age (mo) % (SE) 0–11: 55.2 (0.05) 12–23: 44.8 (0.05) 50.4% (0.05) boys	The demographic distribution was similar among all children included in this study and children who were non-obese at baseline (Table 1). Among those who were non-obese in 2008, ~39% were Hispanics and 36% were non-Hispanic whites.	Infants and children whose weight-for-length or BMI-for-age was at the 0 to 94th percentile were considered non-obese.
Choi, J.Y. 2012[71] US n = 7,786	This study provides an overall picture of overweight and obesity of new US immigrants by the place of origin.	Age (y), (%) 18–29: 27.5 30–39: 34.9 40–49: 18.8 50–59: 10.0 >60: 8.9 45% male	Place of Origin; % North America: 1.4 Latin America & Caribbean: 43.2 East and South Asia/Pacific/Oceania: 30.3 Sub-Saharan Africa: 6.4 Europe/Central Asia: 14.3 Middle East/North Africa: 4.4	As a key variable, weight status was created from the calculated BMI based on self-reported weight and height, following the National Institutes of Health guidelines: underweight (BMI\18.5 kg/m2), normal weight (18.5 kg/m2 B BMI\23 kg/m2), overweight (23 kg/m2 B BMI\30 kg/m2), and obesity (BMI C 30 kg/m2).
Howel, D. 2012[72] Europe n = 86,398	To describe recent age and time trends in abdominal obesity and overweight in England, based on waist circumference cut-offs, to identify any variation in trends across the age range and investigate whether	Age range 18-67 years 46% male	NR	Abdominal overweight and obesity: WC ≥102 cm and ≥94cm in men, and ≥88 cm and ≥80 cm in women.

Author, Year / Country / Sample Size	Study Objective	Age / Gender (% Male)	Study Population Characteristics (including Socio-economic Data & Baseline Comorbidities)	BMI Definition or Range / Other Weight Measures
	there were any signs of change in their trajectory as has been seen in generalized obesity.			
Moss, A. et al., 2012[73] Europe Inquiry 1 n=543 380 Inquiry 2 n=607 444	The aim of this project was to analyse recent data of the SEE (school enrolment examinations) in Germany in order to investigate the most recent development of prevalence rates for overweight and obesity in German children entering school.	6 years NR	NR	Overweight and obesity were defined by BMI>90th and BMI>97th age- and gender-related percentiles of German reference values, respectively.
Foulds, H.J. et al., 2011[74] Canada n=759	To examine the current overweight and obesity prevalence of British Columbian Aboriginal adults.	Mean years, (SD): men 42.9 ±14.7. women 41.2 ±12.2 24% male	Men vs Women: Hypertension 45% vs 30.5% Diabetes 12.1% vs 6.8%	Mean BMI; waist circumference
Singh, G.K. et al., 2011[75] US n=323,627 in 1992–1995 n=154,649 in 2003–2008	The purpose of this study was to describe national trends in immigrant and social class inequalities in the prevalence of obesity and over-weight and to identify immigrant and social class groups who are at high risk of obesity and who have experienced substantial increases in their obesity rates.	>18 years NR	NR	Adult overweight was defined as a BMI C 25 kg/m2 and obesity as a BMI C 30 kg/m2.
Howel, D. 2011[76] Europe n=131,248	To describe trends in the prevalence of obesity and overweight in English adults. The present study also uses the HSE data to describe the patterns in obesity and overweight in sub-groups born in different decades, and compares these with trends seen in two British cohort studies which recruited in the 1940s and 1950s.	16 and 65 years 46.9% male	NR	The outcome measures used for the analyses were the binary measures of obesity (BMI≥30.0 kg/m2) and overweight (BMI≥25.0 kg/m2). International cut-off points of BMI for obesity and overweight as described by Cole et al. were used on those aged 16–17 years.
Finucane, M. M. et al., 2011[77] Multinational	We estimated worldwide trends in population mean BMI.	NR NR	NR	Mean BMI

Author, Year / Country / Sample Size	Study Objective	Age / Gender (% Male)	Study Population Characteristics (including Socio-economic Data & Baseline Comorbidities)	BMI Definition or Range / Other Weight Measures
n =9.1 million				
Young, T. K. et al., 2007[78] Multinational n=2,545	We investigated the prevalence of obesity and the metabolic correlates of different levels of body mass index (BMI) and waist circumference among the Inuit in 3 countries.	NR 43.6% male	NR	WHO criteria for overweight (BMI=25.0 to 29.9) and obesity (BMI≥30.0

Evidence Table of Included Epidemiology Studies: Measurement and Analysis

Author, Year / Country / Sample Size	Primary Study Outcome Examined / Other Outcomes Examined	Analysis (definitions/calculations)	Limitations
Ogden, C.L. et al., 2014[65] US n = 9120 (5181 adults)	Prevalence and trends of obesity in children and adults.	Analyses of trends in high weight for recumbent length or obesity prevalence were conducted overall and separately by age across 5 periods (2003-2004, 2005-2006, 2007-2008, 2009-2010, and 2011-2012).	Analysis of trends depends on what is chosen as the initial point of examination.
Twells, L.K. et al., 2014[66] Canada n=NR	Body mass index values are categorized as follows: normal weight (BMI 18.5–24.9), overweight (BMI 25.0–29.9), obese class I (BMI 30.0–34.9), obese class II (BMI 35.0–39.9) and obese class III (BMI ≥ 40.0). In our study, BMI was calculated using self-reported heights and weights gathered from the 3 surveys. Calculated for historical data and prediction data to 2019. Provincial prevalence variations and sex and age variations.	All surveys were weighted to be representative of both national and provincial populations. The 10-year historical BMI prevalence data between 2000/01 and 2011 were tested for linear, quadratic and cubic trends. Based on visual inspection and evaluation of the models, we chose a linear model as the best fit for the data and used it in the prediction analysis. The trend analysis was limited to 6 data points over a 10-year period, because the CCHS was only started in 2000. As a result, we used linear regression to estimate the future prevalence of obesity up to 2019.27 This linear line technique has been used frequently to describe population prevalence or growth, and to make predictions for the future.	• The use of BMI as a measure of body fat does not differentiate between lean and fat tissue, and therefore its use in the clinical setting is limited. • Use of cross-sectional surveys with limited sample size for conducting meaningful subgroup analysis.
Schmidt Morgen, C. et al., 2013 [67] Europe n=16,557	Prevalence of infant, childhood and adolescent overweight and obesity.	Age, gender and source specific point estimates of the prevalence were calculated with 95% confidence intervals of the estimates. Overall trends and their linearity were assessed graphically. The PROC REG procedure in the SAS statistical software (ver. 9.2) was used to estimate and test for linear trends across time for all groups defined by data source, age and gender. The procedure fits least-squares estimates to linear regression models with the prevalence rates in per cent as a linear function of measurement year, and thereby providing regression coefficients that are changes in prevalence in per cent per year. To adjust for differences in sample size between observations, the prevalence rates were weighted by the inverse of the standard error in the statistical model, which implies that larger samples are given more weight. A p-value below 0.05 was considered statistically significant	• Data from the DHVCHD and from the DNBC cannot be considered representative for the entire Danish population with regard to socioeconomic composition. • Use of BMI as a measure of weight status has been criticized, especially in children, because BMI may be affected by skeletal structure and muscle mass
Gallus, S. et al., 2013[68]	Prevalence distribution of BMI by gender.	*p*-values for comparisons were derived using *t*-test for continuous variables and X2 test for categorical variables. Prevalence ratios (PR) and corresponding 95% confidence	• Use of self-reported information on height and weight

Author, Year / Country / Sample Size	Primary Study Outcome Examined / Other Outcomes Examined	Analysis (definitions/calculations)	Limitations
Europe n = 14,135		intervals (CI) were derived using multiplicative generalized linear models (log-binomial model), after adjustment for calendar year, age, education, marital status, geographic area, area of residence, tobacco smoking and alcohol drinking.	
Frizzell, L.M. & Canning, P.M. 2013[69] Canada born in 1984, n=3,857 born in 1997, n=4,161 born in 2005, n=1,305	Prevalence of overweight or obesity	ANOVAs were used to compare continuous variables. Prevalence estimates were compared using multinomial or binary logistical regression analyses with body weight status as the dependent variable and year of measurement as predictor variable. Models were adjusted for age, sex and health region.	NR
Pan, L. et al., 2013[70] US n = 1, 204, 839	We calculated the incidence of obesity in various population subgroups. The populations in denominators were defined as infants and children who were non-obese in 2008. The numerator was defined as the subset of these children who were obese in 2010–2011. Incidence of obesity was then calculated by dividing the numbers of children who developed obesity during the 24-to 35-month follow-up period by the numbers of children who were non obese at baseline.	SAS version 9.3 (SAS Institute, Cary, NC) was used to estimate the incidence and reverse of obesity from 2008 to 2010–2011, both overall and by gender, baseline age (0–11 months or 12–23 months), and race/ethnicity. *t*-tests were used to compare the incidence and reverse of obesity across population subgroups, and Bonferroni adjustments were used to maintain the overall type 1 error rate of 5% during multiple comparisons. To estimate the adjusted relative risk (ARR) that represents the risk of obesity in 1 group relative to that in another group, we conducted logbinomial regression, a form of generalized linear modeling with binomial errors and log link, adjusting for gender, baseline age, race/ethnicity, duration of follow-up, and baseline weight-for-length percentile.	• Only low-income children are monitored by PedNSS. • This follow-up study included only ~30% of the children aged 0 to 23 months who participated in PedNSS in 2008.
Choi, J.Y. 2012[71] US n = 7,786	The prevalence patterns in overweight and obesity were described by years of US residence, current residence, and socio-demographic characteristics within each place of origin immigrant group.	The respondent's place of origin was categorized into six groups, using the regional classification of the country available in the NIS data: North America; Latin America and Caribbean; African Sub-Sahara; Middle East and North Africa; Europe and Central Asia; and East and South Asia, the Pacific, and Oceania. In the NIS data, the respondent's country of origin was aggregated to nine regions except the countries with the considerable number of immigrants. The individually identified countries were included in one of the nine regions. Oceania, Antarctic region, and Arctic region were combined with the East and South Asia and the Pacific	• Estimated prevalence of overweight and obesity relied on self-reported weight and height, which may involve systematic biases. • This study presented the aggregate estimates of pan-ethnic categories based on six world regions. The aggregate estimates may mask differences in the prevalence of obesity and overweight and the nature of changes in the distribution within subgroups. • The estimates for some groups such as North

Author, Year / Country / Sample Size	Primary Study Outcome Examined / Other Outcomes Examined	Analysis (definitions/calculations)	Limitations
		region due to their small number of observations. Then, this region was labeled as the East and South Asia/Pacific/Oceania region. Years of US residence was categorized into four groups: less than 1 year; 1 year to less than 5 years; 5 years to less than 10 years; and 10 years or longer. Statistical analyses were performed using STATA version 11. Descriptive statistics were used to summarize the sample characteristics. The prevalence estimates and the confidence intervals of overweight and obesity among immigrants overall and by place of origin subgroups were calculated. All the analyses took into account the sampling weight to provide more accurate probability estimates of the population.	Americans might be imprecise due to insufficient sample size.
Howel, D. 2012[72] Europe n = 86,398	The prevalence of abdominal obesity/overweight by age and years in adults.	The relationship between prevalence of abdominal obesity/ overweight with age and time period was fitted by generalized linear models with binomial errors and an identity link function, which allowed the prevalence to be estimated for a combination of age and survey year.	• The reported analysis has only considered the factors of the survey year and age. Other factors, associated with obesity, may have also changed over time.
Moss, A. et al., 2012[73] Europe Inquiry 1 n=543 380 Inquiry 2 n=607 444	Prevalence of obesity and overweight in children starting school in Germany.	To estimate the development of prevalence rates of overweight and obesity in children starting school in Germany the current data (inquiry 2) were compared to SEE data out of the former analysis (inquiry 1). The first data retrieval was performed in 2007, asking for the most recent SEE data in general out of 2004 (inquiry 1) and included an estimated number of n=543 380 examined children. The second data retrieval was performed in 2010, asking for the most recent SEE data in general out of 2008 (inquiry 2). Data from all 16 German federal states could be analysed. The most recent data retrieval included n=607 444 children.	NR
Foulds, H.J. et al., 2011[74] Canada n=759	Prevalence of obesity and overweight.	For both genders, each age group and all geographic regions, mean, standard deviation and proportion of obesity and AO were determined. Multiple linear regression analysis was conducted to identify correlates of obesity and relative risk ratios were calculated from these regression results.	NR
Singh, G.K. et al., 2011[75] US n=323,627 in	Prevalence of obesity and overweight by immigrant status and educational attainment.	Adult overweight was defined as a BMI ≥ 25 kg/m2 and obesity as a BMI ≥ 30 kg/m2. Multivariate logistic regression was used to examine the association between the binary outcomes of obesity and overweight and selected socioeconomic and demographic factors.	• Obesity and over-weight prevalence estimates from NHIS are derived from self-reported height and weight data. • Cross-sectional nature of the NHIS. • Dietary information in the NHIS is lacking,

Author, Year / Country / Sample Size	Primary Study Outcome Examined / Other Outcomes Examined	Analysis (definitions/calculations)	Limitations
1992–1995 n=154,649 in 2003–2008			and data on immigration and acculturation are limited. • Did not examine if ethnic-immigrant and social class trends in obesity differed by gender
Howel, D. 2011[76] Europe n=131,248	The outcome measures used for the analyses were the binary measures of obesity (BMI ≥ 30.0 kg/m2) and overweight (BMI ≥ 25.0 kg/m2). The relationship between the prevalence of obesity/overweight with age and time period was fitted by generalized linear models with binomial errors and an identity link function, which allowed the prevalence (and differences between prevalence at different ages or periods) to be estimated from explanatory variables.	Four separate models were fitted for the two outcome measures in both males and females, with the explanatory variables being 4-year period (1991/94, 1995/98, 1999/02, 2003/06), polynomial terms in age in years (linear, quadratic and cubic terms centred on 40 years to reduce co-linearity) and interactions between period and both linear and quadratic age terms; this allows the difference between periods to vary with age. The HSE yearly survey data were divided into sub-groups born in different decades. These birth cohort subgroups were retained only if subjects were in the age range 16–65 years throughout the survey periods (1991–2006). This produced subgroups of adults who were born in the decades 1936–45, 1946–55, 1956–65 and 1966–75 in each survey year. These are called pseudo or synthetic birth cohorts, since they have been assembled from cross-sectional data.	The HSE is a high-quality data set, but the average response rate for BMI data is about 63 % and the possibility of response bias should be considered.
Finucane, M. M. et al., 2011[77] Multinational n =9.1 million	Trends in mean BMI	Our analysis included three steps: (1) identification of data sources, and accessing and extracting data; (2) conversion of extracted data to a comparable metric; and (3) application of a statistical model to estimate BMI trends by country and sex. We analysed the uncertainty in estimates, taking into account sampling error and uncertainty from statistical modelling.	• The main limitation of our study is that data gaps remained despite our extensive data seeking, especially in the 1980s, and for men during the 1990s. • Our analysis did not consider trends in central adiposity because of insufficient population-based data, nor did it quantify within-country disparities by socioeconomic status or race.
Young, T. K. et al., 2007[78] Multinational n=2,545	Prevalence of body mass index (BMI) and waist circumference. Blood pressure was measured. Fasting plasma samples were tested for levels of cholesterol and subfractions, triglycerides, glucose, and insulin. Although different laboratories were used in the 4 studies, comparable techniques were used. Glucose was analyzed by the hexokinase–glucose 6-phosphate dehydrogenase method, and	The 4 data sets were checked for data entry errors and merged. Statistical analyses on the combined data set were performed using SPSS for Windows, version 13.0 (SPSS Institute, Cary, NC). Gender-specific means of various metabolic variables and their 95% confidence intervals (CIs) were computed for different categories of BMI and waist circumference and compared with the Inuit and Euro-Canadian samples. Because of the skewed distribution of the lipids, glucose, and insulin variables in both samples, log-transformed values were used in the analysis (and back-transformed as geometric means in the graphical	• Our data are derived from 4 separate studies that were generally comparable but not identical in methods. • The limitations of using the BMI as an indicator of excess body fat are well known.

Author, Year / Country / Sample Size	Primary Study Outcome Examined / Other Outcomes Examined	Analysis (definitions/calculations)	Limitations
	insulin by radioimmunoassay. Lipids were determined using an autoanalyzer system that used enzymatic colorimetric methods.	presentation).	

Evidence Table of Included Epidemiology Studies: Outcomes

Author, Year / Country / Sample Size	Primary Study Outcome	Risk Factors	Other
Ogden, C.L. et al., 2014[65] US n = 9120 (5181 adults)	In Adults: (Tables 4 and 5) 68.5% were either overweight or obese, 34.9% were obese and 6.4% were grade 3 obesity (extremely obese). This differed by age and sex. In infants, the prevalence of high weight for recumbent length among those birth to age 2 years was 8.1% (Table 2). In 2011-2012, 31.8% of youth were either overweight or obese and 16.9% were obese (Table 3).	NR	NR
Twells, L.K. et al., 2014[66] Canada n=NR	Between 1985 and 2011, the prevalence of adults in the overweight category increased by 21% from 27.8% to 33.6%, and the prevalence of obesity (BMI ≥ 30.0) increased 200% from 6.1% to 18.3%. All classes of obesity increased over this period, with disproportionate increases seen in the higher obese classes. The prevalence for obese class I increased from 5.1% to 13.1%, obese class II from 0.8% to 3.6%, and obese class III from 0.3% to 1.6%. By 2019, we estimate that most (55.4%) of the Canadian adult population will be categorized as overweight (34.2%) or obese (21.2%). Furthermore, we estimate that the prevalence for obese classes I, II and III will increase to 14.8%, 4.4% and 2.0%, respectively.	Age, gender and regional variation reported on "Other"	Provincial: Between 2000/01 and 2011, the prevalence of overweight decreased in Prince Edward Island, New Brunswick and Alberta, whereas there were increases in the other provinces. All provinces had increases in obese class I, II (except for Saskatchewan) and III. Lower prevalence rates of obesity were observed in the west and higher rates in the east. In 2011, the prevalence of overweight varied from 31.3% in British Columbia to 41.8% in Newfoundland and Labrador. The rate for obese class I varied from 10.7% in BC to 20.5% in Newfoundland and Labrador. For obese class II, New Brunswick reported the highest rate (6.1%) and Quebec the lowest (2.5%). For obese class III, New Brunswick reported the highest rate (2.8%), and BC and Quebec the lowest at 1.2% (Table 1). Appendix 1, available at www.cmaj open.ca/content/2/1/E18/suppl/DC1, shows the prevalence of BMI categories as reported by the CCHS for 2000/01 to 2011. For women, increases in the overweight category were reported for most provinces (ranging from an increase of 3.8% in Ontario to an increase of 18.0% in Nova Scotia), with the exception of Prince Edward Island and Alberta, which had decreases of 24.5% and 6.1%, respectively. For overweight men, increases were reported in 6 of 10 provinces, ranging from 1.0% in Nova Scotia to 5.2% in Newfoundland and Labrador. Prince Edward

Author, Year / Country / Sample Size	Primary Study Outcome	Risk Factors	Other
			Island, New Brunswick, Ontario and Alberta all had decreases in the prevalence of men in the overweight category, ranging from 0.5% in Alberta to 6.6% in New Brunswick. In both survey years, men were more likely to be overweight than women, a finding that was consistent across all provinces. Women were more likely than men to be classified as obese class II and III. There was a higher prevalence for the overweight and obese class I categories in the older age categories (40–59 and ≥ 60 yr) compared with the younger group. Subgroup analysis of the prevalence for obese classes II and III was limited owing to unreliable data.
Schmidt Morgen, C. et al., 2013 [67] Europe n=16,557	Among all infants (aged 3-15 months) in the study, the prevalence of overweight varied between 1.2 and 7.3%, and the prevalence of obesity varied between 0.0 and 1.2% in the years 1998 to 2010. We concluded that there were no statistical indications of upward or downward trends in the prevalence of infant overweight and obesity during the period of measurement (1998 to 2010). Among all children (aged 5-8 years) in the study, the prevalence of overweight varied between 12.0 and 20.4%, and the prevalence of obesity varied between 1.7 and 5.0%. We concluded that there were tendencies for a decrease in the prevalence of childhood overweight and obesity, which were significant for the DNBC (2005-2010). In the HBSC, the prevalence of overweight among adolescents varied between 9.9 and 18.5%, and the prevalence of obesity varied between 1.9 and 4.4%. We concluded that for adolescents there was a tendency to a levelling off or even a decline in the prevalence rates for overweight and obesity in the period from 2002 to 2010.	NR	NR
Gallus, S. et al., 2013[68] Europe	Overall, 31.8% were overweight (39.8% of men, 24.4% of women), and 8.9% were obese (8.5% of men, 9.4% of women). Mean BMI linear trend for men (2004-2010) was +0.004 kg/m2 per year (p=0.898), and for women -	The highest prevalence of overweight/obesity was observed in the elderly, in both men and women. Obesity was more frequent among adults with lower levels of education, lower income,	NR

Author, Year / Country / Sample Size	Primary Study Outcome	Risk Factors	Other
n = 14,135	0.068 kg/m2 per year (0.067).	southern Italy, from rural areas.	
Frizzell, L.M. & Canning, P.M. 2013[69] Canada born in 1984, n=3,857 born in 1997, n=4,161 born in 2005, n=1,305	Rates of overweight (OR 1.51, 1.35-1.69) and obesity (OR 1.84, 1.57-2.15) increased significantly between the first two time points, with no further increase evident between 2001/02 and 2009/10. However, both overweight and obesity remained significantly higher in 2009/10 than two decades earlier.	Regions reported	The odds of a child being overweight or obese was greater in rural communities.
Pan, L. et al., 2013[70] US n = 1, 204, 839	In 2008, 13.3% of the low-income children aged 0 to 23 months were obese. Among these children, 36.5% remained obese. After controlling for duration of follow-up, baseline weight-for-length percentile, and selected demographic characteristics, the risk of obesity varied across gender, racial/ethnic, and baseline age subgroups. The results of multivariable log-binomial regression showed that compared with boys, girls had a 4% reduction in the risk of obesity (ARR 0.96; 95% CI 0.95–0.97). Compared with non-Hispanic whites, the risk of obesity was 35% higher among Hispanic (ARR 1.35; 95% CI 1.34–1.37) and 49% higher among AI/AN (ARR 1.49; 95%CI 1.41–1.57) children, but 8% lower among non-Hispanic African American children (ARR 0.92; 95% CI 0.91–0.94; Table 3). Compared with those who were 0 to 11 months old at baseline, children who were 12 to 23 months old at baseline had a 17% lower risk of obesity during the study period (ARR 0.83; 95% CI 0.82–0.84) and 63.5% became non-obese at follow-up. Overall, 11.0% (95% confidence interval [CI] 11.0%–11.1%) of non-obese children aged 0 to 23 months in 2008 were obese 24 to 35 months later.	Age, gender and ethnicity reported in primary outcomes	NR

Author, Year / Country / Sample Size	Primary Study Outcome	Risk Factors	Other
Choi, J.Y. 2012[71] US n = 7,786	The overall estimated prevalence's of overweight and obesity are 33 and 12.5%, respectively. In both overweight and obesity, the Latin/Caribbean group has the highest prevalence rates (39.6 and 19.1%,respectively) while the Asian/Pacific/Oceanian group has the lowest rates (23.5 and 4.7%). Overweight and obesity prevalences vary by selected characteristics. The prevalences of overweight and obesity respectively are 42.3 and 11.9% for men, compared to 25.5 and 12.9% for women. The higher prevalences of both overweight and obesity respectively are found in the groups aged 50–59 (38.4 and 20.4%), less than high school education (36.2 and 17.9%), lived 10 years or longer in the US (40.7 and 20.5%), and currently residing in the West (34.8 and 14.8%) and South regions (33.9 and 12.2%). A higher overweight prevalence is found among those who live at 100% FPL or above (39.6%) compared to those who live below the 100% FPL (30.9%), while there is little difference in obesity prevalence by poverty level. The prevalence estimates of both overweight and obesity vary by six place of origin groups.	See primary outcomes.	NR
Howel, D. 2012[72] Europe n = 86,398	Between 1993 and 2008, the prevalence of abdominal obesity and overweight rose in both men and women. Abdominal overweight rose from 44.9% to 62.3% in men, and from 46.6% to 66.8% in women, while abdominal obesity rose from 19.2% to 35.7% in men, and from 23.8% to 43.9% in women. The pattern noted suggests that the rise in abdominal obesity and overweight has slowed down in recent years.	The prevalence of abdominal obesity was slightly higher in women, whereas abdominal overweight was slightly more common in men.	NR
Moss, A. et al., 2012[73] Europe Inquiry 1 n=543 380 Inquiry 2 n=607 444	The current prevalence rates for overweight and obesity in children starting school in Germany show considerable differences when comparing the data of the individual federal states. The current prevalence of overweight (including obesity) children upon school entry varies between 8.4% in Saxony and 11.9% in Bremen and Thuringia, respectively. The current prevalence of obesity	It is known that the prevalence for overweight and obesity of children with migration back-ground starting school is significantly higher compared to children without migration background. The SES may also play an important role in explaining the regional differences.	NR

Author, Year / Country / Sample Size	Primary Study Outcome	Risk Factors	Other
	ranges from 3.3% in Brandenburg and Saxony till 5.4% in Saarland. Higher prevalence rates for obesity in boys than in girls are found in 11 German federal states. In Mecklenburg, Saxony and Saarland, there are more obese girls in comparison to boys starting school. Equal obesity prevalence rates for both sexes are found in Thuringia and Saxony-Anhalt. Interestingly, the current data from the SEE of the individual German states show by the majority that the prevalence for both overweight and obesity in children starting school did not increase anymore and is even declining in some states compared to data inquiry 1.		
Foulds, H.J. et al., 2011[74] Canada n=759	Nearly half of this population was observed to be obese with a further third presenting BMI values in the overweight range. The prevalence of AO was also high, with two-thirds determined to be centrally obese. Men vs Women mean BMI (SD): 30.3 (5.6) vs 30.9 (7.2); waist circumference (cm) (SD) 104.2 (14.7) vs 99.3 (17.9)	Younger individuals presented with lower prevalence of obesity and AO with age (both males and females).	NR
Singh, G.K. et al., 2011[75] US n=323,627 in 1992–1995 n=154,649 in 2003–2008	The obesity prevalence for the total U.S. adult population aged C 18 tripled from 8.7% in 1976 to 27.4% in 2008. The overweight prevalence for all U.S. adults increased from 36.9% in 1976 to 62.0% in 2008.During 1991–2008, the obesity prevalence for U.S.-born adults increased from 13.9 to 28.7%, whereas the prevalence for immigrants increased from 9.5 to 20.7%. During 1991–2008, increases in overweight prevalence were equally marked among both U.S.-born and immigrant adults, with the prevalence for the U.S.-born rising from 45.7 to 62.7%, while that for immigrants rising from 39.6 to 58.4%. The mean BMI for the U.S.-born increased from 25.24 in 1991 to 27.75 in 2008, while for immigrants it increased from 24.55 to 26.56. The rate of increase in obesity and overweight was greater for those with 12, 13–15 and C 16 years of education than for those with 0–8 and 9–11 years of education. During 1991–2008, the average annual rates of increase in obesity for the 5 (low to high)	The odds and prevalence of obesity and overweight, even after adjusting for socio-demographic factors, increased with increasing duration in the U.S.	NR

Author, Year / Country / Sample Size	Primary Study Outcome	Risk Factors	Other
	educational groups were 2.58, 3.63, 4.75, 5.54, and 5.05%, respectively. The corresponding rates of increase in overweight were 1.36, 1.90, 2.32, 2.90, and 2.25%.		
Howel, D. 2011[76] Europe n=131,248	The prevalence of obesity and overweight has risen in both men and women in England over this time. Obesity is now at similar levels for males and females, but being overweight is still more common in males.	NR	The pseudo cohort curves overlap each other only over a restricted age range, but it can be seen that the prevalence is consistently higher in the cohorts born more recently for a given average age. For instance, the prevalence of male obesity was 24 % in the pseudo cohort born during 1966–75 in 2005 when their average age was 35 years, but was 13 % in the pseudo cohort born during 1956–65 in 1995 when their average age was also 35 years.
Finucane, M. M. et al., 2011[77] Multinational n =9.1 million	Between 1980 and 2008, mean BMI worldwide increased by 0·4 kg/m² per decade (95% uncertainty interval 0·2–0·6, posterior probability of being a true increase >0·999) for men and 0·5 kg/m² per decade (0·3–0·7, posterior probability >0·999) for women. National BMI change for women ranged from non-significant decreases in 19 countries to increases of more than 2·0 kg/m² per decade (posterior probabilities >0·99) in nine countries in Oceania. Male BMI increased in all but eight countries, by more than 2 kg/m² per decade in Nauru and Cook Islands (posterior probabilities >0·999). Male and female BMIs in 2008 were highest in some Oceania countries, reaching 33·9 kg/m² (32·8–35·0) for men and 35·0 kg/m² (33·6–36·3) for women in Nauru. Female BMI was lowest in Bangladesh (20·5 kg/m², 19·8–21·3) and male BMI in Democratic Republic of the Congo 19·9 kg/m² (18·2–21·5), with BMI less than 21·5 kg/m² for both sexes in a few countries in sub-Saharan Africa, and east, south, and southeast Asia. The USA had the highest BMI of high-income countries. In 2008, an estimated 1·46 billion adults (1·41–1·51 billion) worldwide had BMI of 25 kg/m² or greater, of these 205 million men (193–217 million) and 297 million women (280–315 million) were obese.	NR	NR

Author, Year / Country / Sample Size	Primary Study Outcome	Risk Factors	Other
Young, T. K. et al., 2007[78] Multinational n=2,545	The crude prevalence among Inuit men was 36.6% overweight and 15.8% obese, whereas 32.5% of Inuit women were overweight and 25.5% were obese. The age-standardized mean waist circumference of Inuit women was 90.3 cm. Men had an age-standardized mean of 91.6 cm.	NR	As levels of obesity increased, as measured by the BMI or waist circumference, the mean values of various metabolic indicators—blood pressure and blood levels of lipids, glucose, and insulin—also increased. However, at each level of the BMI or waist circumference, Inuits had lower levels of most risk factors than did non-Inuit Canadians. Exceptions were fasting plasma levels of both glucose and insulin; with these indicators the 2 groups tended to overlap.

4 Risk Factor Literature Evidence Tables

Evidence Table of Included Risk Factor Studies: Study and Patient Characteristics

Author, Year / Country / Sample Size	Study Objective	Age / Gender (% Male)	Study Population Characteristics (including Socio-economic Data & Baseline Comorbidities)	BMI Definition or Range / Other Weight Measures
Pei, Z. et al., 2013[79] Europe n=3121	In this study, we established an overweight prediction model using standardized deviation scores of anthropometric parameters collected during the first 5 years of life. Considering the availability of covariates and the aim of developing a concise and easily applicable prediction model, we only included parental education, socioeconomic status and maternal smoking during pregnancy as covariates. Cross-validation was used to test the validity of our prediction model.	Physical examinations conducted at birth, at weeks 4–6, at months 3–4, 6–7, 10–12, 21–24, 46–48 and 60–64 and at 10 years of age. 50.9% male	Table 1.Characteristics of participants of the physical examination at 10 years of age Girls vs Boys: Parental education (%) Low 4.8 vs 5.9 Medium 26.6 vs 26.9 High 68.6 vs 67.3 Family income (%) Low 20.5 vs 23.3 Medium 48.8 vs 46.7 High 30.7 vs 30.0 Maternal smoking during pregnancy (%) 13.9 vs 11.8 Birth weight (kg) (Mean (SD) 3.40 (0.44) vs 3.55 (0.46)	BMI Mean (SD): Standardized BMI Girls vs Boys 4–6 weeks: -0.41 (0.93) vs -0.36 (1.04) 3-4 months: -0.52 (0.98) vs -0.45 (1.06) 6-7 months: -0.33 (0.99) vs -0.33 (1.08) 10–12 months: 0.03 (0.95) vs 0.05 (1.05) 21–24 months: 0.26 (0.97) vs 0.29 (1.06) 46–48 months: 0.05 (0.87) vs 0.12 (0.95) 60–64 months: -0.03 (0.87) vs -0.01 (0.97) 10 years: 0.13 (1.01) vs 0.24 (1.10)
Heppe, D.H. et al., 2013[80] Europe n = 3,610	Therefore, in a population-based prospective cohort study of 3,610 mothers, fathers, and their children, we assessed the independent associations of parental, fetal, and infant risk factors with the risk of preschool-age overweight.	The median age of the measurements was 3.8 y. NR	NR	The prevalence of overweight, including obesity, in boys and girls was 7.1 and 11.4%, respectively. Obesity was prevalent in 1.6 and 1.3% of the boys and girls.
Veldhuis L. et al., 2012[81] The Netherlands n=7505	The aim of the present study was to assess the associations between the four lifestyle-related behaviors having breakfast, drinking sweet beverages, playing outside and watching TV, and overweight in a large sample of 5-year-old children. In addition, as it is likely that the risk behaviors coexist, the association between the number of risk behaviors that is present and overweight (obesity included) was investigated.	5.7 (SD 0.4) years 50.9% were boys	Non-Dutch ethnicity 13.9% Low educational level (parental) 19.6%	BMI Mean (SD): 15.5 (1.5)

Author, Year / Country / Sample Size	Study Objective	Age / Gender (% Male)	Study Population Characteristics (including Socio-economic Data & Baseline Comorbidities)	BMI Definition or Range / Other Weight Measures
Weng, S.F. et al. 2012[82] Multinational Thirty prospective studies met the inclusion criteria.	To determine risk factors for childhood overweight that can be identified during the first year of life to facilitate early identification and targeted intervention.	The median age at follow-up was 6 years, ranging from 2 years26 to 14 years. NR	NR	NR
McConley, R.L et al., 2011[83] US n=4,601	(i) To clarify the relationship between family structure, maternal depression, and child overweight, and whether it varies by child race/ethnicity or sex; (ii) investigate whether parenting quality and its effects on behavioural risk factors for obesity mediate the associations of family structure and maternal depression with child weight; and (iii) examine whether potential differences in these mediating relationships vary by child race/ethnicity or sex.	Age (y) = 11.14 [0.57] 51.5% male	African American (%) 29.6, Hispanic (%) 42.7, Other ethnic minority (%) 4.6, Single parent (%) 33.6, Two other parents (%) 23.0	19% overweight (BMI between 85th and 95th percentile); 27% obese (BMI at or above 95th percentile)
Austin, G. L. et al., 2011[84] US NHANES I n=6149; NHANES 2005–2006 n=1121	The purpose of this study was to examine trends in carbohydrate, fat, and protein intakes among adults and their association with energy intake among normal-weight, overweight, and obese men and women.	Age (y) NHANES I Normal weight: 41.6 (0.4) Overweight: 45.8 (0.4); Obese: 47.3 (0.5) NHANES 05/06 Normal Weight: 40.5 (0.7) Overweight: 44.5 (0.9) Obese:45.6 (0.7) Women (%) NHANES I Normal weight 55.2 (0.9); Overweight: 34.6 (1.4); Obese: 56.9	NHANES I vs NHANES 2005-06 %White: Normal Weight: 55.2 (0.9) vs 56.8 (2.2) Overweight: 34.6(1.4) vs 35.4(1.6) Obese: 56.9(2.0) vs 49.6(2.6) Completed Some College (%) Normal Weight: 33.1(1.3) vs 60.5(3.6) Overweight: 28.7(1.6) vs 58.5(2.9) Obese: 18.5(1.7) vs 52.1(1.7)	NHANES I vs NHANES 2005-06 Normal weight (n): 6149 vs 1121 Overweight (n): 4046 vs 1416 Obese (n): 2081 vs 1520

Author, Year / Country / Sample Size	Study Objective	Age / Gender (% Male)	Study Population Characteristics (including Socio-economic Data & Baseline Comorbidities)	BMI Definition or Range / Other Weight Measures
		(2.0) NHANES 2005–2006 Normal weight: 56.8 (2.2); Overweight: 35.4 (1.6);Obese:49.6 (2.6)		
Beyerlein, A. et al., 2011[85] Europe n=13,223	In a previous study using data from the Bavarian school entry examinations [6], we observed that risk factors for overweight are associated with stronger effects on higher BMI percentiles than on average BMI values, suggesting that incremental exposure to those risk factors would primarily result in more extreme values of BMI or body weight. We hypothesized that these findings might help to explain the observed temporal trend in overweight and obesity: If a risk factor shows stronger effects on higher BMI values and the exposure frequency of this risk factor has increased over time, an increase of the upper BMI percentiles within a population could be explained. We analyzed a large German population-based dataset on children and adolescents in order to answer this question and to assess potential age-specific effects.	Age, mean(SD) 3-10y: 7.1 (2.3) 11-17y: 14.4(2.0) 3-10y: 50.8% 11-17y: 50.9% male	Low parental SES 3-10 y: 26.4% 11-17 y: 25.8%	Children's BMI z-score 3-10 y: 0.33 (1.12) 11-17 y: 0.32 (1.15)
Chaput, J.P. et al., 2010[86] Canada n=537	The present study aimed at comparing the predictive value of two traditional (high dietary lipid intake and non-participation in high-intensity physical exercise) and three non-traditional (short sleep duration, high disinhibition eating behavior and low dietary calcium intake) risk	mean age 38.4 (SD 14.0) 43% male	48% had a paid employment and 25% had a university level	25 to < 30 mean BMI 26.8 (SD 7.1)

Author, Year / Country / Sample Size	Study Objective	Age / Gender (% Male)	Study Population Characteristics (including Socio-economic Data & Baseline Comorbidities)	BMI Definition or Range / Other Weight Measures
	factors for obesity. Furthermore, we verified whether there were additive or synergetic effects among these factors.			
Beyerlein, A. et al., 2010[87] Europe n=9698	Quantile regression is a statistical technique allowing the assessment of associations in different subgroups with the adjustment of confounding factors. We applied this method to data collected during the school-entry health examination in Bavaria, Germany, in 1999 and 2002. We aimed to assess possible differences in associations of several a priori defined risk factors by subgroups of children's BMI distribution.	Age (months) 73.5 (4.7) Males N=4997 (51.5 %)	Elementary or less parental school degree N=2706 (27.9 %)	Children's BMI (kgm2) 15.3 (1.8)
Taveras, E.M. et al., 2010[88] US n=1826 mother-child pairs	The purpose of this study was to examine racial/ethnic differences in early life risk factors for childhood obesity. We hypothesized that compared with white children, black and Hispanic children would have higher rates of obesity-related risk factors in early life.	Maternal age, years (±SD) 31.9 (5.2) Child Characteristics: Boy (%) 52%	Education, Some college or more 88%; Household income > $40,000, 85%	BMI z-score at age 3 0.48 (1.02)
Stamatakis, E. et al., 2010[89] Europe n= 15,271 (core) Due to 1622 missing values on income or parental social class, SEP analyses included 13,649 cases	The main objectives of this work were: a) to update the most recent overweight and obesity prevalence trends among school-age children in England using identical methodology to previously published long-term trends, 16 and b) to examine the changes over time in the relationship between obesity and multiple SEP indicators.	Mean Age Boys 1997/8: 7.5 (1.7) 2000/1: 7.5 (1.7) 2002/3: 7.5 (1.7) 2004/5: 7.6 (1.7) 2006/7: 7.6 (1.7 Girls 1997/8: 7.5 (1.7) 2000/1: 7.5 (1.7) 2002/3: 7.5 (1.7) 2004/5: 7.5 (1.8) 2006/7: 7.6 (1.7) 7880 boys (51.6%) (core) 6902 boys (50.6%)	Household income (GB Pounds) 1997/8: 16,010 (14,458) 2000/1: 20,826 (18,048) 2002/3: 22,546 (19,636) 2004/5: 23,633 (20,007) 2006/7: 25,560 (21,384) Social class (% manual households) 1997/8: 52; 2000/1: 46; 2002/3: 44; 2004/5:42; 2006/7: 40	Mean BMI: 1997/8 vs 2000/1 vs 2002/3 vs 2004/5 vs 2006/7 Boys: 16.7 (2.2) vs 17.0 (2.4) vs 17.0 (2.5) vs 17.2 (2.7) vs 17.1 (2.6) Girls: 16.9 (2.4) vs 17.1 (2.7) vs 17.3 (2.8) vs 17.3 (2.9) vs 17.2 (2.7)

Author, Year / Country / Sample Size	Study Objective	Age / Gender (% Male)	Study Population Characteristics (including Socio-economic Data & Baseline Comorbidities)	BMI Definition or Range / Other Weight Measures
		(SEP)		
McLaren, L. & Godley, J., 2009[90] Canada n= 49,252	The objective of the present study was to examine the association between occupational prestige and BMI across a large, population-based sample of Canadian adults, adjusting for two more commonly used indicators of social class: income and education. It was hypothesized that an indicator of occupational prestige would better enable us to tap into the psychosocial and symbolic dimensions of class, and its role in explaining socioeconomic variation in BMI, above and beyond the role of indicators more commonly used in Canadian quantitative research: income and education.	Range: 25–64 M(SD)=42.2(9.9) 53.4% male	Marital Status (%) : Married or common law: 74.7; Separated/divorced/widowed: 9.7; single: 15.6 Household income (%): Lowest quartile: 26.9 Low-mid quartile: 23.5 Mid-high quartile: 26.0 Highest quartile: 23.7 Education (%) Less than high school: 10.6 Complete high school: 24.8 Some postsecondary: 38.5 Complete postsecondary: 26.1	Mean BMI: 25.8 (4.3)
Spence, J. C. et al., 2009[91] Canada n = 2900	The purposes of this study were (a) to determine if the local food environment is associated with obesity in a Canadian context, and (b) if this association varies as a function of distance between food locations and people's homes. We hypothesized that residents of areas with high fast-food access would be more likely to be obese than those in areas with relatively low access. Additionally, we hypothesized that these associations would be stronger for facilities that were more proximal (within 800 m) to the resident's home as opposed to more distal (within 1600 m).	> 18 NR	NR	30+

Author, Year / Country / Sample Size	Study Objective	Age / Gender (% Male)	Study Population Characteristics (including Socio-economic Data & Baseline Comorbidities)	BMI Definition or Range / Other Weight Measures
Chaput, J.P. et al., 2009[92] Canada n=537	In adults, the Quebec Family Study (QFS) has evidenced several risk factors for obesity. Thus, high lipid and alcohol intakes (4,5), low calcium and micronutrient intakes (6,7), high dietary restraint behavior (8), high disinhibition and susceptibility to hunger behaviors (9), low vigorous physical activity (10), and short sleep duration (11,12) have all been associated with obesity. However, the independent contribution of these risk factors to obesity has never been assessed. Therefore, we examined the relative contribution of these factors to the risk of being overweight or obese.	18-64 years 42.8% male	French Canadian Families	Not reported
Anderson, S.E. & Whitaker, R.C., 2009[93] United States n=8550	Using measured height and weight data collected in 2005 on a large nationally representative sample of 4-year-old U.S. children, we sought to estimate the prevalence of obesity in each of the 5 major racial/ethnic groups in the United States—non-Hispanic white, Hispanic, non-Hispanic black, Asian, and American Indian/Native Alaskan—and to determine whether there were differences in the prevalence of obesity between these groups at this age.	52.3 months (SE, 0.07; range, 44.0-65.3 months) 50.9% boys	2.4% American Indian/Native Alaskan, 3.4% Asian, 15.6% non-Hispanic black, 24.1% Hispanic, 54.0% non-Hispanic white, and 0.2% Pacific Islander.	The overall prevalence of BMI at or above the 95th and 97th percentiles was 18.4% and 13.8%, respectively.
Robinson, W.R. et al., 2009[94] United States n= 2096 black and n= 5651 white respondents.	We explored whether childhood socio-demographic factors (parental education, single-mother household, number of siblings, number of minors in household, birth order, and female caregiver's age) were associated with the gender disparity in obesity prevalence in young black adults in the United States.	Age (y) Black: Females 21.5 (0.2); Males 21.7 (0.2) White: Females 21.2 (0.1); Males 21.5 (0.1) 45.0% Black 48.5% White	Black Females vs Males vs White Females vs Males Parental education [%] - Less than HS graduate: 21.0 vs 15.3 vs 9.2 vs 8.9; HS graduate: 37.3 vs 36.7 vs 33.7 vs 32.8; Some college: 24.5 vs 27.0 vs 29.6 vs 31.3; College graduate: 17.2 vs 21.1 vs 27.6 vs 27.0	30+

Author, Year / Country / Sample Size	Study Objective	Age / Gender (% Male)	Study Population Characteristics (including Socio-economic Data & Baseline Comorbidities)	BMI Definition or Range / Other Weight Measures
Liang, T. et al. 2009[95] Canada n=4966	The present study examines the associations of television viewing and eating while viewing television with children's diet and body weights.	NR, grade 5 students NR	NR	NR
Veugelers, P. et al., 2008[96] Canada n =5 471	We conducted the present study to establish the direction and size of the relationship between neighborhood factors and diet, physical activity and weight of children.	Grade 5 students (primarily 10 or 11) 48.4% Male	Parental education: Secondary or less 29.2% vs. Community college 37.9% vs. University 23.5% vs. Graduate university 9.4% Parental income: <$20000, 10.8% vs. $20 000-$40 000, 22.1% vs $40 000-$60 000, 26.6% vs. >S60 000, 40.5%	Overweight (n =4 298) 32.9% Obesity (n =4 298) 9.9%
Oliver, L. N. & Hayes, M. V. 2008[97] Canada n = 2152	The primary goal of this study was to assess the impact of the neighbourhood environment on children's BMI from early childhood to adolescence while controlling for family factors. It was hypothesised that from early childhood to adolescence there would be increasing disparity in body weight by neighbourhood income as neighbour-hood factors become more influential and children are exposed to such environments over time.	Age = 2, 48.52% Age = 3, 51.48% (at baseline 1994) Male 50.44 %	Income Adequacy in 1994 (%) Low/low middle 20.28 Middle/high middle 64.43 High 15.29 Parent Education in 1994 (%) No high school certificate 14.98 High School/Some Postsecondary 46.41 Postsecondary degree 38.61 Family Structure in 1994 (%) Child living in an intact family 81.28 Child not living in an intact family 18.72 Neighbourhood Low Income (%) Least Poor (less than 7.6%) 22.56 Middle (7.7 to 28.6%) 57.07 Most Poor (greater than 28.7%) 21.37 Census Metropolitan Area (%) Urban 67.59 Rural 32.41	Mean (SD) BMI: Ages 2–3 (1994): 65.77 (1.45) Ages 4–5 (1996): 63.26 (1.29) Ages 6–7 (1998): 59.85 (1.40) Ages 8–9 (2000): 59.43 (1.54) Ages 10–11 (2002): 59.57 (1.31)
Blaine, B. 2008[98] Multinational n =33,000, 16	The present study reports a meta-analytic review of longitudinal studies of the relationship between depression and later obesity. The review estimates the overall	Studies included adolescent and adult populations. Overall NR	NR	30+

Author, Year / Country / Sample Size	Study Objective	Age / Gender (% Male)	Study Population Characteristics (including Socio-economic Data & Baseline Comorbidities)	BMI Definition or Range / Other Weight Measures
studies	population effect size for depression on later weight gain or obesity status, determines if that effect remains when controlling for potential confounding variables, and examines whether the effect is moderated by subject age.			
Katzmarzyk, P. T. 2008[99] Canada n=24,279	The purpose of this study was to examine the prevalence of measured obesity among Aboriginal Canadians and compare them to general population estimates. Information on several demographic and lifestyle variables, including physical activity, was also examined in relation to the prevalence of obesity.	Age: Mean (SE) - Men, Non-Aboriginal: 40.1 (0.2) Men, Aboriginal: 37.0 (1.9) Women, Non-Aboriginal: 40.5 (0.2) Women, Aboriginal: 36.2 (1.1) Boys, Non-Aboriginal: 9.9 (0.1) Boys, Aboriginal: 9.5 (0.5) Girls, Non-Aboriginal: 9.9 (0.1) Girls, Aboriginal: 9.1 (0.7) 28.0% men, 26.0% boys	NR	25 to <30 and 30+
Dubois, L. et al., 2007[100] Canada n=1499	The aim of this research is to examine the relationship between sugar-sweetened beverage consumption (e.g., carbonated soft drinks and fruit drinks) between meals and the prevalence of overweight among preschoolers. Various characteristics, including parental and child factors (e.g.,	2.5, 3.5, 4.5 years % Male Daily Consumers 2.5y: 12% 3.5y: 16.7% 4.5y: 16.5% Non Consumers: 30.7%	Collected information on mother's age group, mother's immigrant status, mother's education, family type, household annual income, and income level.	NR

Author, Year / Country / Sample Size	Study Objective	Age / Gender (% Male)	Study Population Characteristics (including Socio-economic Data & Baseline Comorbidities)	BMI Definition or Range / Other Weight Measures
	parental weight and children's birth weight and sex), demographic and socioeconomic factors (e.g., maternal age, education, immigrant status, family type, and family in-come), and dietary factors (e.g., energy intake, macronutrient intake, and total food group consumption) related to sugar-sweetened beverage consumption between ages 2.5 and 4.5 years, and to body mass index (BMI) at age 4.5 years, were analyzed to better understand the relation-ship between these factors in a population-based birth cohort of preschoolers from Québec, Canada.	Regular Consumers: 6.2%		
Kruger et al., 2009[101] United States N=12,610	The aim of this study is to identify differences by sex in behavioral correlates of overweight and obesity in a large national sample of adults aged 50 years or older.	Age, years (%): 50-59 years: 42.2% of men; 37.9% of women 60-69years: 28.3% of men; 26.4% of women ≥70years: 29.3% of men; 35.7% of women Men, n=5711 Women, n=7769	Characteristics: Men vs. Women Race/Ethnicity - Non Hispanic White: 76.3% vs 75.5%; Non-Hispanic Black: 12.8% vs 13.4%; Hispanic: 10.9% vs 11.1% Education Level - <High school graduate: 20.3% vs 22.3%; High School Graduate: 28.6% vs 32.6%; Some college: 23.5% vs. 24.9%; College Graduate: 27.6 vs 20.2 Annual Family Income, <$20,000: 21.7% vs 30.9%; ≥20,000: 71.6% vs 60.9%	Among older men, the prevalence of overweight was 46.3%, and the prevalence of obesity was 25.1%. Among older women, the prevalence of overweight was 33.4%, and the prevalence of obesity was 28.8% (data not shown).

Evidence Table of Included Risk Factor Studies: Measurement and Analysis

Author, Year / Country / Sample Size	Primary Study Outcome Examined / Other Outcomes Examined	Analysis (definitions/calculations)	Limitations
Pei, Z. et al., 2013[79] Europe n=3121	Anthropometric measurements of weight and height were collected by pediatricians during physical examinations at birth, at weeks 4–6, at months 3–4, 6–7, 10–12, 21–24, 46–48 and 60–64 and at 10 years of age.	BMI values were calculated from these weight and height measurements and transformed to standardized deviation scores (z-scores) according to the sex- and age-specific 'WHO-Child-Growth-Standards' for children. This standardization allows for comparisons across studies.	• 65.7% subjects originally recruited at birth did not participate in the 10-year physical examination. • Did not consider all known causes of childhood obesity, such as genetic variation, epigenetics, endocrine disease, diet, physical activity and sleep.
Heppe, D.H. et al., 2013[80] Europe n = 3,610	Independent associations of parental, fetal, and infant risk factors with the risk of preschool-age overweight.	Information about maternal age, parity, education, marital status, and family household income was obtained by questionnaire at the time of enrollment into the study. We measured maternal anthropometrics, without shoes and heavy clothing, in each trimester at the research center. We assessed maternal smoking and alcohol use in the first, second, and third trimester of pregnancy by questionnaires. We assessed maternal dietary intake at enrollment in the study using a modified version of a validated semiquantitative food frequency questionnaire. Paternal anthropometrics were measured, without shoes and heavy clothing, at the research center at intake. Paternal smoking was assessed by a questionnaire that was filled in by the mother at the time of enrollment into the study. We measured head circumference, abdominal circumference, and femur length in the second trimester (median: 20.5wk of gestation, interquartile range (IQR): 1.3 wk) and third trimester (median: 30.4wk of gestation, IQR: 1.1wk) of pregnancy using ultrasound. Information about offspring sex, gestational age, and weight at birth was obtained from medical records and hospital registries. Postnatal growth was routinely measured at the community health centers. Information about breast-feeding was obtained from questionnaires at 2, 6, and 12 mo and about introduction of solid foods at 6 and 12 mo. Information about nighttime sleep duration (hours/night), attending day care (never, <8, 8–16, 16–24, 14–32,or >32h/wk), and TV watching during the week (never, <0.5, 0.5–1, or >1 h/d) and weekend (never, <1, 1–2, or >2 h/d) was collected by questionnaires at the age of 2 y. Overweight	• Results should be carefully generalized to other populations.

Author, Year / Country / Sample Size	Primary Study Outcome Examined / Other Outcomes Examined	Analysis (definitions/calculations)	Limitations
		(including obesity) was defined on the basis of the international growth charts presented by the International Obesity Taskforce.	
Veldhuis L. et al., 2012[81] The Netherlands n=7505	We assessed the associations between the four lifestyle-related behaviors having breakfast, drinking sweet beverages, playing outside and watching TV, and overweight among 5-year-old children.	Risk behaviors were defined as having breakfast <7 days/week, drinking sweet beverages >2 glasses/day, playing outside < 1hour/day and watching TV >2 hours/day. When the BMI value of a child was the same as or higher than the cut-off point for overweight or obesity for the child's age and sex, the child was defined as having over-weight or obesity.	• There was some selection towards a study population in which the children more often were of Dutch ethnicity, had a higher SES, had a healthier lifestyle and less often had overweight. So, the prevalence of the risk behaviors and overweight in this study might therefore be somewhat underestimated. • The characteristics of the parent and the child were based on self-reported data of the parent, and although anonymity was assured, parents might have given socially desirable answers.
Weng, S.F. et al. 2012[82] Multinational Thirty prospective studies met the inclusion criteria.	The primary outcome was the adjusted odds of overweight.	For certain risk factors that met meta-analysis eligibility criteria, the random effects model was utilised to pool the effect sizes of the individual risk factors taking into account both the sampling error and between-study heterogeneity. The I2 statistic was used to explain the between-study heterogeneity (0–100%), with higher percentage variation suggesting more heterogeneity or differences among studies. The primary outcome was the adjusted odds of overweight. The meta-analysis only included adjusted outcomes (at least age and sex) to minimise confounding. Publication bias was assessed by an asymmetry test.[25] The results were statistically significant when two-sided *p*-values were less than 5%. All analyses were conducted in STATA V. (Stata Corporation, College Station, Texas, USA). Ten of the 30 studies defined childhood overweight by IOTF cut-offs.[1]Sixteen of the 30 studies defined childhood overweight by CDC percentiles. Two UK studies defined childhood overweight by the UK 1990 growth reference centiles. One study[55] used reference data from France to define childhood overweight and another study used national reference data from Germany.	• One limitation was that we used a late age cut-off of 16 years to account for varying pubertal development. This may have meant that some children close to their final height were included. • Another limitation was the use of BMI as an outcome measure. • The cohort studies examined in this review included samples of children from a range of different socioeconomic and cultural backgrounds. • There was also a great deal of heterogeneity between overweight outcomes in childhood depending on the particular growth reference data used (IOTF, CDC, UK 1990, French, German).

Author, Year / Country / Sample Size	Primary Study Outcome Examined / Other Outcomes Examined	Analysis (definitions/calculations)	Limitations
McConley, R.L et al., 2011[83] US n=4,601	Prediction of child BMI percentile from parenting variables, including family structure, maternal depression, parenting quality, sedentary behaviour, healthy foods index and leisure activity.	Descriptive and inferential statistics were adjusted for the complex sampling design. First tested was the necessary prerequisites for mediation, i.e., that the three parental variables are related to BMI, for those that were related, we tested the full mediation model using structural equation modeling. This three path mediation model included links from maternal depression and family structure to parenting quality; links from parenting quality to children's healthy diet, sedentary behaviours, and leisure activity; and links from these behavioural risk factors for overweight to child BMI percentile. This was tested across child's sex and race/ethnicity.	• The cross-sectional snapshots underestimate the true strengths of the effects. • Use of self-reported measures and small number of items used to measure some constructs may have attenuated measurement reliability and validity. • The exclusion of participants with incomplete data may limit the extent to which the results generalize to the sampled populations.
Austin, G. L. et al., 2011[84] US NHANES I n=6149; NHANES 2005–2006 n=1121	Individuals were classified into normal-weight, overweight, and obese on the basis of their BMI. Outcomes were the percentage of energy intake from each macronutrient (carbohydrate, fat, and protein) and total energy intake. Additional outcomes included the associations between the percent-age of energy intake from each macronutrient and daily energy intake.	For adults in both NHANES I and NHANES 2005–2006, normal weight was defined as a BMI (in kg/m2) of 19.0 to 25.0, overweight was defined as a BMI of 25.0 to 30.0, and obese was defined as a BMI of 30.0.	• The NHANES data were obtained as a cross-sectional survey • Another limitation is that a direct comparison of sugar intake between the 2 surveys is not possible.
Beyerlein, A. et al., 2011[85] Europe n=13,223	z-scores of children's BMI	Maternal smoking in pregnancy was documented in three categories (never, occasionally or regularly) and dichotomised to never or any. Mothers were asked about their present height and weight, which were used to calculate their BMI at interview. Socioeconomic status (SES) was classified based on the parents' professional status, income and educational achievements and assigned to low, middle or high according to the parent with the higher status [10]. Exclusive formula-feeding (yes/no) was defined as no breastfeeding of the index child at any time as reported by the mothers. The child's TV viewing time per day was recorded in the following categories (ordinal value in brackets): none (1), 0.5 hours (2), 1–2 hours (3), 3–4 hours (4), >4 hours (5). In the 3–13 year-old children, TV viewing time was recorded separately for working days and weekends,	• As always in a cross-sectional study, we cannot finally preclude common confounding effects by other factors, but we cannot imagine a potential mechanism of residual confounding causing the specific patterns of our main results.

Author, Year / Country / Sample Size	Primary Study Outcome Examined / Other Outcomes Examined	Analysis (definitions/calculations)	Limitations
		while the 14–17 year-olds were only asked about their ‘‘mean’’ TV viewing time without differentiation between working days and weekends. Children’s height was measured, without wearing shoes, by trained staff with an accuracy of 0.1 cm, using a portable Harpenden stadiometer (Holtain Ltd., Crymych, UK). Body weight was measured with an accuracy of 0.1 kg, wearing underwear, with a calibrated electronic scale (SECA, Birmingham, UK). These measures were used to calculate children’s BMI. To adjust children’s BMI for sex and age, we transformed the observed BMI values to sex- and age-specific z-scores established by the World Health Organization.	
Chaput, J.P. et al., 2010[86] Canada n=537	The main outcome measure was overweight/obesity, defined as a BMI ≥ 25 kg/m2.	Lipid and calcium intake were estimated with a 3-day food record, including 2 week days and 1 weekend day. Disinhibition eating behavior (over-consumption of food in response to cognitive or emotional cues) was assessed using the Three-Factor Eating Questionnaire. Daily physical activity level and pattern were evaluated with a 3-day physical activity diary. Finally, the number of hours of sleep was assessed through a question inserted in a self-administered questionnaire.	• Although cohort studies are well suited for the identification of associations, they cannot establish causality. • Future work that is similar in design is needed on a larger sample that is more representative of Canadians from across the country for a better generalizability of the results obtained. • We also have to keep in mind the limitations of questionnaire-based measurements that are inherent in epidemiological studies, as opposed to objective measures. • Finally, the risk factors for overweight and obesity are more numerous than those considered in this study, and the network of interactions between behaviors, environment and genes in an ever-changing environment makes it difficult for epidemiologic studies to rule out reverse causation.
Beyerlein, A. et al., 2010[87] Europe n=9698	Outcome variable BMI-SDS at preschool age.	Exclusive formula feeding was defined by a negative answer to the question ‘Did you ever breastfeed your child?’ Maternal BMI and weight gain were considered as continuous variables; all other risk factors were binary-coded. Regression coefficients of binary variables can be interpreted as BMI differences between exposed and non-exposed children, whereas coefficients of continuous variables reflect BMI differences per change in unit of the	• Cross-sectional data do not allow the identification of target groups for obesity-prevention programs because the examined percentiles refer to the outcome variable BMI-SDS at preschool age. • It is unclear whether overweight children at school entry would also have been overweight at an earlier age, when a potential intervention (such as breastfeeding) might take place. • To quantify differing effects on specific subgroups

Author, Year / Country / Sample Size	Primary Study Outcome Examined / Other Outcomes Examined	Analysis (definitions/calculations)	Limitations
		respective risk factor.	at the start of an intervention, longitudinal data are required.
Taveras, E.M. et al., 2010[88] US n=1826 mother-child pairs	The main outcomes were risk factors during the prenatal, infancy, and early childhood periods that are associated with childhood obesity in the medical literature. (See analysis cell.)	Gestational weight gain (GWG): We calculated total GWG by subtracting pre-pregnancy weight from the last prenatal weight. Gestational Diabetes (GDM): We categorized women with 2 or more abnormal fasting glucose tolerance test results as having GDM, based on published criteria. Smoking during pregnancy: We asked mothers at both first and second trimester visits about their cigarette smoking habits before and during pregnancy. Maternal depression: Mothers completed a validated 10-item Edinburgh Postpartum Depression Scale (EPDS) during mid-pregnancy that queried history of depression and current depressive symptoms. Fetal growth and rapid infant weight gain: We calculated birth weight for gestational age z-score as a measure of fetal growth. 1 As a measure of infant weight gain, we calculated the difference between weight-for-age z-scores at 6 months and at birth. Cord blood adipokines: We collected cord blood samples from the umbilical vein after delivery of the infant, and measured concentrations of leptin and adiponectin, as described previously. Infant feeding: t 6 and 12 months, we asked mothers if they were exclusively breastfeeding, mixed breast and formula feeding, weaned, or formula-feeding only. Maternal control of infant feeding: At 1 year, we measured mothers' reports of restricting their children's food intake and pressuring their children to eat more food using a modified Child Feeding Questionnaire. Daily sleep during infancy: At 6 months, 1-year, and 2-years postpartum, we asked mothers to quantify the average amount of daily sleep their children obtained over the past month. Daily television viewing during infancy: At 6 months, 1-year, and 2-years postpartum, we asked mothers to report the number of hours their children watched TV/videos on an average weekday and weekend day in the past month. Sugar-	• Most of our measures were from self-report. • Loss to follow-up was not random. • The educational and income levels of our study population were relatively high. • We did not have enough power to examine potentially important interactions between race/ethnicity and socioeconomic status.

Author, Year / Country / Sample Size	Primary Study Outcome Examined / Other Outcomes Examined	Analysis (definitions/calculations)	Limitations
		sweetened Beverages, Fast Food, and Family Dinner: We used a validated semi-quantitative child food frequency questionnaire completed by each mother when the child was 2 years old to estimate daily sugar-sweetened beverage intake. 37 We defined a sugar-sweetened beverage as soda (not sugar-free), flavored milks, and fruit drinks (Hi-C, Kool-Aid, lemonade). At age 3 years, we asked mothers to report their child's weekly servings of fast food using a question adapted from a longitudinal study of adults. At age 4 years, we asked mothers to report how often their child ate supper or dinner together with family members.	
Stamatakis, E. et al., 2010[89] Europe n= 15,271 (core) Due to 1622 missing values on income or parental social class, SEP analyses included 13,649 cases	Trends in overweight and obesity prevalence from 1997 to 2007; Overweight and obesity prevalence by income and SEP.	In brief, height was measured using Harpenden stadiometers (Chasmors Ltd., London, UK) and weight was measured using electronic digital scales (Tanita Corporation, Japan). For comparability with the previous prevalence estimates, 16 weight was adjusted for children's clothing using the same method as before. Household income was converted to equivalised annual household income adjusted for the number of persons in the household using the McClements scoring system. 1718 To examine whether socioeconomic position has a cumulative effect on obesity prevalence over time we developed an aggregate SEP score, based on the family's position on income (quintiles) and social class scales (I, II, III-manual, III-nonmanual, IV, V). The Registrar-General's social class is based on occupation of the head of the household. 20 For each indicator, children were assigned between zero (lowest income quintile, social class V) and four (highest income quintile) or five (social class I) points. The resulting score ranged from zero (lowest SEP) to nine (highest SEP). We grouped SEP score to low (0-3), medium (4-6) and high (7-9) to give similar size groups. Similar composite scores of socioeconomic position score have been used previously by us 21 and others.	• Our analyses did not include children from minority ethnic groups due to their small numbers. • The decline in response rates in recent years may have introduced respondent bias as individuals (and presumably families) from lower SEP groups are more likely to be both non-responders in survey research and obese or overweight. • Response bias may have been introduced by the considerably higher percentages of BMI missing data in the 2000s (8-14%) compared with 1997/98 (2%).

Author, Year / Country / Sample Size	Primary Study Outcome Examined / Other Outcomes Examined	Analysis (definitions/calculations)	Limitations
McLaren, L. & Godley, J., 2009[90] Canada n= 49,252	We used multiple linear regression to examine the association between BMI and occupational prestige rankings, adjusting sequentially for other socio-demographic variables (age, education, income, marital status, hours worked).	In response to recent interest in reviving a prestige-based classification scheme, Canadian researchers Goyder and Frank (50) have updated the 1967 Pineo–Porter work to derive a prestige score for several occupational groupings, using a national survey approach that resembled the earliest work. Occupation data in CCHS 2.1 were classified using the 1991 Standard Occupational Classification (http://www.statcan.ca/english/Subjects/Standard/soc/1991/soc91-index.htm), which were then recoded using concordance tables and formula into occupational prestige rankings (Ta b l e 1), via the National Occupational Classification for Statistics (http://www.statcan.ca/english/Subjects/Standard/soc/2001/nocs01-index.htm)	• The use of self-reported height and weight is a key limitation to this study. • Limitations of cross-sectional research, including the inability to attribute temporality, also apply here. • Behavioral mediators such as diet, which have been explored elsewhere (ref. 18,63 and J. Godley and L. McLaren, unpublished data), were not a focus here, and would be one important pursuit for further research in Canada and elsewhere.
Spence, J. C. et al., 2009[91] Canada n = 2900	Association between BMI and a Retail Food Environment Index (RFEI)	Education was a stronger covariate of risk for obesity than household income in the PHS-2002 [23], therefore we used level of education attained by the respondent (less than high school, completed high school, some post secondary, completed college/technical school, completed university, completed post-bachelor university) as our sole indicator of individual-level SES. Based on self-reported height and weight, the body mass index (BMI) was calculated and participants were classified as being obese if they had a BMI of 30 or greater. ArcGIS version 9.2 (ESRI Inc., Redlands, California, USA) was used to create buffers of 800 m and 1600 m around the points indicating the location of respondents' postal codes. To calculate the number of facilities (e.g., fast food restaurants, convenience stores, supermarkets) within each buffer, we used the Count Points in Polygon analysis tool [38]. A Retail Food Environment Index (RFEI) [11] was calculated for each respondent within both buffers. The RFEI was based on the following formula: RFEI = (F+C)/G where F represents the number of fast-food restaurants within a given radius; C represents the number of convenience stores (including convenience stores, gasoline stations with convenience stores and convenience neighbourhood stores that also sell	• Cross-sectional design and use of self-reported height and weight. • We have no information on the fast-food consumption habits of the participants so it is impossible to determine if they were actually consuming such foods and how they were traveling to the establishments.

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		selected grocery items) within a given radius; and G represents the number of grocery stores (including supermarkets, ethnic stores and upscale organic markets) within a given radius. A higher REFI would, therefore, indicate a more obesogenic food environment.	
Chaput, J.P. et al., 2009[92] Canada n=537	The main outcome measure was overweight/obesity, defined as a BMI ≥ 25 kg/m 2.	We thus included nine risk factors on the basis of previously reported associations with overweight and obesity by our research group (4–12). Lipid, alcohol, and calcium intake were evaluated with a 3-day food record, including 2 week days and 1 weekend day. Mean daily intake was estimated by a dietician using the computerized version of the Canadian Nutrient File (16). In addition, a questionnaire was used to gather dietary information. Eating behavior traits (cognitive dietary restraint (intent to control food intake), disinhibition (overconsumption of food in response to cognitive or emotional cues), and susceptibility to hunger (food intake in response to feelings and perceptions of hunger)) were assessed using the Three-Factor Eating Questionnaire. Daily physical activity level and pattern were evaluated with a 3-day physical activity diary, as previously described. Finally, the number of hours of sleep was assessed through a question inserted in a self-administered questionnaire.	• However, although cohort studies are well suited for the identification of associations, they cannot establish causality. • QFS was originally designed to explore the role of genetics in the etiology of obesity, fitness, and cardiovascular and diabetes risk factors. • Future work that is similar in design is needed on a larger sample that is more representative of Canadians from across the country for a better generalizability of the results obtained.
Anderson, S.E. & Whitaker, R.C., 2009[93] United States n=8550	Prevalence of obesity, defined as body mass index at or above the 95th percentile for age of the sex-specific Centers for Disease Control and Prevention growth charts.	The ECLS-B interviewers measured children's height and weight using standardized protocol. Following recent suggestions about nomenclature, we refer to all children at or above the 95th percentile as obese. Mothers were al-lowed to choose more than 1 race designation for their child. These race and ethnicity data were combined to make a single race/ethnicity variable for our analysis.	• There are shortcomings to the use of BMI as a measure of obesity prevalence in young children and for comparing the prevalence of obesity between racial/ethnic groups.
Robinson, W.R. et al., 2009[94] United States n= 2096 black and n= 5651 white	The main study outcome was the prevalence difference for obesity (obesity prevalence in women minus that in men) at the 7-y follow-up visit.	Obesity was defined as body mass index (BMI; in kg/m2) greater than 30. Six exposure variables were examined: number of full siblings (including respondent), birth order, number of minors (age less than 18 y) living in the respondent's household (including respondent), parental education, family structure, and female caregiver's age at the time of	• Our findings may not generalize to older adults. • We did not investigate the respondent's adult SES independent of his or her parents' educational attainment; the age range examined is a highly complex transitional period, in which it is difficult to classify SES independent of family of origin.

Author, Year / Country / Sample Size	Primary Study Outcome Examined / Other Outcomes Examined	Analysis (definitions/calculations)	Limitations
respondents.		the respondent's birth. Both birth order and number of siblings were defined in terms of the respondent's full sibship, i.e., all children of both respondents' biological parents. Parental education was defined as the highest education attained by either of the respondent's biological parents.	• We were limited in using pre-existing data. • Compared with tests of main effects in data sets of the same size, tests of modification tend to have relatively low power, which would increase the likelihood of failing to detect an association. • There was a possibility of differential selection bias by gender, especially among blacks.
Liang, T. et al. 2009[95] Canada n=4966	% overweight	We applied random effects models to examine associations of watching television and of eating while watching television with the nutritional indices and body weights, thereby considering the clustering of students' observations within schools. We applied multivariable linear or logistic random effects models: logistic models for the binary outcomes of 'consumption of soft drinks' and body weights; and linear models for the continuous outcomes of 'percentage energy intake from sugar out of total energy from carbohydrate', 'percentage energy intake from fat', 'percentage energy intake from snack food', 'daily servings of fruits and vegetables' and the Diet Quality Index. The number of servings of fruits and vegetables was square-root-transformed to yield a Gaussian distribution. These analyses were adjusted for the confounding influence of child's gender and household income. All analyses with nutritional outcomes were further adjusted for energy intake as is recommended for analyses of food frequency data(41). To reveal the independent importance of watching television and eating supper while watching television, the multivariable random effects models simultaneously considered 'watching television' and 'eating supper while watching television'.	• Although the YAQ and questions on sedentary activities have been validated, responses remain subjective and prone to error. • Another limitation is that causality cannot be proved owing to the cross-sectional and observational design.
Veugelers, P. et al., 2008[96] Canada n =5 471	We studied the influence of neighborhood characteristics on diet, physical activity and weight status. Based on the student response on the Harvard Food Frequency Questionnaire, we characterized diet in terms of 1) number of daily servings of fruit and vegetables; 2) percentage energy	Study representatives visited schools to administer the Harvard Food Frequency Questionnaire (27) and to measure the height and weight (26). Standing height was measured to the nearest 0.1 ern after students had removed their shoes and body weight to the nearest 0.1 kg on calibrated digital scales. Body mass index (BMI) was calculated by dividing weight	NR

Author, Year / Country / Sample Size	Primary Study Outcome Examined / Other Outcomes Examined	Analysis (definitions/calculations)	Limitations
	obtained through dietary fat; and 3) a diet quality index. Based on parental responses, we characterized student's physical activity as 1) number of times per week their child engages in sports with a coach; 2) number of times per week their child engages in sports without a coach; and 3) number of hours per day their child spent playing video games, watching television or using the computer (screen time).	(in kilograms) by height (in meters) squared. Overweight and obesity were defined using the international BMI cut-off points established for children and youth. The parental survey included questions on 1) access to shops; 2) access to playgrounds and parks; 3) access to recreational facilities; and 4) safe places for children to play during the day. Responses to these questions were on a scale of 1 to 5, with 1 representing 'poor' and 5 'excellent'.	
Oliver, L. N. & Hayes, M. V. 2008[97] Canada n = 2152	Heights and weights were used to calculate Body Mass Index (BMI kg/ m2), which was then used to derive the outcome variable.	Children living in an intact family were coded as 1 and others as 0. The income adequacy variable originally was created with 5 categories (lowest, low-middle, middle, high middle, and high). Lowest and low-middle were merged due to small sample sizes in the lowest group. Middle and high middle were combined to create three categories: low, middle (omitted reference group) and high. Enumeration Areas, the smallest level of census geography in 1996 containing between 125 and 440 dwellings, were used as neighbourhood proxies. Proportions were divided into quintiles and the three middle quintiles were grouped resulting in three categories: 'least poor', 'middle' (omitted reference category) and 'most poor'.	• A limitation is the use of PMK (person most knowledgeable) reported heights and weights. • Parental BMI was not assessed in the NLSCY. • A statistical limitation is that the few cases per neighbourhood prevented specifying a three level model.
Blaine, B. 2008[98] Multinational n =33,000, 16 studies	An odds ratio (the probability of depressed compared to non-depressed subjects at baseline having obesity status at follow-up)	A random effects model was used to assess the overall relationship between depression and weight control. To determine if the overall estimate was moderated by whether a study reported adjusted or unadjusted effect size statistics, a fixed effects analysis was conducted that generated population effect size estimates separately from those two types of studies.	• Because the articles in this review, with one exception (Hasler et al., 2005a), do not report subjects' antidepressant use or control for it in analyses, we cannot rule out the confounding influence of antidepressant use.
Katzmarzyk, P. T. 2008[99] Canada n=24,279	The BMI was calculated as weight (kg)/height (m2). Adults 18–64 years of age were divided into BMI categories of underweight/normal weight (BMI < 25 kg/m2), overweight (BMI 25–29.9 kg/m2) and obesity (BMI ≥ 30 kg/m2) (23). Children and youth 2–17 years of age were divided into BMI categories of normal	Descriptive statistics and the prevalence figures for physical inactivity, overweight, and obesity were calculated. The prevalence figures for physical inactivity, overweight, and obesity were weighted so they would be representative of the Canadian household population. Logistic regression was used to predict obesity and physical inactivity among adults based upon ethnicity in a series of three	• When the sample was divided according to sex and ethnicity, some prevalence estimates had high coefficients of variation and should be interpreted with caution. • Data for physical activity and obesity used for these analyses were cross-sectional, and no cause-and-effect interpretations can be invoked.

Author, Year / Country / Sample Size	Primary Study Outcome Examined / Other Outcomes Examined	Analysis (definitions/calculations)	Limitations
	weight, overweight, and obese based on the international age- and sex-specific cut-offs published by Cole et al. Physically inactive (<1.5 KKD), moderately active (1.5–3.0 KKD), and active (≥3.0 KKD) categories. In addition to the physical activity energy expenditure, participants 12–17 years of age were also asked about the amount of time spent in sedentary activities including time spent watching television or videos, playing video games, and working on a computer, which was categorized into two groups: (i) <20 h, (ii) ≥20 h.	models. The first model included age and sex as covariates (Model 1), the second model included age, sex, smoking status, household income, and education (Model 2), and the third model included either physical activity levels or body weight category in addition to all covariates from Model 2 (Model 3). Among youth of 12–17 years of age, a single model that included ethnicity, sex, age (as a continuous variable) and physical activity levels was used.	• Self-reports of physical activity may be subject to bias, and do not take into account culturally diverse activities. • Reliance on leisure-time physical activity only may have masked important differences in overall physical activity levels between the Aboriginal and non-Aboriginal population. • Sample size limitations necessitated collapsing both those who indicated they were Aboriginal-only and those of mixed-Aboriginal ancestry into the same group for analysis. • Sample sizes were too small to examine the prevalence figures of overweight and obesity among First Nation, Métis, and Inuit groups separately. • Limited data exist on measured heights and weights of the on-reserve Aboriginal population.
Dubois, L. et al., 2007[100] Canada n=1499	The relationship between consumption of sugar-sweetened beverages (e.g., non-diet carbonated drinks and fruit drinks) and the prevalence of overweight.	Children's weight and height were measured at age 4.5 years at home by trained registered dietitians (RDs) following a standardized protocol. A sugar-sweetened beverage was defined for this study as a drink that has added sugar. Sugar-sweetened beverages consisted of regular or non-diet carbonated drinks and fruit-flavored drinks (e.g., fruit punch and orange drinks) listed on the FFQ. Pure fruit juices (e.g., 100% apple or orange juice) were excluded because they provide nutritional value be-yond the energy provided by beverages with added sugar and they are included as part of Canada's Food Guide for Healthy Eating.	• Although FFQs are not an optimal method for measuring dietary intake, they are the most practical and economical way to collect comprehensive dietary data in large epidemiologic studies (68). • Although we were able to measure frequency of sugar-sweetened beverage consumption, we were not able to measure specifics related to the eating patterns provided by sugar-sweetened beverages. • Another limitation is due to the self-reported energy intakes on the 24-hour recall. • Finally, we were unable to examine the effects of subcategories of sugar-sweetened beverages because they were combined into one question on the FFQ, making it difficult to disentangle the effects of various sweetened beverages.
Kruger et al., 2009[101] United States n=12,610	We examined several behaviors (e.g., inactivity, consumption of fruits and vegetables, alcohol intake) associated with overweight or obesity. Because former smokers may increase their likelihood of gaining weight when they quit smoking (former smokers have a higher body mass index [BMI] than do current smokers [14]), we included smoking status as a risk	We reported descriptive statistics dichotomized by sex for age, race/ethnicity, education level, family income, functional limitation status, and overall health status. We estimated prevalence for all of the functional health and behavioral risk-factor measures, stratified by BMI category (i.e., healthy weight, overweight, and obese) and reported separately for men and women. We computed significant differences between BMI groups for each risk factor	• NHIS data are cross-sectional and do not allow any statistical relationships to be interpreted as causal. • Data are self-reported. • We were not able to examine all of the risk factors that may be associated with increased risk of overweight and obesity; future studies should consider other types of risk factors that are likely to affect older adults more frequently than younger people.

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	behavior. Men and women differ in their attitudes about preventive measures and health conditions (12), so we present our results stratified by sex. The aim of this study is to identify differences by sex in behavioral correlates of overweight and obesity in a large national sample of adults aged 50 years or older.	using pairwise comparisons (differences in proportions using t test) with $\alpha = .05$. We examined correlates of overweight and obesity using logistic regression to identify the odds of being overweight or obese (using healthy weight as the referent) for each of the health risk behaviors. We assessed weight category by sex in models adjusting for demographic factors, functional health (includes both functional limitation and overall health status), smoking status, alcohol intake, servings per day of fruits and vegetables, and physical activity. Prevalence estimates and logistic regression models were weighted to account for probability of selection and nonresponse. We used SUDAAN version 9.0 (RTI International, Research Triangle Park, North Carolina) statistical software to account for the complex sampling design.	• Fruit and vegetable consumption and physical activity behavior questions from NHIS have not been validated or tested for reliability.

Evidence Table of Included Risk Factor Studies: Outcomes

Author, Year / Country / Sample Size	Primary Study Outcome	Etiology/ Causality of overweight/obesity	Other
Pei, Z. et al., 2013[79] Europe n=3121	We developed a model that uses anthropometric parameters during the first 5 years of life to predict whether a child will be overweight at 10 years of age. Birth weight, standardized BMI at the age of 60–64 months, parental education, family income and maternal smoking during pregnancy were included in the final prediction model. High birth weight, high standardized BMI at approximately 5 years of age (60–64 months) and maternal smoking during pregnancy increased the risk of being overweight at 10 years. Conversely, children of parents with high parental education were less likely to be overweight at 10 years of age. The sensitivity of our model was low, but the specificity was high. The PPV was higher in the model for female subjects; the NPV was similar across genders.	On the basis of our prediction model, we found that high birth weight, high standardized BMI at approximately 5 years of age and maternal smoking during pregnancy increased the risk of being overweight at 10 years of age. Conversely, having parents with a high level of education decreases this risk.	NR
Heppe, D.H. et al., 2013[80] Europe n = 3,610	In this prospective cohort study in the Netherlands, we found that low family household income, high maternal and paternal BMI, female gender, higher birth weight, and both fetal and infant accelerated growth were associated with increased risk of preschool overweight. Late introduction of solid foods and infant intake of PUFA were associated with a reduced risk of preschool overweight. In single mothers, older age was found to reduce the risk of preschool overweight.	See primary outcome.	NR
Veldhuis L. et al., 2012[81] The Netherlands n=7505	The prevalence of overweight (obesity included) among the children was 8.8%. 6.5% did not have breakfast daily, 64.3% drank > 2 glasses of sweet beverages/day, 6.5% played outside < 1 hour/day, and 19.1% watched TV > 2 hours/day. In 21.1% of the children, 2 or more of the risk behaviors were present (the	The results indicate that not having break-fast daily and spending too much time watching TV are behavioral risk factors for having overweight (obesity included) already at this young age. We also found that not having breakfast every day is a risk factor independent of the other lifestyle-related behaviors. Further, we found that having multiple	As we used cross-sectional data, the direction of the associations we found cannot be confirmed. Spending too much time watching TV might increase the risk for developing obesity, but obese children might also in-crease the time their watching TV as a consequence of their weight status. For having breakfast, it might be the case that parents let their

Author, Year / Country / Sample Size	Primary Study Outcome	Etiology/ Causality of overweight/obesity	Other
	sum of the frequencies 'any 2' and 'any 3 or all'). The number of risk behaviors that were present, was positively associated with having overweight (obesity included), and compared to children with none of the risk behaviors, the OR for having overweight was 1.73 for children with 3 or all behaviors (95% CI: 1.11-2.71, adjusted for confounders).	of the investigated behavioral risk behaviors (not having breakfast daily; drinking >2 glasses of sweet beverages; spending < 1 hour playing outside; and spending >2hours watching TV per day) is associated with an increased risk of having overweight (obesity included) in early childhood.	children skip this meal as a strategy to control the children's weight, but not much is known from literature about such a mechanism among such young children[39]. It is however more likely that, also considering the age of the children, the skipping breakfast contributed to the excess weight gain and not the other way around.
Weng, S.F. et al. 2012[82] Multinational Thirty prospective studies met the inclusion criteria.	Where reported, the median prevalence of childhood overweight was 13.2%, ranging from 5.4% to 29.6%.	Three studies found a significant association between maternal pre-pregnancy overweight and subsequent childhood overweight. Seven studies identified high birth weight as a potential risk factor for childhood overweight. The reported results were adjusted for maternal overweight status, sex and gestational weight gain. The six studies that investigated infant rapid weight gain in the first year of life found significant associations with childhood overweight. Children with mothers who had smoked regularly during pregnancy were 47% more likely to be overweight compared with children with mothers who had not smoked during pregnancy (adjusted odds ratio (AOR) 1.47, 95% CI 1.26 to 1.73; I2=47.5%; n=7 studies). There was a moderate but insignificant amount of heterogeneity (p=0.064). Evidence of publication bias was detected by an asymmetry test (p=0.0010. Evidence for the protective effect of breastfeeding against overweight in childhood was mixed. The studies met random effects meta-analysis criteria and a pooled AOR could therefore be obtained. Children who were 'ever breastfed' included those exclusively breastfed, ever breastfed or fed a mixture of formula and breast milk during the first year of life. The reference group of 'never breastfed' included children who were exclusively formula-fed. Ever breastfeeding in the first year of life significantly decreased the odds of overweight in childhood by 15% (AOR 0.85, 95% CI 0.74 to 0.99; I2=73.3%; n=10 studies). There was no	NR

Author, Year / Country / Sample Size	Primary Study Outcome	Etiology/ Causality of overweight/obesity	Other
		evidence of publication bias, which was confirmed by an asymmetry test (p=0.248). There was some evidence supporting the early introduction of solid foods as a risk factor for later overweight. No independent association with childhood overweight was found for maternal age at birth, maternal education at birth, maternal antenatal or postnatal depression or infant ethnicity. Due to the limited number of studies, there was inconclusive evidence for the following factors: delivery type, maternal postpartum weight loss, gestational weight gain and 'fussy' infant temperament There was also conflicting evidence for the following factors: maternal marital status at birth, socioeconomic status at birth and parity.	
McConley, R.L et al., 2011[83] US n=4,601	Families characterized by higher levels of maternal depression and single parenthood were more likely to report lower levels of parenting quality, a latent construct derived from family cohesion and maternal nurturance. Lower parenting quality was, in turn, related to lower activity levels, less healthy diet and more sedentary behaviour in the child. Finally, lower levels of leisure activity and more sedentary behaviour were associated with a higher BMI percentile. Contrary to expectations, child's consumption of health foods was not related to child's BMI percentile.	See primary outcome.	Single parenting was related to girls but not boys BMI. Lower parenting quality was related to child's sedentary behaviour only in non-Hispanic whites, whereas this relationship was only marginally significant for Hispanics and non-existent among non-Hispanic blacks.
Austin, G. L. et al., 2011[84] US NHANES I n=6149; NHANES 2005–2006 n=1121	Compared with data from NHANES I, the prevalence of obesity among adults aged 20–74 y dramatically increased from 11.9% to 33.4% in men and from 16.6% to 36.5% in women. Trends in energy intake and macronutrient distribution. Carbohydrates: The percentage of energy from carbohydrates increased uniformly across both men and women and across the normal-weight, overweight, and obese groups. Fat: The percentage of energy from fat	The increasing amount of energy consumed by Americans has likely contributed to the increased prevalence of obesity. Obese men and women in the United States consumed an additional 225 and 341 kcal, respectively, in NHANES 2005–2006 than in NHANES I.	NR

Author, Year / Country / Sample Size	Primary Study Outcome	Etiology/ Causality of overweight/obesity	Other
	decreased uniformly across both men and women and across the normal-weight, overweight, and obese groups. Protein: The percentage of energy from protein decreased across both men and women and across the normal-weight, overweight, and obese groups.		
Beyerlein, A. et al., 2011[85] Europe n=13,223	Our findings demonstrate considerable increases of the regression coefficients of specific risk factors for overweight by BMI z-score percentile rank in children, both in children up to ten years and in teenagers. The adjusted linear regression estimates for all risk factors (Maternal BMI, High TV viewing time, smoking in pregnancy, exclusive formula feeding, low parental SES) except formula-feeding were positive in both the 3–10 year-old and 11–17 year-old children (tables 2 and 3), indicating a shift of the mean BMI in children under exposure.	The driving forces of the obesity epidemic in children appear to be high caloric / fat intake and sedentary lifestyle. Media use and TV viewing time as a proxy for sedentary lifestyle have consistently been found to be associated with obesity [18,19,20] and seem to have increased over time [21,22]. Maternal overweight is also on the rise [23,24]. The higher maternal BMI in the group of older children observed in our study can be explained by a higher age of mothers of 11–17 year-old children compared to mothers of 3–10 year-old children at the time of data collection (41.3 vs. 35.9 years). Maternal age and BMI are known to be slightly positively associated [25], which could be confirmed in our data. Since the explanatory variables considered represent established risk factors, the observed associations are likely to be causative, although the cross-sectional design per se does not allow for addressing causal inference.	NR
Chaput, J.P. et al., 2010[86] Canada n=537	We observed that both the prevalence and incidence of over - weight/obesity were best predicted by a combination of risk factors. In this cohort of adults, short sleep duration, high disinhibition eating behavior and low dietary calcium intake appeared to have a greater contribution to overweight and obesity than high dietary lipid intake and non-participation in high-intensity physical exercise. This suggests that health practitioners and clinicians may need to consider a broader range of influential factors to more adequately address the obesity epidemic.	See primary outcome.	A careful examination of our results shows that non-participation in high-intensity physical activity was the most prevalent risk factor in this cohort (53.6%), suggesting that targeting this factor at a population level may reach a more important number of individuals.

Author, Year / Country / Sample Size	Primary Study Outcome	Etiology/ Causality of overweight/obesity	Other
Beyerlein, A. et al., 2010[87] Europe n=9698	The risk factors: high maternal BMI, maternal smoking during pregnancy, high early weight gain, low parental education and high TV viewing showed a significant positive association with average BMI-SDS values in the whole population of children. For all risk factors examined, the size of the association was directly associated with the percentile of the BMI-SDS distribution. However, there were considerably stronger associations between risk factors and BMI-SDS in children with high BMI-SDS values compared with normal-weight or underweight children.	As the explanatory variables considered represent established risk factors, the observed associations are likely to be causative, although the cross-sectional design per se does not allow for addressing causal inference.	NR
Taveras, E.M. et al., 2010[88] US n=1826 mother-child pairs	In fully adjusted multivariable models, we observed several differences between black and Hispanic children compared with white children in a range of risk factors related to childhood obesity. Black and Hispanic children had lower fetal growth indices but grew very rapidly in the first 6 months of life (Tables 3 and 4). Although black and Hispanic mothers were more likely to initiate breastfeeding, they were less likely to exclusively breastfeed their infants to 6 months of age, and were more likely to introduce solid foods prior to 4 months of age (Table 4 and Figure). Black and Hispanic mothers were also more likely to exert greater control over their infants' feeding by restricting and pressuring their children to eat (Table 4). Between 6 months to 2 years of age, black and Hispanic children were sleeping less than their white counterparts. After age 2 years, Black and Hispanic children were much more likely to have a TV in their bedroom and had higher consumption of sugar-sweetened beverages and fast food. Some risk factors were associated with only one minority group. Hispanic, but not Black mothers had elevated odds of gestational diabetes (Table 4). Black	Overall, our findings suggest that racial/ethnic disparities in childhood obesity may be determined by factors operating in pregnancy, infancy, and early childhood. These factors may include differences in behaviors such as diet patterns and physical activity or differences in access to and utilization of pregnancy- or infancy-related health care. It is also possible that cumulative disadvantage or "weathering", 57 even before conception, among racial/ethnic minority mother-child pairs may also explain the observed disparities.	NR

Author, Year / Country / Sample Size	Primary Study Outcome	Etiology/ Causality of overweight/obesity	Other
	children had higher cordblood leptin levels, viewed greater hours of TV from 6 months to 2 years of age, and consumed fewer meals together with their families. In contrast to these risk factors that might raise the risk of obesity, black and Hispanic women had lower odds of excess gestational weight gain. Black women also had lower odds of smoking during pregnancy.		
Stamatakis, E. et al., 2010[89] Europe n= 15,271 (core) Due to 1622 missing values on income or parental social class, SEP analyses included 13,649 cases	Using nationally representative data we have examined the 10 year time trends of overweight and obesity prevalence in children by socioeconomic position. Our findings suggest that despite stabilization of the overall prevalence between 2004 and 2007, social disparities continue to grow at the expense of children in lower socioeconomic position groups. Figure 1 shows the trends in overweight and obesity prevalence from 1997 to 2007, with both levelling off after 2002. Table 2 presents the overweight and obesity prevalence between 2002/3 and 2006/7 by age and sex. With the exception of obesity in boys aged 5-7, neither overweight nor obesity prevalence changed noticeably during the period. Overweight and obesity prevalence by income and SEP score at each time point are shown in Figures 2 and 3 respectively, where disparities tended to increase over time. In Figure 2, the gradient in prevalence between high and low income groups was significant for overweight in boys (p=.04) and girls (p=.003) in 2006/7, and for obesity in girls in 2002/03 (p=.001), 2004/5 (p=.005) and 2006/7 (p=.04). The SEP score gradient in Figure 3 also increased over time, reaching significance in 2006/7 for boys' overweight (p<.001) and obesity (p=.002), when obesity prevalence in the low SEP score group was twice that in the higher groups.	Childhood obesity and overweight prevalence among school-age children in England has stabilised in recent years, but children from lower socio-economic strata have not benefited from this trend. There is an urgent need to reduce socio-economic disparities in childhood overweight and obesity.	NR

Author, Year / Country / Sample Size	Primary Study Outcome	Etiology/ Causality of overweight/obesity	Other
	Similar gradients in girls' obesity prevalence were seen in 2002/3 (p<.001), 2004/5 (p=.03) and 2006/7 (p=.03).		
McLaren, L. & Godley, J., 2009[90] Canada n= 49,252	For women (Table 3), associations with occupational prestige, adjusting for age only (model 1), indicate that relative to the reference category (elemental sales and service, which includes jobs such as cashiers and janitors), many occupations had a lower average BMI. This was especially true for occupations near the top of the prestige rankings: seven of the top ten occupations showed a lower average BMI relative to elemental sales and service in model 1: professional occupations in health (e.g., physicians, pharmacists); technical and skilled occupations in health (e.g., medical laboratory technicians; midwives); professional occupations in social science, education, government service, and religion (e.g., professors/ teachers, social workers); professional occupations in natural and applied sciences (e.g., engineers, architects); technical occupations related to natural and applied sciences (e.g., conservation and fishery officers, air pilots); professional occupations in business and finance (e.g., accountants, investment dealers); and professional occupations in art and culture (e.g., curators, writers).While this pattern of findings was largely retained when further adjusting for income (model 3), nearly all effects were eliminated when adjusting for education (model 2), suggesting that effects of occupational prestige are largely attributable to education level. For men (Table 3), associations adjusting for age only (model 1) resembled a nonlinear pattern whereby those in certain higher prestige jobs (e.g., professional occupations in health) were lighter on average,	Overall, we detected negligible independent effects of occupational prestige on BMI for women. In models adjusting just for age, and for age and income, women in skilled professional occupations tended to be thinner on average than those in lower ranking occupations, and it is certainly plausible that the workplace culture in higher ranking occupations is one in which thinness in particular and physical appearance in general are valued. However, the elimination of most of these effects in other adjusted models suggests that education is also important in this regard. For men on the other hand, occupation effects were more robust to adjustment for income and education. In the fully adjusted models, a lighter body size on average was observed among men in professional health-related occupations (category 1), and in technical and skilled occupations in art, culture, recreation and sport (category 13). These findings probably reflect some combination of the activity level inherent in these occupations (for example, health professionals in category 1 may be on their feet a great deal; category 13 includes athletes), and the focus on health and/or recreation in these categories, which might indicate a selection effect of thinner workers (however, other health-related occupational categories did not show this effect, such as technical and skilled occupations in health, and assisting occupations in support of health services).	NR

Author, Year / Country / Sample Size	Primary Study Outcome	Etiology/ Causality of overweight/obesity	Other
	and those in certain mid-range prestige jobs (e.g., skilled administrative and business occupations; intermediate occupations in transport, equipment operators, installation and maintenance) were heavier on average, than those in the reference category of elemental sales and service.		
Spence, J. C. et al., 2009[91] Canada n = 2900	RFEI within 800 m of the home was negatively associated with obesity prevalence (see Table 2). Specifically, the odds of a resident being obese were significantly lower (OR = 0.75, 95%CI 0.59 – 0.95) if they lived in an area with the lowest RFEI (below 3.0) in comparison to the highest RFEI (5.0 and above).	We found that the lower the ratio of fast-food restaurants and convenience stores to grocery stores and produce vendors near the home, the lower the odds of being obese. This association existed for establishments within an 800 m buffer around people's homes but not for establishments within 1600 m of their homes. Thus the proximity of the obesogenic environment [10] to individuals appears to be an important factor in their risk for obesity.	NR
Chaput, J.P. et al., 2009[92] Canada n=537	In the adjusted model, short sleep duration, high disinhibition eating behavior, low dietary calcium intake, high susceptibility to hunger behavior, nonparticipation in high-intensity physical exercise, high dietary restraint behavior, no consumption of multivitamin and dietary supplements, high dietary lipid intake, and high alcohol intake were all significantly associated with adult overweight and obesity. After adjustment for age, socioeconomic status, and all other risk factors, only individuals presenting short sleep duration, high disinhibition eating behavior, and low dietary calcium intake had significantly higher BMI compared to the reference category in both sexes. Over the 6-year follow-up period, 88 of the 283 subjects (31%) experienced a weight gain of ≥5kg. Short-duration sleepers, low calcium consumers, and those with a high disinhibition and restraint eating behavior score were 35, 30, 28, and 26% more likely to experience a 5-kg weight gain, respectively, as com-pared with the reference category, P<0.05.	This study investigated the contributions of nine risk factors to overweight and obesity in adulthood. These risk factors were all significantly related to overweight and obesity, as previously reported (4–12). However, after statistical adjustment, only short sleep duration, low dietary calcium intake, and high dis-inhibition eating behavior were significantly associated with a higher BMI in both sexes in the cross-sectional sample. In the sample followed for 6 years, short sleep duration, low dietary calcium intake, and high disinhibition and restraint eating behaviors were significantly associated with a higher weight gain and a higher risk of developing obesity.	NR

Author, Year / Country / Sample Size	Primary Study Outcome	Etiology/ Causality of overweight/obesity	Other
Anderson, S.E. & Whitaker, R.C., 2009[93] United States n=8550	In our analysis of measured BMI data collected in 2005 from a large nationally representative sample of US pre-school children, significant differences in the prevalence of obesity between racial/ethnic groups were evident at 4 years of age. Among US preschool children, there appear to be 3 tiers of obesity prevalence by racial/ ethnic group, with the highest prevalence among American Indian/Native Alaskan children, the lowest prevalence among non-Hispanic white and Asian children, and an intermediate prevalence among Hispanic and non-Hispanic black children.	These analyses did not attempt to explain what biologic, social, structural, or economic factors might explain the racial/ethnic disparities in obesity that we identified among preschool children. However, previous research suggests that these differences in preschool children would not be significantly attenuated by adjusting for socioeconomic variables.	NR
Robinson, W.R. et al., 2009[94] United States n= 2096 black and n= 5651 white respondents.	As expected, obesity prevalence was higher in black women than in black men: the estimated prevalence difference was 11.9 percentage points (95% CI: 7.0, 16.7). Parental education was the only socio-demographic variable that was strongly associated with the gender disparity in obesity in blacks. In fact, nearly half of the overall gender gap was concentrated among the one-fifth of young black adults whose parents did not complete high school. Whereas young black women from low-education families were at the greatest risk of obesity, young black men from these same families appeared to be at the lowest risk.	NR	NR
Liang, T. et al. 2009[95] Canada n=4966	Relative to children with the lowest frequency, those with the highest frequency of television watching were 2.42 times more likely to be overweight and those with the higher frequency of eating in front of the television were 1.43 times more likely to be overweight.	See primary outcome.	The percentage of students consuming two or more servings of soft drinks weekly, the percentage of energy from sugar out of carbohydrate energy, the percentage of energy from dietary fat, the percentage of energy from snack foods and the prevalence of overweight all demonstrated gradual increases with increases in television watching, whereas the Diet Quality Index decreased gradually. Similar gradients were observed for the frequency that children eat supper in front of the television. Television watching showed statistically significant positive associations with consumption of two or more weekly servings of

Author, Year / Country / Sample Size	Primary Study Outcome	Etiology/ Causality of overweight/obesity	Other
			soft drinks, percentage of energy from sugar out of carbohydrate energy, percentage of energy from snack foods, daily servings of fruit and vegetables, Diet Quality Index and percentage of overweight.
Veugelers, P. et al., 2008[96] Canada n =5 471	Access to shops in 'relation to diet, overweight and obesity. Relative to the neighborhoods with the poorest access to shops (neighborhoods grouped in the lowest one-third), children in neighborhoods with the best access to shops (grouped in the highest one third) reported more consumption of fruit and vegetables, substantially less consumption of dietary fat and a higher DQI. Access to parks, playgrounds and recreational facilities in relation to sports, screen time, overweight: and obesity. Table ill shows that children in neighborhoods with good access to playgrounds and parks and to recreational facilities engaged more in 'sports with a coach' and spent less time in front of a computer or TV screen relative to children in neighborhoods with poor access to such facilities. In addition, the probability of being overweight or obese was lower among children residing in neighborhoods with good access to these facilities relative to children in neighborhoods with poor access. Neighborhood safety in relation to unorganized sports, screen time and overweight and obesity. Relative to the unsafe neighborhoods, children in safe neighborhoods engaged more in sports without a coach (Table IV). However, the association between neighborhood safety and overweight and obesity was not statistically significant.	The present study shows that parental perception of characteristics of Canadian neighborhoods is associated with health behavior and body weights of children. Specifically, children residing in neighborhoods with good access to shops with modestly priced fresh produce have healthier diets and were less likely to be overweight or obese. Children in neighborhoods with good access to playgrounds, parks and recreational facilities are more actively engaged in structured sports, less likely to spend time in front of a computer or TV screen, and less likely to be overweight or obese. Children in safe neighborhoods were more likely to engage in unsupervised sports though this was not reflected in healthier body weights.	In the present study we observed higher overweight and obesity prevalence rates among children residing in rural areas. In our previous research we had demonstrated that these differences are for a large part the result of lower socio-economic conditions that exist in rural areas (26). The present study adds to this in that limited access to good playgrounds, parks and recreational facilities hinders children being physically active and puts them at increased risk of becoming overweight.
Oliver, L. N. & Hayes, M. V. 2008[97] Canada	The principal finding of this paper is that the early neighbourhood environment influences children's BMI percentiles. Children living in the 'most poor' neighbourhoods have an increased rate of change in BMI percentile relative to children living in a 'middle' income	See primary outcome.	The findings of this research suggest that obesity policies which focus on conditions of childhood including the places in which young children live may meet with the greatest success. Such policies may reduce the prevalence of obesity among all children and prevent the emergence of

Author, Year / Country / Sample Size	Primary Study Outcome	Etiology/ Causality of overweight/obesity	Other
n = 2152	neighbourhood. Living in the 'least poor' neighbourhood did not confer benefits suggesting that it is the effect of neighbourhood poverty rather than affluence that may matter most. The final model showed that over time living in the 'most poor' neighbourhood increases BMI percentile which is consistent with our hypothesis that neighbourhood characteristics may have a greater influence as children age.		neighbourhood-based disparities in body weight as children age.
Blaine, B. 2008[98] Multinational n =33,000, 16 studies	A significant population effect size estimate of 1.47 (95% CI: 1.16, 1.85), indicating that depressed people at baseline measurement are about 1.8 times more likely than non-depressed people to have obese status or weight gain at follow-up measurement. There was considerable non-random variability across sample estimates, $Q(22) = 474.6$, $p < .001$, indicating that the relationship between depression and weight change was likely moderated by other variables.	See primary outcome.	Subject sex and age were also analyzed as moderating variables. Using a fixed effects analysis, male (n = 4, odds ratio: 1.34, 95% CI: 1.14, 1.58) and female (n = 11, odds ratio: 1.26, 95% CI: 1.20, 1.32) did not generate significantly different estimates. Further, these results did not change when analyzing only studies with adjusted effect size statistics. Thus, depressed compared with non-depressed men and women do not differ in their greater likelihood of being obese or having gained weight at follow-up, controlling for baseline BMI. A similar analysis investigated the moderating influence of sample age and found that adolescent (n= 12, odds ratio: 2.31, 95% CI: 2.06, 2.58) and adult (n = 11, odds ratio: 1.08, 95%CI: 1.03, 1.13) samples differed in the effect of depression on obesity status. This difference, as well as the odds ratios for each group, was essentially unchanged when only samples reporting adjusted effect size statistics were analyzed and background variables. These results show that the implications of depression for later weight control are more dependent on other factors (i.e. chronic illness) in adults, especially older adults, than in adolescents.
Katzmarzyk, P. T. 2008[99] Canada n=24,279	The overall prevalence of obesity (BMI ≥ 30 kg/m2) in the total sample of adults was 22.9% (22.9% in men, 22.9% in women). The prevalence was higher among Aboriginal adults (37.8%), when compared to the rest of the population (22.6%). Similar trends of the higher	After the inclusion of age and sex as covariates (Model 1), Aboriginal adults (OR = 2.4 (95% CI: 1.6–3.6)) had elevated odds for being obese. These results were largely unchanged after the addition of several covariates, including physical activity level (Models 2 and 3). Thus, the elevated risk for	The overall prevalence of physical inactivity (<1.5 KKD) in the total sample of adults was 57.2% (55.7% in men, 58.7% in women). The prevalence was similar among Aboriginal adults and the rest of the population: 57.2% in non-Aboriginals and 58.3% in Aboriginals. There were no

Author, Year / Country / Sample Size	Primary Study Outcome	Etiology/ Causality of overweight/obesity	Other
	prevalence of obesity among those indicating an Aboriginal ethnicity were observed when the sample was divided into men and women separately (Figure 1). The prevalence of obesity in the total sample of children and youth was 8.2% (9.2% in boys, 7.2% in girls). The prevalence was higher among Aboriginal children and youth (15.8%), when compared to the rest of the population (8.0%). Similar trends of the higher prevalence of obesity among those indicating an Aboriginal ethnicity were also observed when the sample was divided into boys and girls separately.	obesity associated with Aboriginal ethnicity was independent of the demographic and lifestyle variables included in the model. The odds for obesity were also higher among those who were physically inactive, independent of other variables in the model (OR = 2.0 (95%CI: 1.5–2.7)). An analysis of physical inactivity in the prediction of obesity was performed separately in the Aboriginal and non-Aboriginal samples. The odds ratios for obesity associated with physical inactivity were 2.0 (95% CI: 1.4–2.6) in the non-Aboriginal sample, and 3.0 (95% CI: 1.1–8.4) in the Aboriginal sample, after adjustment for age, sex, education, household income and smoking. After the inclusion of age (in years), sex and physical activity level as covariates, Aboriginal youth (OR = 2.3 (95% CI: 1.4–3.8)) had elevated odds for being obese.	consistent associations between ethnicity and physical inactivity when the sample was divided to separate men and women (Figure 2a). However, within each ethnic group, the prevalence of physical inactivity was higher in women than in men. The overall prevalence of physical activity (≥3.0 KKD) in the total sample of adults was 17.7% (19.0% in men, 16.5% in women). There was no trend for physical activity across ethnic groups in adults: 17.7% in non-Aboriginals and 19.2% in Aboriginals (Figure 2b). A similar lack of trend was observed when the sample was divided into men and women; however, within each ethnic group, the prevalence of physical activity was higher in men than in women. The results of the logistic regression analyses predicting physical inactivity in adults are presented in Table 4. In contrast to the results for obesity, Aboriginal ethnicity was not a significant predictor of physical inactivity in this sample. However, being a daily smoker and being obese were both significantly associated with greater odds for being physically inactive, while higher education and income are both associated with lower odds for being physically inactive. The prevalence of sedentary behavior (20+ h/week) among youth 12–17 years of age was 65.8% (71.7% in boys, 59.0% in girls). There were no consistent associations between ethnicity and the prevalence of sedentary behavior; however, within each ethnic group, boys reported consistently more sedentary behaviour than girls.
Dubois, L. et al., 2007[100] Canada n=1499	Overall, 17.2% of children consumed sugar - sweetened beverages daily (at meals and between meals) at age 4.5 years (data not shown). The total daily consumption of sugar-sweetened beverages (i.e., carbonated non-diet drinks and fruit drinks) is not related with overweight at age 4.5 years (data not shown), but daily sugar-sweetened beverage consumption between meals is related. In	Our findings suggest that preschoolers' regular sugar-sweetened beverage consumption, in particular between meals, is positively related to overweight. We did not find a relationship to overall daily consumption of sugar-sweetened beverages with overweight at age 4.5 years, but we found a significant positive association with regular consumption of sugar-sweetened beverages between meals throughout the 3-year period.	NR

Author, Year / Country / Sample Size	Primary Study Outcome	Etiology/ Causality of overweight/obesity	Other
	comparison with non-consumption, regular sugar-sweetened beverage consumption between meals from age 2.5 to 4.5 years more than doubles the odds (OR 2.4) of being overweight at age 4.5 years, even when other important factors related to overweight, such as birth weight, in-come sufficiency, and parental overweight or obesity (adjusted for children's sex and physical activity level and maternal smoking during pregnancy), are taken into consideration in the analysis. Energy intake (Table 2, Model 2), carbohydrates (adjusted for energy consumption) (Table 2, Model 3), and servings of grain products (adjusted for energy consumption) (Table 2, Model 4) are also related to overweight. When these elements are added to the analysis, regular sugar-sweetened beverage consumption between meals still doubles the odds (OR between 2.1 and 2.4) of being overweight at age 4.5 years. This result is important because it indicates there is a relationship between sugar- sweetened beverage consumption and overweight that is independent of the overall nutritional content of the diet. An interaction is observed between income sufficiency and regular sugar-sweetened beverage consumption from age 2.5 to 4.5 years (Table 3). Compared to children who were non-consumers and from sufficient income families, consumption of sugar-sweetened beverages between meals regularly from age 2.5 to 4.5 years almost triples the odds (OR 2.7) of being overweight for children from income sufficient families and more than triples the odds (OR 3.4) for children from insufficient and very insufficient income families.	Similarly, we found a statistically significant positive association with non-consumers of sugar-sweetened beverages between meals and not being overweight.	

Author, Year / Country / Sample Size	Primary Study Outcome	Etiology/ Causality of overweight/obesity	Other
Kruger et al., 2009[101] United States n=12,610	In adjusted analyses (Table 2), significant differences were found between obese men and men who were overweight or who were at a healthy weight. More obese men (28.8%) had a functional limitation than men who were at a healthy weight (25.6%) or men who were overweight (18.7%). More obese men (47.5%) were former smokers than were overweight men (43.9%) or men at a healthy weight (38.0%). A larger percentage of healthy-weight men (42.9%) were non-drinkers than were overweight men (36.7%) or obese men (38.0%). Differences in fruit and vegetable consumption by BMI category were also found. More obese men (36.8%) consumed fewer than 2 servings of fruits and vegetables per day than men at a healthy weight (30.0%) or men who were overweight (31.3%). Conversely, a higher percentage of healthy-weight men (30.3%) consumed 3.5 or more servings of fruits and vegetables per day than overweight men (26.4%) or obese men (19.6%). In addition, a higher percentage of healthy-weight or overweight men engaged in recommended levels of leisure-time physical activity and strength training than obese men. Correspondingly, a lower percentage of obese men (7.3%) engaged in walking for leisure than men at a healthy weight (14.6%) or men who were overweight (13.7%). Similarly, a lower percentage of obese men engaged in walking for transportation than did healthy-weight or overweight men. As was the case with the men, many significant differences were found among women after adjusted analyses were conducted (Table 3). The percentages of women with a functional limitation increased as BMI increased (22.5%	Overall, overweight was significantly more likely among former smokers than among non-smokers, among adults who consumed 2 to fewer than 3.5 servings of fruit and vegetables per day than among those who consumed 3.5 or more servings per day, among adults who did not walk for transportation than among those who did, and among adults who engaged in strength training than among those who did not. Overweight was less likely among current smokers than among non-smokers and among heavy drinkers than among non-drinkers. Significant correlates of overweight varied by sex. Although being a former smoker was a correlate of overweight among men, it was not a correlate among women. Consuming 2 to fewer than 3.5 servings per day of fruits and vegetables was not a significant correlate of overweight among women, but it was among men. Overweight was significantly more likely among women who did not walk for leisure than among those who did and among women who did not engage in strengthening activities than among those who did, but this was not the case for men. Among men, not walking for transportation was a significant correlate of overweight. Adjusted odds of obesity among the total sample of adults aged 50 years or older and for men and women are presented in Table 5. Overall, obesity was more likely among former smokers than among non-smokers, among adults who consumed fewer than 3.5 servings of fruits and vegetables per day than among those who consumed 3.5 or more servings, among adults who were inactive or insufficiently active during their leisure time than among those who met the recommended levels of leisure-time physical activity, among adults who did not walk for leisure or transportation than among those who did, and among adults who did	NR

Author, Year / Country / Sample Size	Primary Study Outcome	Etiology/ Causality of overweight/obesity	Other
	for healthy-weight women, 26.9% for overweight women, and 38.6% for obese women). More women at a healthy weight (15.3%) were current smokers than were overweight women (13.2%) or obese women (11.3%). In addition, a larger percentage of obese women (59.4%) were non-drinkers than were overweight women (52.6%) or healthy-weight women (47.9%). More women at a healthy weight (37.7%) consumed 3.5 or more servings of fruits and vegetables per day than did overweight women (32.9%) or obese women (31.0%). A larger percentage of healthy-weight women engaged in recommended levels of leisure-time physical activity (29.8%) than did overweight women (23.2%) or obese women (16.5%). Similarly, compared with overweight and obese women, a larger proportion of healthy-weight women walked for leisure, walked for transportation, and engaged in strength training.	not engage in strengthening activities than among those who did. Obese older adults were less likely to be current smokers than non-smokers and to be heavy drinkers than non-drinkers. Again, differences by sex were observed. Correlates for obesity among men but not women were being a former smoker; being an occasional, light, or moderate drinker; and being inactive or insufficiently active. Correlates for obesity among women but not men included heavy drinking, not walking for transportation, and not engaging in strength training. Not walking for leisure was a significant correlate of obesity among women and men.	

5 Summary of Findings

The causes and associations of overweight and obesity are multifactorial and result from a complex interaction of individual and societal risk factors. Based on the finding of the literature review, **Figure 7** outlines factors that have been shown to be associated with excess weight gain and high BMI. The majority of studies are observational in nature, and therefore explore associations rather than causal relationships between variables.[1]

Perinatal and Early Childhood Risk Factors

The risk for becoming overweight or obese begins early in life. The following perinatal and early childhood risk factors were associated with an increased risk in excess weight: high pre-pregnancy weight,[14,16,21,84] maternal smoking,[13-16] high birth weight,[13,14,15] infant feeding,[15,84,85] maternal depression or single parenting.[76]

Health and Lifestyle Factors

A number of lifestyle factors have also been associated with the increased prevalence of obesity.[17] Several studies indicated that diet and eating behaviours (e.g. high caloric intake, skipping breakfast, consumption of sugary beverages, high disinhibition eating[2]) and metabolic factors were associated with increased risk of being overweight.[17-20,82,86,83]

Other lifestyle factors such as sedentary behaviour[16,20,21,29,80,87] as well as tobacco use and alcohol intake were associated with overweight and obesity.[87] In addition, a higher incidence of obesity has been observed among individuals with shorter sleep duration, though this finding was not consistent across age and gender.[18,23,24]

Finally, a meta-analysis indicated that individuals with depression were 1.8 times more likely to have an obese BMI, compared to those who were non-depressed; though this relationship may be influenced by other variables (e.g., depressed adolescent females were approximately 2.5 times more likely to be obese at follow-up than non-depressed adolescent females).[25]

Community Level Factors

The term 'obesogenic' or built environment' refers to the role that environmental/community factors may play in determining both nutrition and physical activity. The environment has been shown to impact the risk of becoming overweight and obese in several ways including the availability of fresh produce and access to parks and green space. An Alberta study showed that the type of foods available around a person's home (e.g. the proximity of fast-food restaurants and convenience stores versus grocery stores and produce vendors) was associated with risk of overweight or obesity, noting that the odds of obesity

[1] A limitation for causal inference from observational studies (hence the use of the term "association") is the possibility that the observed association between the exposure and the effect is spuriously created, enhanced, reduced or eliminated because of confounding of another factor. Care was taken to examine studies that aimed to control for confounding factors, but there is the possibility that unknown, residual confounding may exist.

[2] High disinhibition eating behaviour refers to the behaviour of overeating in response to different stimuli. This behaviour may occur in a variety of circumstances (e.g., when an individual is presented with palatable foods; or under emotional distress).

decreased with a lower ratio of fast-food restaurants and convenience stores to grocery stores and produce vendors near the home.[78] A Nova Scotia study found that children residing in neighborhoods with good access to shops (with modestly priced fresh produce) as well as to playgrounds, parks and recreational facilities were less likely to be overweight or obese.[26] A large Canadian longitudinal study showed that neighborhood disadvantage was associated with an increased BMI, noting that children living in the 'most poor' neighbourhoods had an increased rate of change in BMI percentile relative to children living in a 'middle' income neighbourhood (after controlling for individual/family factors).[27]

Socio-demographic Factors

Socioeconomic variables, including education and income, have been shown to be associated with increased risk of overweight and obesity. Reviews of this topic indicate an inverse association (lower socioeconomic status, higher likelihood of obesity) among women in developed countries that is most pronounced when education is used as an indicator of socioeconomic status. For men in developed countries, the association is less consistent.[28,29] The trend has also been noted in children, where studies have indicated that *parental* education, family income, and socio-economic status are risk factors for childhood overweight and obesity.[13,14,16,21,30,31]

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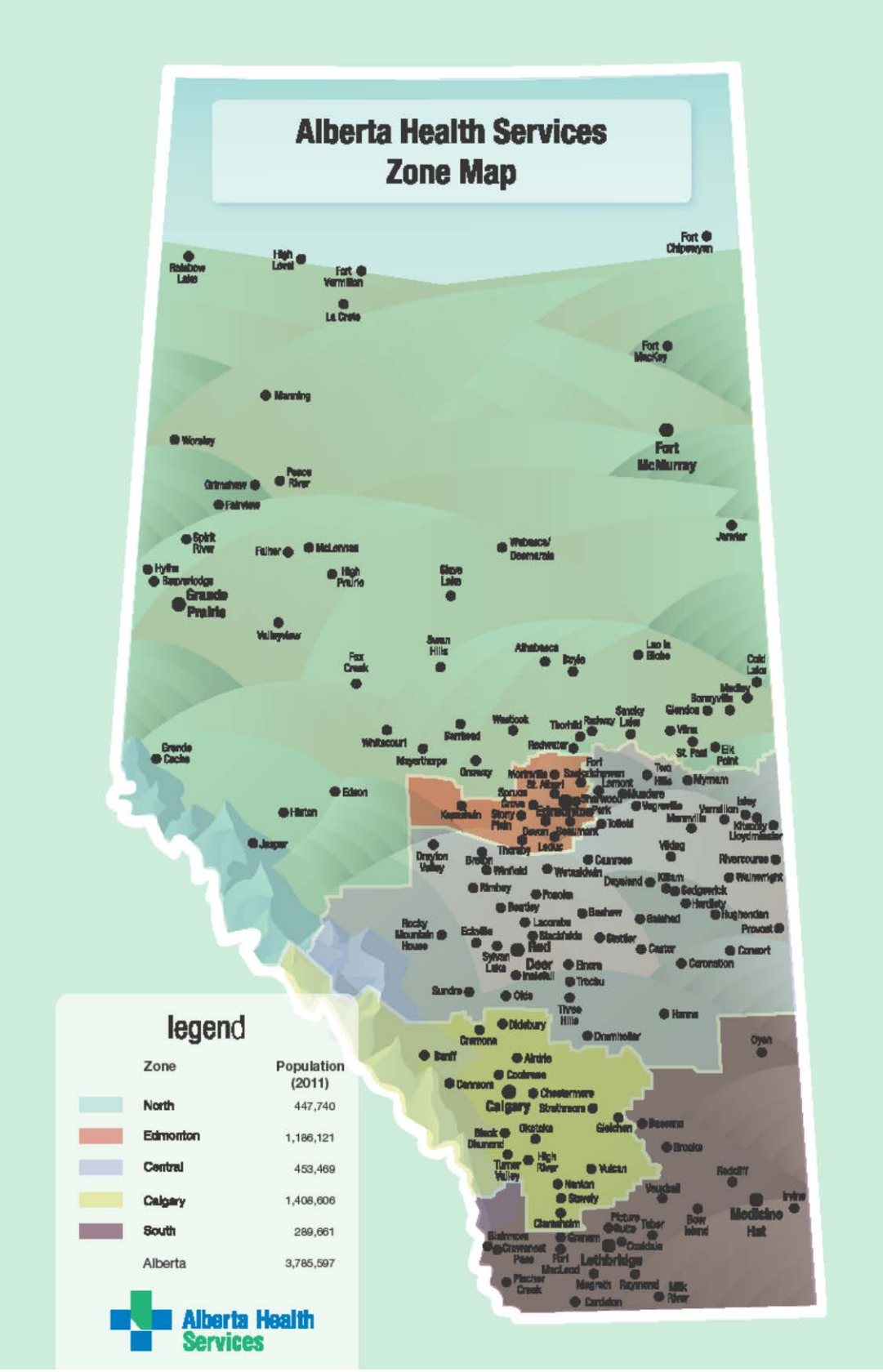
APPENDIX III: ALBERTA HEALTH SERVICES ZONE MAP



MEDLIOR
HEALTH OUTCOMES RESEARCH

APPENDIX 4: *Environmental Scan of Weight Management in Alberta*

1. Table of Contents

2. ENVIRONMENTAL SCAN

2.1 Methodology

A structured online Environmental Scan was conducted in January-March 2104 to identify research projects and health system initiatives/programs intended for overweight and obese populations in Alberta. The search included all levels of the health system (Alberta Health, Alberta Health Services (AHS), Primary Care Networks (PCNs)) as well as Organizations and Universities based in Alberta. A summary has been provided below with full details located in APPENDIX A: Environmental Scan - Alberta Detailed Summary and APPENDIX B: Environmental Scan - PCN Detailed Summary.

Limitations of the online Environmental Scan, which should be considered in the context of the reported information, include: several PCNs websites were not available, several websites contained content which was not updated, details of certain programs were unavailable, and for many programs, only basic details were publicly available. Therefore, interviews with several experts from all levels of the health system and Universities were conducted to gain additional insights and information regarding initiatives/programs and research projects intended for overweight and obese populations in Alberta.

2.2 Summary of Findings

The Canadian Obesity Network

The Canadian Obesity Network is a national organization based out of Edmonton, Alberta. Of the 10,000 members, 1200 are based out of Alberta, including obesity researchers, health professionals, trainees and other professionals with an interest in obesity prevention and management. The Network is responsible for a number of Alberta based initiatives, including: the International School for Obesity Research and Management (ISORAM); the National Student Meeting; the Annual Obesity Research Bootcamp; the launch of the 5A's of Obesity Management; and the development of obesity conversation cards.

University Research Studies and Programs

There were numerous studies out of the University of Alberta, including the 'Promoting Optimal Weights through Ecological Research (POWER)' Study; the 'Healthy Alberta Communities (HAC)' Project ; the 'Raising Healthy Eating and Active Living Kids Alberta (REAL Kids Alberta)' evaluation; and the Alberta Project Promoting active Living and healthy Eating (APPLE Schools) project.

Adult/Community population

The *'Healthy Alberta Communities (HAC)'* Project was affiliated with the School of Public Health at the University of Alberta. This project involved four communities, selected by Alberta Health and Wellness:

Bonnyville, St. Paul, Norwood/North Central Edmonton and Medicine Hat. The main objective of this community-based intervention was to reduce risk factors for chronic diseases by fostering healthier lifestyles in people living in these communities. Data collection took place in 2006 and 2009, pre and post-intervention; and involved self-reports and physical measurements and gathering information to address environment-level risks for obesity. Likewise, the '*POWER* study' considers the social and environmental determinants of obesity. Other studies aimed at the adult population include the 'Alberta population-based prospective evaluation of the quality of life outcomes and economic impact of bariatric surgery (*APPLES*)' study, which assesses bariatric surgery using an Albertan sample. The Outcome Assessment to Optimize Patient Selection for Bariatric Surgery (*OASIS*) program looks at factors for triaging patients for bariatric surgery, which can be used to streamline access for patients to the Edmonton Weight Wise program. Finally, the Evaluating Self-Management and Educational Support in Severely Obese Patients Awaiting Multidisciplinary Bariatric Care (*EVOLUTION*) study, assesses the effectiveness of an educational intervention (designed to enhance self-management skills in patients who are on the wait list for bariatric care) in improving outcomes and for cost-effectiveness.

Pediatric populations

There have been several research studies aimed at obesity in children, including: *'REAL Kids Alberta'* (funded by the Government of Alberta) which has collected data provincially from Grade 5 classrooms since 2008 and this data has been used to track provincial trends and to evaluate healthy weights initiatives funded by Government of Alberta since 2007. The *Alberta Healthy School Community Wellness Fund* was one of the healthy weights initiatives funded by government and established in partnership with the School of Public Health to enhance the health and wellbeing of school-aged children and youth within Alberta school communities. The Wellness Fund provides support to school community projects, which address healthy eating, active living and positive social environments using a Comprehensive School Health approach. *APPLE Schools* was started in 2008 by the School of Public Health at the University of Alberta, with a focus on improving healthy living habits of students; increasing knowledge about healthy living for parents, students, teachers and the school community; and to sustain healthy environments in school communities.

Furthermore, several more studies out of the University of Alberta focus on children and families of children who are overweight or obese. These include two ongoing studies: *Pediatric Weight Management, Advancing the Evidence in Family-Centered Care* and a pilot study which hopes to identify overweight children using iPads. Past studies that have looked at children and obesity include: *One Size Does Not Fit all*: Partnering with Parents and Clinicians to 'Set the Agenda' for Pediatric Weight Management; The PAC Study, *Using Parents as Agents of Change (PAC)* to Improve Health Outcomes of Obese Children;

Identifying Factors Influencing Healthy Lifestyles in First Nations Children, Community-based, Formative Assessment; and *The HIP Study*: Healthy Initiative Program to Promote Weight Management for Overweight Teens.

Research and programs out of the University of Calgary include: "Integrating eating disorder and obesity prevention: A study of school-based activities aimed at shared risk factors"; "Weight Bias and Primary Health Care: Creating a Provincial Research Strategy" (Werklund School of Education); and "Psychosocial aspects of body weight"(Werklund School of Education, Dept. of Psychology and Community Health Sciences); and the Media Literacy & Food Marketing program implemented under the Food Marketing, Policy and Children's Health Canada Research Chair, University of Calgary. In addition, in 2013 a team of researchers, led Dr Raylene Reimer, were granted $300,000 gift from the BMO Endowed Research Fund in Healthy Living. The projects will include a study of how children reacting to food packaging, using an MRI to examine how they respond to images of junk-food products. Another will examine the effects of fibre in a pediatric population. Finally, a third project involves the evaluation of the pediatric weight and health clinic based out of the Alberta Children's Hospital1 (details provided below).

Government of Alberta: Alberta Health

'*Healthy U*' social marketing campaign and website (www.healthyalberta.com) was developed in 2002 as a long term public information and education initiative to support and encourage Albertans to lead healthier lifestyles by providing them with access to healthy eating and active living information and resources. Healthy U strategies have included media campaigns, resources for families and practitioners, community outreach through Healthy U Crews, and the healthyalberta.com website which shares healthy eating and active living information, resources and programs with Albertans and with healthy living practitioners in schools, workplaces and communities. The most recent Healthy U social marketing campaign has two main themes: "Be a Health Champion" (introduced in July 2012), which encourages parents and caregivers of 0 to 5 year olds to become healthy living role models for their children, and the "The Healthy U 5&1 Experiment" (introduced in April 2013), which helps parents and their 6 to 12 year old kids get a recommended five servings of vegetables and fruit and one hour of activity each day by

[1] UToday, October 16, 2013. "Nutrition 'dream team' targets childhood obesity epidemic: Multidisciplinary researchers focus on three key questions" From: http://www.ucalgary.ca/utoday/issue/2013-10-16/nutrition-dream-team-targets-childhood-obesity-epidemic (accessed May 13, 2014)

packaging healthy eating and active living in a fun way that encourages kids to try new foods and activities.

'*UWALK*' is a provincial initiative (funded by the Government of Alberta) which was designed by the Faculty of Physical Education and Recreation at the University of Alberta to encourage Albertans to partake in physical activity through walking. UWalk's interactive website offers Albertans information, individual and group challenges, goal setting assistance and a mechanism to log steps and time spent being active.

'*Communities ChooseWell*' is an initiative run by Alberta Recreation and Parks Association (funded by Alberta Health), which focuses on developing healthy communities and citizens through education, community capacity building and fostering environments that are supportive of healthy eating, active living and social well-being. Communities ChooseWell allows communities to register for free, and provides them with the opportunity to apply for funding grants, a tool kit of available resources, webinars, newsletter and educational opportunities.

The '*Alberta Centre for Active Living*' is funded by Alberta Sport, Recreation, Parks & Wildlife Foundation & Alberta Tourism, Parks and Recreation, and is affiliated with University of Alberta. The centre is involved in a number of projects across the province including: conducting the Alberta Survey on Physical Activity; contributing articles to the Healthy U website; creation of the Physical Activity Counselling Toolkit, a resource for practitioners; a study of after-school programs in Alberta; the development of 'Home Support Exercise Program' training videos; evaluation of Sacred Circle Aboriginal Diabetes Initiative; and a community walking project.

The Government of Alberta supports *Healthy Children and Youth Initiatives* which include healthy weights initiatives, such as the Alberta Nutrition Guidelines for Children and Youth, and the Alberta Healthy School Community Wellness Fund. The Wellness fund has provided support to 54 out of 61 school districts to address healthy eating, physical activity and positive social environments using a comprehensive school health approach.

Supporting over 700 school communities in Alberta, the *'Ever Active School'* is an initiative which is run by the Health and Physical Education Council of the Alberta Teachers Association, and supported by Alberta Health; Alberta Education and Tourism, Parks and Recreation. This program assists school communities in addressing and creating healthy environments by focusing on physical activity, healthy eating and positive mental health.

Alberta Health Services (AHS)

Diabetes, Obesity and Nutrition (DON) - Strategic Clinical Network (SCN)

The DON SCN provides *health policy guidance* by developing strategies for chronic disease prevention, management and treatment. Similar to American Medical Association (AMA) the SCN views obesity as a chronic disease. To date most of the focus in AHS has been on building infrastructure for the treatment of obesity (e.g. speciality clinics and bariatric surgery), with a recent provincial Health Technology Assessment (HTA) showing certain bariatric procedures are more effective than others. [2] *Key partnerships with other SCNs* are driving forward obesity services and interventions in the province (e.g. Surgery SCN collaboration is supporting the provincial program for bariatric surgery). The DON SCN emphasizes obesity prevention/management from the perspective of broader disease prevention/management. To that end, the SCN examines upstream evidence based interventions in primary care and population health promotion.

The DON SCN has also uncovered a broad variety of educational resources and tools for providers and patients in the province. The DON SCN is co-leading with the Provincial Chronic Disease Management portfolio a Pan-SCN initiative that will standardize the source(s) and accessibility of patient and provider education resources/tools in chronic disease management for patients and providers across Alberta. The SCN is looking to standardize *an evidence-based set of recommendations for obesity management* with a pan-SCN committee. This will occur as the SCN works on various clinical guideline/pathway initiatives, though the creation of educational resources for providers and patients. These resources are housed on existing portals for patients and health care providers (to be developed in the future through the AHS Clinical Care Pathway Initiative).

In addition, the Primary Care and Chronic Disease SCN are expected to be launched in 2014 and will work closely with the DON SCN. Primary and community care for obesity management is an area for additional support (e.g. transition from pediatric to adult services is not well addressed). The goal for this collaboration would be to *provide primary care with best prevention/management strategies for overweight and obese patients* which align with other chronic conditions (i.e. not separate set of recommendations for each condition).

[2] Institute of Health Economics. Bariatric treatments for adult obesity. Edmonton AB: Institute of Health Economics. 2012.

AHS Obesity Programs/Initiatives

There are numerous programs and initiatives run through AHS for obesity management and prevention. Provincially, in 2011 AHS announced the '*Alberta Health Services Obesity Initiative*', a 5 year plan that includes a range of services, from community-based programs to intensive medical intervention. Planned community-based services include school-based programs and new programming targeting adults who are ready to adopt a healthier lifestyle; as well as the establishment of a new specialty care clinic in Grande Prairie to serve northern populations. A number of these services/programs will be addressed below[3].

Community based programs offered through AHS for individuals with chronic conditions, including obesity, include: 'Better Choices, Better Health™'; and the 'Alberta Healthy Living Program'. There are also geographically specific programs, including the 'Weight Wise Adult Community Program' in Edmonton, as well as the Alberta Healthy Living Programs (AHLP) in the Calgary area (formerly 'Living Well with a Chronic Condition'); in the Lethbridge area (formerly 'Building Healthy Lifestyles'); in the Medicine Hat & Brooks area (formerly 'Living Healthy Program') as well as in the North Zone of Alberta.

'Better Choices, Better Health™': This program involves workshops, which are generally run on a weekly basis for two and a half hours over 6 weeks, that offer skill development for people with ongoing chronic health conditions, including: high blood pressure, asthma, heart disease, arthritis, obesity, chronic pain, and diabetes

'Alberta Healthy Living Program' (AHLP): The AHLP is a provincial model for community-based chronic disease management, which is aimed at a number of chronic diseases including: cardiovascular disease; respiratory diseases; diabetes; and obesity; and involves three parts: patient education; self-management support (through Better Choices, Better Health™ workshops –described below); and supervised exercises.

'Weight Wise Adult Community Program' - Edmonton: This program is intended to provide weight management education and support to patients (through Weight Wise Group Education Workshops; the Weight Wise Information Line and a Post Bariatric Surgery Support group) and health care professionals (through Weight Management Education/Training).

AHS Obesity Pediatric Programs/Initiatives

[3] Metabolic Clinics are also run for clients of AHS Mental Health and Addictions who require weight management and do not have a primary care physician; these clinics provide basic testing and counselling on healthy choices.

Outpatient diet counselling is available for pediatric patients requiring weight management. The province-wide service addresses multiple components for families including: activity levels, sleep, and screen time in addition to diet. Primary care physicians or nurse practitioners have access to a centralized referral system for either outpatient dietitian counselling services or speciality clinic services (Pediatric Centres for Weight and Health) for pediatric patients described below.

Infant, Toddler and Preschool Nutrition Classes: Within each zone, Nutrition Services public health dietitians offer nutrition classes to parents of infants and toddlers/preschoolers. Founded on the 'healthy feeding relationship' model by Dr. Ellyn Satter, these classes offer information to parents on a range of healthy eating issues including nutritional needs of children, healthy growth, infant feeding, establishing a positive feeding relationship between parent/caregiver and child, managing children's food dislikes, creating positive healthy eating environments, and promoting families eating together ('family meals' concept).

Healthy Eating Environments in Child Care: Led by Nutrition Services, this program aims to support child care centres in efforts to create healthy social and physical environments within their settings. This includes tools and resources around provision of healthy foods, raising healthy eaters, curriculum for providers, and steps to improve the environment.

AHS Speciality Clinics

Currently there are *five adult bariatric clinics in Alberta*, located in Grande Prairie, Edmonton, Red Deer, Calgary and Medicine Hat. The Grande Prairie clinic was established as part of the AHS Obesity Initiative, with the other four existing clinics receiving significant enhancements of multidisciplinary staff.

The five multidisciplinary speciality clinics listed above provide medical management for obesity and comorbidities. All of the clinics provide bariatric surgery as a treatment option, with Grande Prairie referring patients eligible for surgery to the Edmonton clinic. All patients referred to the specialty clinics go through a multi-disciplinary approach to treatment with surgery as an option. The referral criteria for these patients is the same as the National Institute for Health criteria (i.e. BMI ≥35 with one obesity-related comorbidity or BMI >40). Clinics aim to support primary care providers to manage patients with obesity, although some are more closely linked (e.g. Edmonton zone) than others.

Three Pediatric Centre for Weight and Health specialty clinics (2 in Edmonton and 1 in Calgary) offer a multidisciplinary, family focused approach to weight management for complex pediatric patients in Alberta. The Pediatric Centre for Weight and Health in Calgary at the Alberta Children's Hospital and

South Health Campus was established through the AHS Obesity Initiative. Bariatric surgery for pediatric patients is currently not available in Alberta.

Population, Public and Aboriginal Health Programs

There are several initiatives and programs offered by AHS Population and Public Health promoting healthy eating and active lifestyles through collaboration with many stakeholders both internal and external to AHS. A web-site (www.healthyeatingstartshere.ca) for external members has been established to promote key messages around healthy eating habits in multiple settings (childcare, schools, and work places). One of the key settings is workplace environment, where AHS aims to model policy on health eating environments at all AHS sites, including healthy food options for meetings, vending machines and cafeterias. In addition, the patient food services also follow the nutritional guidelines for implementing healthy food choices to residents of the AHS sites.

AHS Nutrition and Food Services provides evidence-based nutrition guidelines for providers to manage patients and clients throughout the lifecycle and for a range of concerns (e.g. allergies). The nutrition guidelines are available online (http://www.albertahealthservices.ca/3505.asp).

Maternal and Child population

One of the key guidelines available is the Healthy Pregnancy Weight Gain guideline (see below). In addition, direct client services are offered at the zone level (e.g. infant feeding classes or picky eaters' classes, noted above) as well as support through HealthLink with direct access to dietitians. Furthermore, standardized growth charts for infants and children are to be rolled-out across the province this year to promote consistent weight and height measurement at all check-up and vaccination appointments; with training offered on the interpretation of the growth charts to detect growth failure or obesity risk. Finally, the www.healthyeatingstartshere.ca web-site promotes healthy eating habits in multiple settings (childcare, schools, and recreational centres) with links to the Alberta Nutrition Guidelines for children and youth. The goal for this web-site is to provide information to the operators of these settings to assess and improve their healthy food options.

'Healthy Pregnancy Weight Gain Resources': AHS Population, Public and Aboriginal Health has developed a Healthy Pregnancy Weight Gain initiative. The goals of this initiative are to promote healthy eating, physical activity, and healthy pregnancy weight gain among pregnant women in Alberta; as well as to increase the capacity of healthcare providers to address weight gain, nutrition and physical activity. Working collaboratively with provincial stakeholders, tools and resources were developed for expectant women and healthcare providers. The evaluation of this initiative is entering the second phase. This site

provides resources for health professions on healthy pregnancy weight gain. Additionally, these resources are being evaluated from both a provider and patient perspective, using a pre- and post- test design.

Alberta Health Services is also collaborating on the ENRICH research study to improve maternal health outcomes by supporting healthy weight management during pregnancy and the postpartum period. Universal and selected strategies will be developed to meet the unique needs of women in Alberta.

'Healthy Parents, Healthy Children': Population, Public and Aboriginal Health recently developed and implemented a standardized provincial resource for expectant parents, parents of children from birth up to six years of age, and health professionals in Alberta. It provides information about pregnancy and birth, as well as provides information on helping young children to grow, learn and be healthy.

'Childhood Growth Measurement Protocol': As part of the childhood obesity prevention, a provincial *Childhood Growth Measurement Protocol* for public health settings was developed, implemented and evaluated. The goal was to ensure reliable and accurate measuring and weighing of infants and children. Standardized weighing and measuring contributes to more accurate surveillance data to evaluate the growth of children in Alberta. Equipment specifications and procurement were also included in this initiative in addition to standardized guidelines for calibration of equipment. Professional development resources (videos, posters) and sessions were provided to health care providers who would be weighing and measuring infants and children. Nutrition Services in AHS is currently working on developing a similar protocol for acute care settings

'Mind, Exercise, Nutrition … Do it! (MEND)': Alberta Health Services also conducted a pilot of the program 'Mind, Exercise, Nutrition … Do it! (MEND)'. This pilot was launched in 2010 as part of the Provincial Obesity Program. MEND is an evidence-informed, community-based program which emphasizes the prevention and early intervention of childhood obesity, and was developed for children aged 2 – 13 and their families. This program was piloted and adapted for Canada from 2010 to 2013, and was delivered by 19 community agencies across Alberta: 365 children and 365 parents/caregivers (730 participants' total) took part in 47 MEND programs. MEND now has operational funding to implement 40 programs per year in Alberta. The pilot was completed in 2013 and planning is now underway for MEND program implementation in AHS.

'Comprehensive School Health (CSH)': Alberta Health Services also has a school health initiative focused on promoting child and youth health through a Comprehensive School Health (CSH) approach. Aimed at students, teachers, staff and parents, the CSH is used to address a variety of health issues; however, the focus is on improving nutrition, physical activity and mental health. Health Promotion

Coordinators (HPCs) partner with school districts at a systems level to create healthy environments where children live, learn, and play.

AHS - Chronic Disease Management Research

'Clinical Effectiveness of Adult Bariatric Specialty Care Clinics in Alberta': This study looks at clinical effectiveness, changes in health-related quality of life and patient satisfaction associated with the management of obesity among both medically and surgically managed patients from the five bariatric specialty care centres in the province. Additionally, among the surgical patients, post-operative complications were to be assessed.

'Pediatric Bariatric Specialty Care Program Evaluation': This study includes all three Pediatric Centre for Weight and Health specialty clinics in Alberta, and explores the humanistic burden of obesity, changes in health-promoting behaviours and the clinical effectiveness of attending the clinics in pediatric patients with obesity.

'A Survey of General Practitioners in Alberta Regarding Current Perceptions, Practices and Needs for the Care of Children and Adolescents with Obesity': This study was used to assess the attitudes, practices, barriers and needs of primary care providers in Alberta, in terms of managing pediatric obesity[4].

Primary Care Networks

The Primary Care Networks provide a number of programs and initiatives related to weight management and dealing with chronic diseases (including Obesity). A number of PCNs utilize AHS programming, including 'Chronic Disease Management', 'Weight Wise'; and 'Better Choices, Better Health™'. Other PCNs offer other programming (and some of these programs utilize parts of AHS programs). Full details of the PCN programs are listed in APPENDIX B: Environmental Scan - PCN Detailed Summary.

Others – Programs

'Nstep' is a program that has been implemented Alberta, BC and Ontario. As with 'Ever Active School', this program focuses on school communities and promotes nutrition, healthy eating and activity education.

[4] McGuire N, Cullum J, Jelinski SE, Klein D, Rasquinha A, Ball GDC. Managing Pediatric Obesity in Alberta: A Cross-Sectional Study to Assess the Attitudes, Practices, Barriers, and Needs of Primary Care Physicians. Submitted to Canadian Family Physician (April 22, 2014)

Private Medical Clinics

Aside from programs and clinics run through AHS, there are also independent medical weight loss clinics, including the Calgary Weight Management Centre; Lefebre and Burke Weight Loss & Laser Centre; and the Dr. Bernstein Diet & Health Clinics. For more details see APPENDIX A: Environmental Scan - Alberta Detailed Summary.

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4. APPENDIX A: Environmental Scan - Alberta Detailed Summary

Name	What? (Program /Initiative, Clinic, Research Study)	Who?	Where?	Project Details	Sources
Healthy U	Program/ Initiative	Government of Alberta	Province-wide	'Healthy U social marketing campaign and website': www.healthyalberta.com. Healthy U was developed in 2002 as a long term public information and education initiative to support and encourage Albertans to lead healthier lifestyles by providing them with access to healthy eating and active living information and resources. Healthy U strategies have included media campaigns, resources for families and practitioners, community outreach through Healthy U Crews, and the healthyalberta.com website which shares healthy eating and active living information, resources and programs with Albertans and with healthy living practitioners in schools, workplaces and communities. The most recent Healthy U social marketing campaign has two main themes: "Be a Health Champion" (introduced in July 2012) encourages parents and caregivers of 0 to 5 year olds to become healthy living role models for their children, and the "The Healthy U 5&1 Experiment" (introduced in April 2013), helps parents and their 6 to 12 year old kids get a recommended five servings of vegetables and fruit and one hour of activity each day by packaging healthy eating and active living in a fun way that encourages kids to try new foods and activities. A 5&1 microsite and a mobile app (Android and iOS) allows users to sign up to try experiments, track their progress, and unlock awards http://5and1.healthyalberta.com	Government of Alberta. 2014. About Healthy U. http://www.healthyalberta.com/abouthealthyu.htm (Accessed January 18, 2014) Government of Alberta. 2014. Healthy U. http://healthyalberta.com/425.htm (Accessed March 16, 2014) Government of Alberta. 2014. Be a health champion for your family. http://www.healthyalberta.com/1386.htm (Accessed March 16, 2014) Government of Alberta. 2014. School Community Health Champions. http://www.healthyalberta.com/1286.htm (Accessed March 16, 2014) Government of Alberta. 2014. 5&1 Experiment. http://5and1.healthyalberta.com/ (Accessed March 16, 2014)

Alberta's Strategic Approach to Wellness	Program/ Initiative	Alberta Health	Province-wide	This is a concept/approach to wellness that will involve engagement with Albertans. Some of the outcomes of the framework include creating communities that support health and wellness, enhancing quality of life for all Albertans, preventing disease and injury, promoting health and wellness and prolonging life expectancy. Proposed strategies for attaining these outcomes include improving health knowledge, skills and behaviours; building healthier communities; improving the social and economic supports for wellness; strengthening primary prevention; and building healthy public policy.	Government of Alberta. 2014. Alberta's Strategic Approach to Wellness. Downloaded from: http://www.health.alberta.ca/documents/Strategic-Approach-Wellness-2013.pdf (accessed March, 23, 2014)
Communities ChooseWell	Program/ Initiative	Alberta Recreation and Parks Association (Supported by Alberta Health)	Province-wide	This is an initiative focusing on encouraging Albertans to partake in healthy eating and active living. As noted on their website: "The **goal** of Communities ChooseWell is to foster healthy Albertan citizens and communities through education, community capacity building and partnerships that support healthy eating, active living and social wellbeing". This initiative allows communities to register for free, and provides them with: the opportunity to apply for funding grants, a tool kit of available resources; webinars, newsletter and educational opportunities.	ARPA. 2010. Program: Communities Choosewell. http://arpaonline.ca/program/choosewell/ (Accessed February 25, 2014)
Alberta Centre for Active Living	Centre	Funded by Alberta Sport, Recreation, Parks & Wildlife Foundation & Alberta Tourism, Parks and Recreation. Affiliated with University of Alberta	Province-wide	The Centre of Active Living has numerous goals, including: advocating for physical activity; generating and disseminating knowledge about physical activity; and supporting and building capacity among practitioners and decision makers to increase activity levels. The Centre is involved in a number of projects including: conducting the Alberta Survey on Physical Activity; contributing articles to the Healthy U website; creation of the Physical Activity Counselling Toolkit, a resource for practitioners; a study of after-school programs in Alberta; the development of 'Home Support Exercise Program' training videos; evaluation of Sacred Circle Aboriginal Diabetes Initiative; and a community walking project.	Alberta Centre for Active Living. Who We Are. http://www.centre4activeliving.ca/about/facts-who-we-are.html (Accessed February 26, 2014) Alberta Centre for Active Living. Centre Projects. http://www.centre4activeliving.ca/our-work/projects.html (Accessed February 26, 2014).
Alberta Healthy School Community Wellness Fund	Program/ Initiative	Joint initiative between: Alberta Education, Alberta Health, Centre for Health Promotion Studies, and Alberta Coalition for	Province-wide	Established as part of the Healthy Weights Initiative, the Wellness Fund is aimed at addressing health and wellness for children within Alberta school communities. As noted on the website, "the objective of the Wellness Fund is to enhance the health and wellbeing of school-aged children and youth within Alberta school communities through support of school community projects, which address healthy eating, active living and positive social environments using a Comprehensive School Health Approach". To date, the fund has provided support to 239 projects (including Readiness projects, Curriculum projects, wellness projects and healthy relationships	University of Alberta. 2014. Alberta Healthy School Community Wellness Fund. http://www.wellnessfund.ualberta.ca/ (Accessed March 16, 2014) University of Alberta. 2014. Our Projects. http://www.wellnessfund.ualberta.ca/en/OurProjects.aspx

		Healthy School Communities		projects), across 1000 schools in 54 of Alberta's 61 school districts.	(Accessed March 16, 2014)
Ever Active Schools	Program/ Initiative	Project of the Health and Physical Education Council of the Alberta Teachers Association. Supported by Alberta Health; Alberta Education and Tourism, Parks and Recreation.	Province-wide	This is a provincial program that supports over 700 school communities in addressing and creating healthy environments and healthy living behaviours in Alberta's schools, by focusing on physical activity, healthy eating and positive mental health.	Ever Active Schools. 2009. About Ever Active Schools. http://www.everactive.org/about-us (Accessed February 25, 2014)
'NSTEP (Nutrition, Students, Teachers Exercising with Parents) EAT WALK LIVE	Program/ Initiative	Registered Charity	Alberta, BC and Ontario	This program has been utilized in Alberta, BC and Ontario. This program is targeted to promote nutrition, healthy eating and activity education to everyone within the school community.	'NSTEP. 2014. Nutrition Students Teachers Exercising With Parents. http://nstep.ca/ (Accessed February 26, 2014)
UWalk	Program/ Initiative	Developed at the University of Alberta (Faculty of Physical Education and Recreation); funded by the Government of Alberta	Province-wide	A provincial program that encourages people to be active, by allowing people register online (individually or as part of a group) to track minutes of activity or count their steps. As explained on their website: "UWALK is a free interactive website that can help motivate you and track your activities progress." (http://uwalk.ca/pages/faq/) UWalk pedometers are available for purchase from its website (www.uwalk.ca) and are available as loans from many library branches throughout Alberta.	UWalk. 2013. FAQ. http://uwalk.ca/pages/faq/ (Accessed February 14, 2014) UWalk. 2013. http://uwalk.ca/pages/about/ (Accessed February 14, 2014) UWalk. 2013. Library Loan Project. http://uwalk.ca/pages/resources/ (Accessed March 16, 2014)

Alberta Health Services (AHS) Obesity Initiative	Program/ Initiative	AHS	Province-wide	Announced in 2011, the Obesity Initiative is a 5 year plan that includes a range of services, from community-based programs to intensive medical intervention. Community-based services will include school-based programs and new programming targeting adults who are ready to adopt a healthier lifestyle and prevent future weight gain; and a new specialty care clinic will be established in Grande Prairie to serve northern populations.	Alberta Health Services. 2011, September 7. News Release - Alberta Health Services Launches obesity initiative. http://www.albertahealthservices.ca/5670.asp (Accessed January 18, 2014)
Weight Wise Adult Community Program	Program/ Initiative	AHS	Province-wide	Provides weight management education and support to patients and health care professionals. Patient services include: - Weight Wise Group Education Workshops - Weight Wise Information Line - Post Bariatric Surgery Support group Healthcare professional services include: - Weight Management Education/Training Community services include: - Education at community organization/site	Alberta Health Services. Weight Wise Adult Community Program. http://www.albertahealthservices.ca/services.asp?pid=service&rid=1060802 (accessed January 18, 2014)
Better Choices, Better Health™ (Self-Management Support)	Program/ Initiative	AHS	Province-wide	These are free workshops (Workshops are usually once a week for 2 1/2 hours for six weeks) that offer capacity building for people who have ongoing chronic health conditions, or are at risk of developing a condition like: high blood pressure, asthma, heart disease, arthritis, obesity, chronic pain, diabetes and others.	Alberta Health Services. Better Choices, Better Health™. http://www.albertahealthservices.ca/services.asp?pid=service&rid=1054851 (Accessed January 18, 2014)
Alberta Healthy Living Program (AHLP)	Program/ Initiative	AHS	Province-wide	The AHLP is a provincial model, community-based chronic disease management program that is aimed at a number of chronic diseases including: cardiovascular disease; respiratory diseases; diabetes; and obesity. The program involves three parts: 1. patient education (disease-specific and general health and lifestyle topics), 2. Self-management support (including through Better Choices, Better Health™ workshops) and 3. Supervised exercises (facility- or home-based).	Alberta Health Services. Alberta Healthy Living Program. http://www.albertahealthservices.ca/8930.asp (Accessed January 19, 2014)

Alberta Healthy Living Program – known as Living Well with a Chronic Condition	Program/ Initiative	AHS	Calgary and area	A program for people with diabetes, high blood pressure, heart disease, chronic lung disease, chronic pain and other long term illnesses. There are three parts to this program: -supervised exercise classes -education classes -self management workshop (Better Choices, Better Health™).	Alberta Health Services. Living Well with a Chronic Condition. http://www.albertahealthservices.ca/services.asp?pid=service&rid=1005671 (Accessed January 18, 2014)
Alberta Healthy Living Program (formerly: Building Healthy Lifestyles)	Program /Initiative	AHS	Lethbridge and area	Helps people assess their eating habits and learn about healthy eating, through One-on-one counselling or classes.	Alberta Health Services. Nutrition Counselling (Dietitian) - Building Healthy Lifestyles. http://www.albertahealthservices.ca/services.asp?pid=service&rid=3721 (Accessed January 18, 2014)
Alberta Healthy Living Program (formerly: Living Healthy Program)	Program/ Initiative	AHS	Medicine Hat and Brooks area	The Alberta Healthy Living Program (AHLP) includes services for: cardiac rehabilitation; adult and pediatric diabetes education and management; heart function clinic; TIA / Stroke prevention education; chronic disease self-management workshops (Better Choices, Better Health™); community & home exercise programs and COPD rehabilitation. LHP accepts referrals for clients with multiple co-morbidities (e.g.) hypertension, dyslipidemia, obesity, COPD, renal disease, diabetes.	Alberta Health Services. Living Healthy Program/Cardiac Rehabilitation. http://www.albertahealthservices.ca/services.asp?pid=service&rid=3839 (Accessed January 19, 2014)
Healthy Pregnancy Weight Gain resources	Resources	AHS	Province-wide	This site provides resources for health professions on healthy pregnancy weight gain. The resources for healthcare providers and expectant women can be found at www.albertahealthservices.ca/6073.asp and include: Background document for health professionals; Key actions and messages for health professionals; Singleton weight gain graphs (underweight, healthy, overweight, obese); Healthy Eating and Active Living for Pregnancy (Revised in collaboration with Alberta Health); Nutrition Counselling for Healthy Pregnancy Weight Gain; Nutrition Guidelines for Primary Care: Considerations Across the Lifespan; APPEL online learning module for health professionals (Developed in collaboration with the Alberta Perinatal Health Program); and PARmed-X for Pregnancy (developed by the Canadian Society for Exercise Physiology)	Alberta Health Services. Healthy Pregnancy Weight Gain Resources. http://www.albertahealthservices.ca/7501.asp (Accessed February 26, 2014) Alberta Health Services. Pregnancy and Early Childhood; For Professionals. www.albertahealthservices.ca/6073.asp (Accessed March 16, 2014)

ENRICH Program	Research Study	University of Alberta; Funded by Alberta Innovates Health Solutions	Province-wide	Alberta Health Services is also collaborating on the ENRICH research study to improve maternal health outcomes by supporting healthy weight management during pregnancy and the postpartum period. Universal and selected strategies will be developed to meet the unique needs of women in Alberta. "The goals of this Program are to: 1) advance knowledge regarding food and nutrient intake and energy expenditure in pregnancy and postpartum; 2) understand perceptions and experiences of diverse groups of pregnant and postpartum women pertaining to diet, body weight and health; 3) identify needs, gaps and opportunities in health service delivery systems that may be harnessed to promote optimal dietary intake and appropriate weight management strategies; and 4) collaborate with knowledge users, to develop and evaluate strategies aimed at promoting optimal dietary intake and appropriate weight management."	University of Alberta. 2014. Rhonda Bell, Academic Profile. http://www.afns.ualberta.ca/StaffProfiles/AcademicProfiles/Bell.aspx (Accessed March 16, 2014)
Healthy Child and Youth Development – Comprehensive School Heath		AHS	Province-wide	The Healthy Child and Youth Development team is responsible for the planning and coordinating provincial initiatives for children ages 6-18. The comprehensive School Healthy approach is aimed at students, teachers, staff and parents. This is an internationally recognized and evidence-based approach for building healthier communities. This program is based on four pillars: social and physical environments; teaching and learning; healthy school policy; and partnerships and services. The CSH is used to address a variety of health issues; however, the focus is on improving nutrition, physical activity and mental health. Health Promotion Coordinators (HPCs) partner with school districts at a systems level to create healthy environments where children live, learn, and play. The work has focused on education and awareness, healthy environments, health-promoting policies, and adoption of the CSH approach. In the 2012-13 school year, HPCs partnered at a systems level with 90% of the school jurisdictions that they were assigned to (47.52) equalling almost 500,000 students.	Alberta Health Services. Healthy Child and Youth Development. http://www.albertahealthservices.ca/hcyd.asp (Accessed February 26, 2014) Alberta Health Services. 2013. Comprehensive School Health: An approach for building healthy school communities. Downloaded from: http://www.albertahealthservices.ca/SchoolsTeachers/if-sch-csh-an-approach.pdf (Accessed February 26, 2014).
Healthy Parents Healthy Children	Program/ Initiative	AHS	Province-wide	A site intended to deliver information for expecting parents from health experts across Alberta. It provides information about pregnancy and birth, as well as provides information on helping young children to grow, learn and be healthy. A standardized provincial resource for expectant parents, parents, of children from birth up to six years of age, and health professionals in Alberta. A Health Product Development Model was utilized to complete this work. Phases included product analysis, product development, product implementation, and product quality improvement and enhancements. Process evaluation has been ongoing and evaluation of the resources will occur over	Alberta Health Services. What You Will Find On Healthy Parents, Healthy Children. http://www.healthyparentshealthychildren.ca/about-this-resource/what-you-will-find-on-healthy-parents-healthy-children/ (Accessed February 26, 2014)

				the next year. The resources provide comprehensive health information on pregnancy and birth, as well as provide information on helping young children to grow, learn and be healthy. The resources are available both electronically and in print format: Healthy Parents, Healthy Children: Pregnancy and Birth (print resource); Healthy Parents, Healthy Children: The Early Years (print resource); Healthy Parents, Healthy Children at www.healthyparentshealthychildren.ca The electronic resource is available on any smart phone, tablet or computer and contains an e-book, interactive features, and social media. Public service announcements and video vignettes will be available in the spring of 2014.	
Clinical Effectiveness of Adult Bariatric Specialty Care Clinics in Alberta	Research	AHS, Chronic Disease Management Research	The 5 Alberta Bariatric Specialty Care Centres	Study Objective: To determine the clinical effectiveness, changes in health-related quality of life (pending) and patient satisfaction (pending) associated with management of obesity at the bariatric specialty care centres in Alberta. Among the surgical patients, post-operative complications were be assessed. This study includes both medically and surgically managed patients from all 5 bariatric specialty care centres in the province).	Personal Communication with the Chronic Disease Management Research department (Alberta Health Services), March 10, 2014
Pediatric Bariatric Specialty Care Program Evaluation	Research	AHS, Chronic Disease Management Research	The 3 Pediatric Centre for Weight & Health Specialty clinics in Alberta	To assess the humanistic burden of obesity, changes in health-promoting behaviours and clinical effectiveness of attending the Pediatric Centre for Weight & Health (PCWH) among pediatric patients with obesity. The study includes the 3 PCWHs in Alberta.	Personal Communication with the Chronic Disease Management Research department (Alberta Health Services), March 10, 2014
A Survey of General Practitioners in Alberta Regarding Current Perceptions, Practices and Needs for the Care of Children and Adolescents with Obesity	Research	AHS, Chronic Disease Management Research		To assess the attitudes, practices, barriers and needs of Alberta-based primary care providers with respect to managing pediatric obesity.	Personal Communication with the Chronic Disease Management Research department (Alberta Health Services), March 10, 2014
Healthy Alberta Communities (HAC) Project http://healthyalbertacommunities.com/	Program/ Initiative	Affiliated with the Centre for Health Promotion Studies with the School of Public Health at the University of Alberta	4 Communities: Bonnyville, St. Paul, Norwood/North Central Edmonton, and Medicine Hat (selected by Alberta Health and Wellness)	"The HAC project is a comprehensive community-based intervention for obesity prevention in 4 distinct communities in Alberta: Medicine Hat, St. Paul, Bonnyville, and the neighborhoods comprising North Central Edmonton. The main objective of the intervention is to reduce risk factors for development of chronic diseases in these communities by fostering healthy lifestyles among individuals, and increasing capacity of each community to promote health and well-being through coordinated action. The data collection, which consisted of self-reports and physical measurements, occurred at 2 time-points, in 2006 (pre-intervention) and then in 2009 (post intervention), and focused on gathering information to address community environment-level risk factors for obesity." (Sagna, 2013) "To assess overall outcomes, and remaining mindful of principles of	Sagna, M.L.; Schopflocher, D.; Raine, K. et al. 2013. Adjusting Divergences between Self-reported and Measured Height and Weight in an Adult Canadian Population. Am J Health Behav;37(6):841-850 Raine, K.D.; Plotnikoff, R.; Schopflocher, D.; et al (2013). Healthy Alberta Communities:

				community-based population health interventions, we conceptualized the intervention as the collective efforts of the four unique communities in defining and addressing specific community priorities relevant to environmental and social determinants of obesity and chronic disease risk. While each community worked to develop community-specific projects relevant to their assessed needs, the communities also learned from each other. By being a part of the larger Healthy Alberta Communities project, communities were provided with common learning opportunities and templates to work through the process of intervention development, they shared experiences (successes and challenges) through regular teleconferences and semi-annual in person team meetings, and they had ongoing access to intervention development and evaluation expertise through the HAC central team." (Raine, 2013)	Impact of a three-year community-based obesity and chronic disease prevention intervention. Preventive Medicine, 57: 955–962 Healthy Alberta Communities. 2010. Home. http://healthyalbertacommunities.com/ (Accessed January 18, 2014)
Alberta Project Promoting active Living and healthy Eating (APPLE Schools)	Program/ Initiative; Research	The program was operated by the School of Public Health at the University of Alberta until September 1, 2013. Ongoing management now occurs independent of the University of Alberta.	40 Alberta schools	APPLE Schools was started in 2008 to improve healthy living habits of students; to increase knowledge about healthy living for parents, students, teachers and the school community; to apply and sustain Comprehensive School Health in school communities; and to sustain capacity for healthy environments in school communities.	APPLE Schools. Alberta Project Promoting active Living & healthy Eating. http://www.appleschools.ca/ (Accessed January 19, 2014)

Mind, Exercise, Nutrition … Do it! (MEND) Program	Program/ Initiative; Research	AHS	During the period from 2010 to 2013, 730 participants (365 children and 365 parents/caregivers) took part in 47 MEND programs, delivered by 19 community agencies across Alberta.	Launched in 2010 as part of the Provincial Obesity Program, MEND is a evidence-informed, and community-based program that emphasises the prevention and early intervention of childhood obesity, and was aimed for children aged 2 – 13 and their families. The collection of MEND programs includes: • MEND 2–4: a healthy lifestyle prevention program for children ages two to four of any weight, 10 weeks (10 sessions) long, at 90 minutes per week; • MEND 5–7: a healthy lifestyle prevention and early intervention program for children ages five to seven years with a body mass index (BMI) over the 85th percentile, 10 weeks (10 sessions) long, at 105 minutes per week; • MEND 7–13: an early intervention program for children ages seven to 13 years with a BMI over the 85th percentile, 10 weeks (20 sessions) long, at four hours per week; and • MEND World: to support MEND 7–13 graduates for two years after the program, with fun online games, activities, and free magazines.	Bandali, F. 2013. Mind, Exercise, Nutrition… Do it! (MEND). http://innovation.healthcouncilcanada.ca/innovation-practice/mind-exercise-nutrition-%E2%80%A6-do-it-mend# (Accessed January 18, 2014) Bandali, F. 2012. Alberta Health Services childhood obesity prevention programs [Presentation Notes]. Retrieved from http://www.micyrn.ca/PDF/Webinar4slidesBandali.pdf
Alberta population-based prospective evaluation of the quality of life outcomes and economic impact of bariatric surgery (APPLES) study	Research Study			"APPLES is a prospective observational study that aims to address current knowledge gaps by examining the impact of wait times for bariatric care in a surgery eligible population and by generating prospective, population-based Canadian bariatric clinical, economic and humanistic outcome data." (Padwal, 2010) "In this prospective cohort study, consecutive and consenting patients enrolled in the Weight Wise Regional Obesity Program and without a contraindication to surgery will be enrolled. The minimum enrolment sample size will include 150 surgical patients, 200 patients receiving intensive medical therapy and 150 patients wait-listed to enter the clinic" (Padwal 2010)	Padwal et al. 2010. The Alberta population-based prospective evaluation of the quality of life outcomes and economic impact of bariatric surgery (APPLES) study: background, design and rationale. BMC Health Services Research, 10:284
Outcome Assessment to Optimize Patient Selection for Bariatric Surgery (OASIS)	Research Study	University of Alberta		“The objective of this study is to identify factors that predict a higher chance of obesity-related health problems or death. Another objective is to assess how patients feel about triaging for surgery. A final objective is to examine if operating on certain types of patients will minimize costs for the system overall. These factors can then be used by health care providers and administrators to help determine if certain patients should receive surgery ahead of others. This information will be immediately used to help streamline access to surgery within the Edmonton Weight Wise program, a large regional obesity program that includes one of Canada's largest surgical programs (100+ operations per year).”	Canadian Research Information System. 2012. Outcome Assessment to Optimize Patient Selection for Bariatric Surgery (OASIS). http://webapps.cihr-irsc.gc.ca/cris/detail_e?pResearchId=4282262&p_version=CRIS&p_language=E&p_session_id=1333597 (Accessed February 26, 2014)

The evaluating self-management and educational support in severely obese patients awaiting multidisciplinary bariatric care (EVOLUTION) trial	Research Study	University of Alberta		"A supportive, educational intervention (with in-person and web-based versions) designed to enhance the self-management skills of patients wait-listed for multidisciplinary bariatric medical and surgical care has been variably implemented across Alberta, Canada. However, its effectiveness has not been evaluated. Our objectives were: 1. To determine if this program improves clinical and humanistic outcomes and is cost-effective compared to a control intervention; and 2. To compare the effectiveness and cost-effectiveness of in-person group-based versus web-based care." (Padwal 2013, Background Section)	Padwal, R; Sharma, A;, et al. 2013. The evaluating self-management and educational support in severely obese patients awaiting multidisciplinary bariatric care (EVOLUTION) trial: Rationale and design. *BMC Health Services Research* 2013, **13**:321
Promoting Optimal Weights through Ecological Research (POWER)	Research Study	Led by Dr. Kim Raine at the Centre for Health Promotion Studies, School of Public Health, at the University of Alberta		The POWER study is examining the social and environmental determinants of obesity	POWER. 2010. Welcome. http://www.ualberta.ca/~powerlab/index.html (Accessed January 19, 2014)
Raising healthy Eating and Active Living Kids Alberta (REAL Kids Alberta) evaluation	Research Study	A joint project of the School of Public Health, University of Alberta and Alberta Health		REAL Kids Alberta has collected data provincially since 2008 from Grade 5 classrooms. The study involves data collection to track provincial trends, and the evaluation of programs aimed at improving the health of students.	REAL Kids Alberta. REAL Kids Alberta. http://www.realkidsalberta.ca/ (Accessed January 19, 2014) REAL Kids Alberta. Overview. http://www.realkidsalberta.ca/overview (Accessed January 19, 2014)

Pediatric Weight Management: Advancing the Evidence in Family-Centered Care	Research Study	University of Alberta – Geoff Ball; Funded by Emerging Research Team Grant from the Faculty of Medicine and Dentistry, Alberta Health Services and WCHRI		"The research team will be conducting related four studies that will lay the groundwork for the first national study for treating childhood obesity. This multi-centre study is scheduled to begin in 2012."	Women & Children's Health Research Institute. 2009. Parents with Overweight Kids. http://wchri.srv.ualberta.ca/node/98 (Accessed February 26, 2014) Dr. Geoff DC Ball. 2009. FOMD – AHS Team Grant. http://www.ualberta.ca/~gdball/fomd.html (Accessed February 26, 2014)
Fighting Obesity with Technology (pilot)	Research Study	AHS/ University of Alberta/Edmonton Oliver PCN; Funded by Canadian Institutes of Health Research and Alberta Innovates – Health Solutions		"A new pilot project will engage parents through the use of iPads to learn more about supporting a healthy lifestyle for their child. While waiting for their doctor's appointment, parents visiting clinics in the Edmonton Oliver Primary Care Network will have the opportunity to take a 10- to 15-minute survey. If parents consent, their child's weight and height will be entered into the iPad application to provide customized feedback." A key of this initiative will be in the ability to provide early interventions in children who are overweight (but not obese), which will help minimize the need for more intensive treatments in the long term.	Alberta Health Services. Fighting Obesity with Technology. http://www.albertahealthservices.ca/7033.asp (Accessed February 26, 2014)
One Size Does Not Fit All: Partnering With Parents and Clinicians to 'Set the Agenda' for Pediatric Weight Management	Research Study (2008-2010)	University of Alberta – Geoff Ball; Funded by Women's and Children's Health Research Institute		This study was designed to develop 'Agenda Cards' which would improve communication between parents of overweight children and clinicians, and are intended to help parents 'set the agenda'. Phase 1 involved focus groups to generate content for the agenda cards; while phase 2 would involve reviewing prototypes of the cards.	Dr. Geoff DC Ball. 2009. http://www.ualberta.ca/~gdball/research.html (Accessed February 26, 2014)
The PAC Study: Using Parents as Agents of Change (PAC) to Improve Health Outcomes of Obese Children	Research Study (2009-2012)	University of Alberta – Geoff Ball; Funded by Canadian Diabetes		A clinical trial to explore two 16-session, group based weight management interventions (for parents of obese children) – the study will look at how these interventions impact: body composition, risk factors for Type 2 diabetes, lifestyle behaviours and family functioning. In addition, once the interventions are completed, family-based interviews will be conducted to explore the challenges associated with maintaining a healthy lifestyle change.	Dr. Geoff DC Ball. 2009. http://www.ualberta.ca/~gdball/research.html (Accessed February 26, 2014)

		Association (pending) AHS/ Faculty of Medicine and Dentistry Emerging Team Grants Competition (pending)			
Identifying Factors Influencing Healthy Lifestyles in First Nations Children: Community-Based, Formative Assessment	Research Study (2006-2009)	University of Alberta – Geoff Ball; Funded by: Alberta Centre for Child, Family and Community Research		This study involved a community-based, formative assessment of a First Nations community in Alberta. This study looked at indicators of obesity and contextual issues that were related to the development of Type 2 diabetes. This information was intended to assist in the development and evaluation of a community-based health promotion strategy.	Dr. Geoff DC Ball. 2009. http://www.ualberta.ca/~gdball/research.html (Accessed February 26, 2014)
The HIP Study: Healthy Initiative Program to Promote Weight Management for Overweight Teens	Research Study (2005-2008)	University of Alberta – Geoff Ball; Funded by Alberta Heritage Foundation for Medical Research		This study compared three interventions that were developed for overweight teens – healthy initiatives program; youth lifestyle program; and a wait-list control group.	Dr. Geoff DC Ball. 2009. http://www.ualberta.ca/~gdball/research.html (Accessed February 26, 2014)
POWER-UP!— Policy Opportunity Windows: Enhancing Research Uptake in Practice	Research Study	University of Alberta - Kim Raine and Candace Nykiforuk; Funded by Coalitions Linking Action & Science for Prevention (CLASP) program of the Canadian Partnership		This study involves the collaboration of various individuals from Alberta (researchers), Quebec (practitioners) and the Northwest Territories (policy-makers) for the development, implementation and evaluation of obesity related policies. As part of this, a list of successful policies will be developed and shared.	Lauder, Andrea. April 9, 2014. *Funding equips researchers to tackle drivers of obesity.* University of Alberta, School of Public Health, News. *http://publichealth.ualberta.ca/School%20of%20Public%20Health%20News/2014/April/funding-equips-researchers-to-tackle-drivers-of-obesity.aspx?utm_campaign=4/9/2014&utm_source=newsletter&utm_medium=newsletter&utm_content=lnk-obesity*

		Against Cancer			*(Accessed April 9, 2014)*
Integrating eating disorder and obesity prevention: A study of school-based activities aimed at shared risk factors	Research Study	University of Calgary - Werklund School of Education	Calgary area	This study took place between 2009-2012, involving students (junior high school), teachers and parents in the Calgary area. The purpose of this study was to explore whether eating disorder and obesity prevention could be integrated in a school setting through interventions.	Personal Communication with Meaghan Brierley, Food Marketing, Policy & Children's Health, Calgary Institute for the Humanities, University of Calgary (May 9, 2014)
Weight Bias and Primary Health Care: Creating a Provincial Research Strategy	Research Study	University of Calgary - Werklund School of Education		This study involves the U of C, U of A and AHS, and took place June 2013-May 2014. The study has two objectives: First, to understand and review the health research landscape concerning weight bias; and secondly, to build provincial collaborations (between researchers and decision makers).	Personal Communication with Meaghan Brierley, Food Marketing, Policy & Children's Health, Calgary Institute for the Humanities, University of Calgary (May 9, 2014)
Psychosocial aspects of body weight	Research Study	University of Calgary - Werklund School of Education, Dept. of Psychology and Community Health Sciences).		October 2013-September 2015	Personal Communication with Meaghan Brierley, Food Marketing, Policy & Children's Health, Calgary Institute for the Humanities, University of Calgary (May 9, 2014)

Media Literacy & Food marketing program		Food Marketing, Policy and Children's Health Canada Research Chair, University of Calgary			Personal Communication with Meaghan Brierley, Food Marketing, Policy & Children's Health, Calgary Institute for the Humanities, University of Calgary (May 9, 2014)
Edmonton Adult Bariatric Specialty Clinic/Edmonton Weight Wise program	Program/ Initiative; Clinic	Edmonton Zone of Alberta Health Services (AHS)	Based out of the Royal Alexandra Hospital. Approximately 1 million residents within greater Edmonton and an additional 600 000 residents in surrounding regions (Padwal, 2010)	"The Edmonton Weight Wise program is a comprehensive initiative established in 2005 designed to deliver integrated, patient-focused, evidence-based care to the Edmonton Zone of Alberta Health Services (AHS)." (Padwal 2010) "Weight Wise includes a central, region-wide single-point-of-access referral system; community education and weight management sessions; and adult and pediatric bariatric specialty clinics." (Padwal 2010) This clinic provides tertiary medical, psychological, and surgical interventions. Treatment plans may include: behaviour modification; counseling for nutrition, physical activity, and mental health; drug treatment and/or bariatric surgery; or transitioning the patient back to their family physician with recommendations from the Edmonton Adult Bariatric Specialty Clinic. In addition to treatment plans, patients are encouraged to utilize Self-Management Resources including: a patient support and information phone line; weight wise educational workshops; or the Better Choices Better Health Chronic Disease Self-Management Program. Patients must be 17+, with BMI ≥ 35 kg/m2 and one obesity-related comorbidity or BMI ≥ 40 kg/m2	Padwal et al. 2010. The Alberta population-based prospective evaluation of the quality of life outcomes and economic impact of bariatric surgery (APPLES) study: background, design and rationale. BMC Health Services Research, 10:284 Alberta Health Services. Edmoton Adult Bariatric Specialty Clinic. http://www.albertahealthservices.ca/services.asp?pid=service&rid=1008784 (Accessed January 18, 2014)
Weight Management Program - Richmond Road Diagnostic and Treatment Centre	Program/ Initiative; Clinic	AHS	Calgary	Services and treatment options include: classes; individualized dietary and lifestyle counseling; supervised exercise; psychological counseling; medications; laparascopic gastric banding surgery and sleeve surgery. Clients must: be aged 18+; have BMI ≥ 35 kg/m2, with an obesity-related comorbidity or BMI ≥ 40 kg/m2.	Alberta Health Services. Weight Management Program - Richmond Road Diagnostic and Treatment Centre. http://www.albertahealthservices.ca/services.asp?pid=saf&rid=1042102 (Accessed January 18, 2014)

Bariatric Specialty Clinic	Clinic	AHS	Red Deer	The clinic provides patients with intense lifestyle medical management as well surgical procedures (Including: sleeve gastrectomy, gastric bypass and revisional care). Eligibility requirements are: Aged 18+, with a BMI ≥ 35 kg/m2 with two obesity-related comorbidities, or BMI ≥ 40 kg/m2.	Alberta Health Services. Bariatric Specialty Clinic. http://www.albertahealthservices.ca/services.asp?pid=service&rid=1044655 (Accessed January 18, 2014)
Bariatric Specialty Clinic	Clinic	AHS	Medicine Hat	This clinic assesses people with obesity, and develops personal programs including meal planning, exercise programs, or ways to do day-to-day activities.	Alberta Health Services. Bariatric Specialty Clinic. http://www.albertahealthservices.ca/services.asp?pid=service&rid=1060376 (Accessed January 19, 2014)
Calgary Weight Management Centre (http://www.cwmc.ca/)	Clinic	Private	Calgary	CWMC is a patient-focused weight management facility, offering a basic 12-week program "Healthy Living Healthy Weight" (covered by Alberta Health and Wellness) and a Comprehensive treatment program, which is a personalized plan that involves ongoing monitoring and support from a team made up of a medical doctor, psychologist, dietitian and exercise physiologist.	Calgary Weight Management Clinic. Programs. http://www.cwmc.ca/programs (Accessed January 19, 2014)
Lefebre and Burke Weight Loss & Laser Centre (http://www.calgaryweightlossclinic.com/)	Clinic	Private	Calgary	Weight Loss Program - consists of weekly handout materials, weight management books and CD's and a computer program called the "Mental Weight" (MW) personality assessment. First Visit: Initial free consultation by Dr. Burke, Dr. Lefebre or Dr. Safran; Detailed bariatric medical history taken and a physical examination performed (including height, weight, waist measurement, Body Mass Index and body fat analysis); Laboratory tests and an electrocardiogram (EKG) ordered as needed; diet is selected. Second Visit: Review of the first week's diet experience and modifications of the diet made if needed; Motivational counseling by both a counsellor and doctor and motivational material handed out. The doctor will review health improvement, reduce or eliminate medications as weight loss progresses and review lab test and EKG results. Subsequent Weekly Visits: Patients receive on going one on one counselling by a counsellor or doctor and weekly motivational material handouts.	Lefebre and Burke Weight Loss & Laster Centre. 2014. Weight Loss Program. http://www.calgaryweightlossclinic.com/program-overview/ (Accessed January 19, 2014)
Dr. Bernstein Diet & Health Clinics	Clinic	Private	Alberta	Private weight loss clinic	(http://www.drbdiet.com)

5. APPENDIX B: Environmental Scan - PCN Detailed Summary

Project	Who?	Project Details	Sources
Leduc Obesity Clinic	Leduc Beaumont Devon Primary Care Network http://www.lbdpcn.com/	As part of the PCNs S.M.I.L.E Healthcare Program, the Leduc Obesity Clinic was designed as a new treatment pathway for obesity management. Clinics run on a weekly basis and include a team made up of a medical doctor, registered dietitian, exercise specialist, registered nurse, registered pharmacist and clinical psychologist. These clinics are open to patients between the ages of 18 and 70, with a BMI greater than 30 with risk factors/co-morbidities, who are willing to commit to 1 year of attendance and who have a willingness to work on weight issues.	Leduc Beaumont Devon PCN. 2013. Leduc Obesity Clinic. http://www.lbdpcn.com/Services/Pages/LeducObesityClinic.aspx (Accessed January 18, 2014)
Weight Management and Nutrition Classes	WestView Primary Care Network http://www.westviewpcn.ca/	6-session nutrition classes	Westview PCN. 2014. Weight Management and Nutrition Classes. http://www.westviewpcn.ca/admin/contentx/default.cfm?h=10696&PageId=10986 (Accessed January 18, 2014)
Obesity Management Training	Camrose Primary Care Network http://www.camrosepcn.com/	Held in 2013, this was a workshop on the 5A's Of Obesity Management for health care providers. The learning objectives were to: - increase awareness of the fundamental principles of obesity management - Recognize obesity as a chronic disease - Understand the key elements of obesity assessment and counseling - Apply the 5As intervention framework to their patients	Camrose PCN. Obesity Management Training. http://www.camrosepcn.com/blog/obesity-management-training (Accessed January 18, 2014)

On Your Weigh' Weight Management Program	Camrose Primary Care Network http://www.camrosepcn.com/	The goals of these program are to help patients in creating a healthier lifestyle and learning strategies to better manage their weight. Interested patients attend a "Getting Started: Planning for Success" workshop facilitated by a Registered Nurse, attend Lifestyle Change: A Tool Kit For Success session, and complete an intake package. The healthcare team includes a PCN Physician and Registered Nurse; and may also include a Exercise Specialist; Registered Dietitian; Pharmacist; Registered Psychiatric Nurse; Social Worker; Community resources and supports. Additionally, this program includes a support group (open to all participants in the program) and a weekly drop-in walking group.	Camrose PCN. On Your Weigh. http://www.camrosepcn.com/on-your-weigh (Accessed January 18, 2014)
A.C.E.S. Healthy Living Program	Alberta Heartland PCN http://www.albertaheartlandpcn.com/	The A.C.E.S Healthy Living Program is led by health professionals and is designed to help patients in setting achievable goals that will contribute to a healthier lifestyle; creating awareness around eating behaviours; learning how and why we should food journal; adding, or increasing physical activity and addressing the barriers to being active; and identifying how stress management and emotional health contribute to success.	Alberta Heartland PCN. 2013. A.C.E.S. Healthy Living Program. http://www.albertaheartlandpcn.com/Services/WeightManagement/Pages/default.aspx (Accessed January 18, 2014)
Weight Wise Program	Aspen PCN http://www.aspenpcn.ca/	The weight wise program includes Nine 2.5 hour Modules facilitated by a Registered Dietitian and/or a Registered Nurse from AHS. Module One - Getting Started: Planning for Success Module Two - Lifestyle Change: A Toolkit for Success Module Three - Finding Balance: The Role of Calories in Weight Management Module Four - Managing Hunger and Appetite Module Five - Moving Matters – Including Physical Activity in Your Day Module Six - Nutrition: The Truth About What Works in Weight Management Module Seven - Nutrition: I Know I Should Eat Healthy, But How? Module Eight - Nutrition: Eating Away From Home and During Special Occasions Modules Nine – Minding Stress: Effectively Reduce and Manage the Stress in Your Life (Two Consecutive Sessions)	Aspen PCN. 2013. Weight Management. http://www.aspenpcn.ca/Services/chronicdiseasemanagement/Pages/WeightManagement.aspx (Accessed January 18, 2014)

Active Living Program	Bow Valley PCN http://www.bowvalleypcn.ca/	As part of this program, family doctors work with a Physical Therapist and Registered Nurses to provide an active living program based at the Canmore Hospital (also offered in Banff location too). This program is for people with chronic diseases and for local residents who have risks factors such high cholesterol, high blood pressure and / or are overweight.	Bow Valley PCN. 2013. Active Living Program. http://www.bowvalleypcn.ca/Services/Pages/CardiacRehabilitationProgram.aspx (Accessed January 18, 2014)
Weight Management Program	Edmonton North PCN https://www.enpcn.com	This is a patient-centered approach, during which patients participate in a series of small facilitated group discussions with peers and healthcare professionals. "Patients will start their Weight Management journey with two introductory classes, followed by a class related to a goal they have set in the previous class and then an individual initial meeting with a healthcare professional. At that point a number of small groups are available including: Structured Exercise, Elastic Resistance, Health Walking, Eating Out, Hunger and Appetite, Label Reading, Grocery Shopping Tour, Meal Planning and Portions and Serving Sizes, Craving Change (emotional eating) and Cognitive Behavioral Therapy for Weight Management."	Edmonton North PCN. 2014. Weight Management Program. https://www.enpcn.com/index.php/patient-services/weight-management-program (Accessed January 19, 2014)
Weight Loss	Kalyna Country PCN http://www.kalynapcn.ca	The weight loss program, provided by a clinic nurse or dietician, helps participants to make healthy lifestyle choices, starting with their mindset, nutrition and activity. The PCN is proud to co-host Weight Wise Clinics at many locations in conjunction with Alberta Health Services. Weight Wise programs are designed to give patients and health care professionals weight management support and education. Topics of education and discussion in Weight Wise can include: Eating habits and patterns, Nutrition, Stress, Emotional eating, Setting goals & Activity. The focus of any weight loss program or service of the PCN is to ensure that patients have access the information and resources they need to maintain a healthy weight and live a healthy life.	Kalyna Country PCN. 2014. http://www.kalynapcn.ca/Services/Pages/default.aspx (Accessed June 25, 2014)
Healthy Weight, Healthy You	Lloydminister PCN http://www.lloydpcn.ca	Upon referral to the PCN Program, nursing and dietitian staff provide clients with individual assessment and counseling, follow-up and referrals necessary. The program also works with AHS in the delivery of the Weight Wise™ Program. Patients have two options in the Healthy Weight Program: bariatric surgery or lifestyle change. Lifestyle Change (working with RN & Dietitian) involves being seem in the clinic 2-4 times per month; an initial head to toe assessment; setting SMART goals; lifestyle journaling assessment; Canada's food guide; incorporating physical activity and using a pedometer; and managing stress.	Lloydminster PCN. 2013. Healthy Weight, Healthy You. http://www.lloydpcn.ca/Services/healthyweight/Pages/default.aspx (Accessed January 19, 2014)

Edson Obesity Clinic	McLeod River PCN http://mrpcn.ca	This clinic assists individuals who have or are at risk for health problems due to morbid obesity. The goal is to lose at least 5 to 10% of their weight and keep the weight off. Patients are referred to the program by family physicians. The program lasts for two years, and involves follow up visits at two week intervals for 3 months, then monthly and then moving to follow up every 3 months. Referrals to other health professionals will be made based on need.	McLeod River PCN. CDM. http://mrpcn.ca/index.php?/cdm.html (Accessed January 19, 2014)
Childhood Obesity	Mosaic PCN http://www.mosaicpcn.ca	In partnership with community health clinics and Alberta Health Services, this program connects at risk children with a dietitian. The childhood obesity dietitian works with children 0-5 years of age and their parent(s)/guardian(s), providing children who are at risk for obesity and their parent(s)/guardian(s) with nutrition education and strategies. Sessions focus on giving the parent(s)/guardian(s) the tools to provide their child/children with healthy balanced meals and tips for meal and snack times. They are exploring ways to expand services to target childhood obesity – details TBD.	Mosaic PCN. 2013. Childhood Obesity. http://www.mosaicpcn.ca/Services/Prevention/Pages/ChildhoodObesity.aspx (Accessed January 19, 2014)
Pediatric Lifestyle Clinic	Mosaic PCN http://www.mosaicpcn.ca	A multidisciplinary team (including a kinesiologist, RD, psychologist and physician) designed to work with families in developing a healthier lifestyle.	Personal Communication with the Primary Care and Chronic Disease Management department (Alberta Health Services), May 12, 2014
Chronic Disease Management (CDM) Team	Mosaic PCN http://www.mosaicpcn.ca	A multidisciplinary team (physician, CDM RN, pharmacist, chronic disease RN, kinesiologist and physiotherapist). The RN provides basic counselling and refers to other team members as needed. Note: Patients are counselled about obesity management, but this is not a specialty.	Personal Communication with the Primary Care and Chronic Disease Management department (Alberta Health Services), May 12, 2014
Weight Management: Triage and Treatment Intensity in Primary Care	Mosaic PCN http://www.mosaicpcn.ca	The study evaluated ways in which our CDM dietitians (RDs) address weight management. The project consisted of two parts: the first part was a survey to discover physician and patient attitudes toward overweight and weight management.	PDF Downloaded Jan 19 from: http://www.mosaicpcn.ca/Documents/Weight%20Management%20Study%20Part%201%20Sept%202013.pdf

Lighten Up Wellness Clinic	Peace Region PCN http://www.prpcn.ca/	Offered to patients with a BMI greater than 35.0kg/m2 with weight-related co-morbidities (i.e., coronary heart disease, hypertension, diabetes, or sleep apnea), this program aims to manage obesity using a multidisciplinary approach. This program involves community health education, lifestyle modification, dietary support, physical activity and mental wellbeing. Patients must commit for a minimum of 1 year. Modules include: Module One – Getting Started: Planning for Success; Module Two – Finding Balance: The Role of Calories in Weight Management ; Module Three – Managing Hunger and Appetite; Module Four – Moving Matters: Including Physical Activity in Your Day; Module Five – Nutrition: The Truth About What Works in Weight Management; Module Six – Nutrition: I Know I Should Eat Healthy, But How?; Module Seven – Nutrition: Eating Away From Home and During Special Occasions; Module Eight- Craving Change ; and Module Nine - Minding Stress: Effectively Reduce and Manage the Stress in Your Life	Peace Region PCN. 2013. Lighten Up Wellness Clinic. http://www.prpcn.ca/Services/WtMgtPgm/Pages/default.aspx (Accessed January 19, 2014)
Weighs to Wellness	Sherwood Park-Strathcona County Primary Care http://www.sherwoodparkpcn.com	Weighs to Wellness is a weight management program delivered by registered nurses, registered dietitians, and an exercise specialist. This program consists of a series of classes to help individuals overcome common weight loss challenges: An Introductory Session and Craving Change™. Physical activity classes: Moving Towards Wellness or Osteoarthritis. Nutrition classes (participants choose two of the following four): Meal Planning for Weight Management; Eating Away From Home and During Special Occasions ; Label Reading; Group Nutrition/Ask a Dietitian Sessions	Sherwood Park Statchon County PCN. 2013. Weighs to Wellness. http://www.sherwoodparkpcn.com/Services/Pages/WeighstoWellness.aspx (Accessed January 19, 2014)
Pediatric Weight Management Program	Sherwood Park-Strathcona County Primary Care http://www.sherwoodparkpcn.com	The Pediatric Weight Management Program assists family physicians with the education, monitoring, and management of overweight children and youth (2-17 years). Following physician referral to the program, patients receive a comprehensive care program coordinated by a Registered Nurse. The program is designed to improve patients' overall health through increased physical activity levels and improved eating behaviour.	Sherwood Park Strathcona County PCN. 2013. Programs & Services - Pediatric Weight Management Program. http://www.sherwoodparkpcn.com/Services/pediatric/Pages/default.aspx (Accessed January 19, 2014)
Pediatric Weight Management Program	South Calgary PCN https://www.scpcn.ca	The Pediatric Weight Management Program (this is now rolled into their Health Management Clinic) offers comprehensive care for children who are overweight. The goal is to provide patients with individualized care, while emphasizing the importance of family involvement.	South Calgary PCN. 2013. Services - Pediatric Weight Management Program. https://www.scpcn.ca/services/pediatric-weight-management-program

			(Accessed January 19, 2014)
Health Management Clinic	South Calgary PCN https://www.scpcn.ca	In this program a multidisciplinary team provides helm in managing chronic disease risk factors (including an RN, administrator, kinesiologist, behavioural health consultant and an RD). The program is 1 year in length, however, patients can be re-referred if further support is required for weight management.	Personal Communication with the Primary Care and Chronic Disease Management department (Alberta Health Services), May 12, 2014
Weigh to Go Program	St. Albert & Sturgeon PCN http://www.stalbertsturgeonpcn.com	Eight individual Weight Wise modules are being delivered at the St. Albert & Sturgeon PCN by a team of experts including a dietitian, psychologist, exercise specialist, and nurses. Participants will learn: why your weight may be putting your health at risk; latest research on what's really worked for people who have lost significant amounts of weight and kept it off; how to read labels, identify appropriate portion sizes, and use fibre as a weight management tool; choosing healthy foods in restaurants; healthy strategies to cope with stress and emotional eating; tips to counter obstacles to physical activity; 4 components of physical activity to include in any program.	St. Albert and Sturgeon PCN. Weight to Go. http://www.stalbertsturgeonpcn.com/sessions/weightogo.html (Accessed January 19, 2014)
Weight Wise Living	Wolf Creek PCN http://www.wolfcreekpcn.com	Weight Wise provides individuals with tools, access to experts and information, plus programs and services to help them reach a healthy weight for improved health. This course has nine modules that cover subjects such as Setting Goals, Managing Hunger, Nutrition, Managing Stress, and Craving Change.	Wolf Creek PCN. Programs & Services - Weight Wise Living. http://www.wolfcreekpcn.com/Services/GroupClasses/Pages/WeightWiseLiving.aspx (Accessed January 19, 2014)

Weight Wise	Wetaskawin PCN http://www.wetaskiwinpcn.ca	Weight Wise has been put together by Alberta Health Services to help those seeking to achieve healthy weights for healthy lives. Classes are open to adults interested in learning effective and safe strategies to manage a healthy weight. Weight Wise Class Topics: Getting Started: Planning for Success; Lifestyle Change: A Tool Kit for Success; Nutrition: Finding Balance - The Role of Calories in Weight Management; Nutrition: I Know I Should Eat Healthy But How?; Nutrition: The Truth About What Works In Weight Management; Managing Hunger and Apetite; Managing Stress: Effectively Reduce & Manage the Stress in Your Life (2 Sessions); Nutrition: Eating Away From Home and on Special Occasions; Moving Matters: Including Physical Activity in Your Day.	Wetaskiwin PCN. 2013. Weight Wise. http://www.wetaskiwinpcn.ca/#!weight-wise/cb2r (Accessed January 19, 2014)
WBPCN Weight Management program	Wood Buffalo PCN http://www.wbpcn.ca	The WBPCN Weight Management program helps people in Fort McMurray to lose weight safely, under the careful medical supervision of physicians, nurses, dietitians, a mental health therapist, and an exercise specialist, and includes multiple programs: -FitFutures: A team of dietitians, an exercise specialist, and a behavioral therapist provide one-on-one sessions to support families in their efforts to lead balanced lives. - Weight Wise: Participants attend 10 workshops: Getting Started: Planning for Success; Lifestyle Change; Finding Balance; Managing Hunger & Appetite; Moving Matters; The Truth; Eating How?; Eating Out; Minding Stress (2 sessions); Craving Change (2 sessions) - Optifast: A 12-month comprehensive dietary intervention featuring the Optifast product. Each Optifast group is composed of up to 16 patients, who meet together on a weekly basis for the first 4 months (during the liquid meal replacement dietary intervention phase) and then on a monthly basis for the final 8 months. In addition to the clinician-led group sessions, patients also meet one-on-one with a physician, dietitian, exercise specialist, and mental health therapist. All sessions, both group and one-on-one, are conducted in a safe, open, and supportive environment. On average, patients who complete the Optifast program lose 17.48% of their body weight (equivalent to a 300lb person losing 52lbs). - Bariatric Surgery Followup - The WBPCN provides follow-up care for patients who have received some form of bariatric surgery	Wood Buffalo PCN. 2013. Programs & Services - Weight Managemen - Weight Wise. http://www.wbpcn.ca/Services/WeightManagement/WeightWise/Pages/default.aspx (Accessed January 19, 2014)
Chronic Disease Management	Palliser PCN http://www.palliserpcn.ca/	Details not available.	Palliser PCN. 2014. Programs & Services. http://www.palliserpcn.ca/Services/Pages/default.aspx (Accessed June 25, 2014)
Chronic Disease Management	Sexsmith/Spirit River PCN http://www.smsrpcn.ca	Details not available.	Sexsmith/Spirit River PCN. 2014. Programs & Services - Chronic Disease Management. http://www.smsrpcn.ca/Services/ChronicDiseaseMa

			nagement/Pages/default.aspx (Accessed June 25, 2014)
Gaining for Lightness	Calgary West Central	A 4-week program offered to patients. Run on a weekly basis, the program is left by a number of providers including a behavioural health consultant, an RD, registered psychologist or an RN. The program focuses on what and how to eat, emotional eating, coping with stress and problem solving techniques.	Personal Communication with the Primary Care and Chronic Disease Management department (Alberta Health Services), May 12, 2014
Weight Loss Success	Calgary West Central	2-hour classes, which require a physician referral. Helps patients develop strategies for losing weight.	Personal Communication with the Primary Care and Chronic Disease Management department (Alberta Health Services), May 12, 2014
Chronic Disease Management & Living Well With A Chronic Disease	Calgary Foothills PCN http://www.cfpcn.ca/	Chronic Disease Management is provided by Nurses, Pharmacists, Dietitians and Respiratory Therapists, to care for patients with chronic diseases (diabetes, dyslipidemia, congestive heart failure, asthma and chronic obstructive pulmonary disease). Calgary Foothills PCN also teams up with Living Well to increase the availability of courses.	Calgary Foothills PCN. 2007. Programs - Chronic Disease Management. http://www.cfpcn.ca/Programs/ChronicDiseaseManagement/tabid/75/Default.aspx (Accessed January 19, 2014)
Chronic Disease Management	Calgary Rural PCN http://www.crpcn.ca	This program offers assessment, treatment, and follow up by a team of health care professionals for patients with a chronic disease (including Diabetes, Coronary artery disease, Congestive heart failure, Asthma and/or Chronic obstructive pulmonary disease). Teams may include a: Nurse, Pharmacist, Dietitian, Social Worker, Occupational Therapy and/or a Physiotherapy. Team members are affiliated with the Alberta Health Services Chronic Disease Management Program for the Calgary Zone.	Calgary Rural PCN. 2013. Programs & Services - Chronic Disease Management. http://www.crpcn.ca/Services/Pages/ChronicDiseaseManagement.aspx (Accessed January 19, 2014)

Healthy Lifestyle Initiative	Calgary Rural PCN http://www.crpcn.ca	An 8-week program which involves a fitness component, a nutritional component and therapeutic yoga. This program required a pre-assessment conducted by a physician, and a follow-up assessment is done at 8 weeks.	Personal Communication with the Primary Care and Chronic Disease Management department (Alberta Health Services), May 12, 2014
Weight Management Class	Edmonton Oliver PCN http://www.edmontonoliverpcn.com/	Led by dietitians, this program explores how meal patterning, food choices and portion sizes affect calorie intake and weight. Strategies for putting it into action – food journaling, goal setting, etc. Includes a 1-month followup opportunity for interested patients. 1.5- or 2-hour class.	Edmonton Oliver PCN. 2014. Programs & Services. http://www.edmontonoliverpcn.com/programs-services/ (Accessed June 25, 2014)
Chronic Disease Management	Edmonton Southside PCN http://www.edmontonsouthsidepcn.ca	This is a collection of lifestyle, self-management and health care services designed to support a persons overall health, including people with diabetes, dyslipidemia, smoking, obesity and hypertension. These patients work with clinical staff members (including nurses, dietitians and social workers).	Edmonton Southside PCN. 2013. Programs & Services, Chronic Disease Management. http://www.edmontonsouthsidepcn.ca/Services/Pages/CDM.aspx (Accessed January 19, 2014)
Chronic Disease Management	Highland PCN http://www.hpcn.ca	The health management team includes registered nurses, registered dietitians, pharmacists, social workers, kinesiologists, and behavioural health consultants, who work in both physician offices and the centralized Health Management Clinic to create a personalized care plan. This HPCN initiative is concerned with improving screening and data collection related to chronic disease. The strategy has focused on measuring and tracking select clinical indicators (diabetes, hypertension, height and weight), and developing and agreeing upon a standardized approach for diagnosing diabetes, dislypidemia, and hypertension.	Highland PCN. Chronic Disease Management. http://yourhpcn.com/chronic-disease-management/ (Accessed January 19, 2014)
Chronic Disease Management	Lakeland PCN http://www.lakelandpcn.com	Chronic Disease Management provides care to patients with chronic disease, including: diabetes, asthma, congestive heart failure, COPD and High Blood Pressure. Educational classes are offered through the Alberta Healthy Living Program, provided by AHS. Classes are offered in diabetes, hypertension (high blood pressure), cholesterol management and healthy eating.	Lakeland PCN. Programs & Services - Chronic Disease Management. http://www.lakelandpcn.com/Services/Pages/CDM.aspx (Accessed January 19, 2014)

Better Choices, Better Health™	St. Albert & Sturgeon PCN http://www.stalbertsturgeonpcn.com	Available to People living with a chronic condition and their spouse or caregiver, this program is designed to help individuals in: managing symptoms, making action plans, working more effectively with health care teams, better communication, dealing with stress and difficult emotions, relaxation, and increasing exercise, activity and healthy eating.	St. Albert & Sturgeon PCN. Better Choices, Better Health™ . http://www.stalbertsturgeonpcn.com/sessions/bcbh.html (Accessed January 19, 2014).

MEDLIOR
HEALTH OUTCOMES RESEARCH

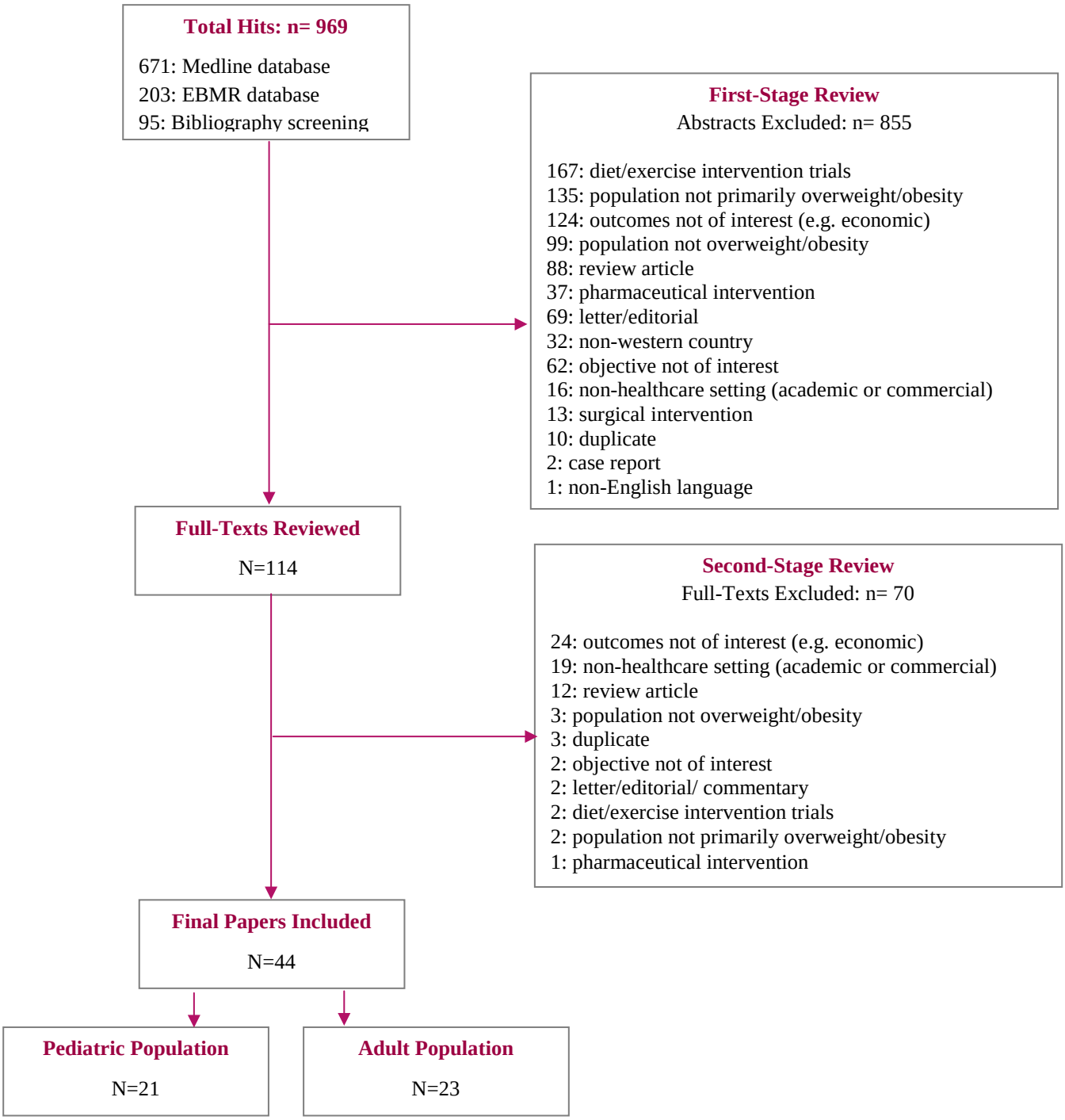
APPENDIX 5: Literature Review Methodology and Evidence Tables– *Strategies in Primary Health*

1 Table of Contents

2 Methodology

A literature search in the OvidSP Medline and selected Evidence Based Medicine Review (EBMR) databases was conducted on March 9, 2014 (and updated on June 30, 2014) in order to identify peer-reviewed literature on S*trategies for managing high-risk, overweight and obese populations (adult and pediatric) in primary health.*

2.1 Study Selection



2.2 Literature Search Strategy

Search Strategy: OvidSP MEDLINE

MEDLINE (R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R) 1946 to present – accessed March 17th 2014

	Searches	Results
1	Obesity (Including Limited Related Terms)	10788
2	Overweight (Including Limited Related Terms)	4785
3	**1 OR 2**	**14981**
4	primary healthcare (Including Limited Related Terms)	14364
5	primary care (Including Limited Related Terms)	14364
6	multidisciplinary (Including Limited Related Terms)	7623
7	community health (Including Limited Related Terms)	6121
8	public health (Including Limited Related Terms)	18635
9	dietician (Including Limited Related Terms)	4914
10	Mental health (Including Limited Related Terms)	10083
11	Exercise (Including Limited Related Terms)	11083
12	Activity (Including Limited Related Terms)	11510
13	**4 OR 5 OR 6 OR 7 OR 8 OR 9 OR 10 OR 11 OR 12**	**84129**
15	**3 AND 13**	**607**
16	**Limit 15 to (English language and humans and yr="2004 -Current")**	**488**
17	**Total references for screening**	**488**
	The search strategy was rerun June 30th 2014	183
	Total references for screening	**671**

Search Strategy: OvidSP Evidence-Based Medicine Reviews

ACP Journal Club 1991 to February 2014, Cochrane Database of Systematic Reviews 2005 to January 2014, Health Technology Assessment 1st Quarter 2014, NHS Economic Evaluation Database 1st Quarter 2014 – accessed March 17th 2014

	Searches	Results
1	Obesity (Including Limited Related Terms)	578
2	Overweight (Including Limited Related Terms)	1080
3	**1 OR 2**	**1577**
4	primary healthcare (Including Limited Related Terms)	2708
5	primary care (Including Limited Related Terms)	2708
6	multidisciplinary (Including Limited Related Terms)	372
7	community health (Including Limited Related Terms)	151
8	public health (Including Limited Related Terms)	640
9	dietician (Including Limited Related Terms)	109
10	Mental health (Including Limited Related Terms)	563
11	Exercise (Including Limited Related Terms)	3546
12	**4 OR 5 OR 6 OR 7 OR 8 OR 9 OR 10 OR 11**	**10603**
13	**3 AND 10**	**303**
14	**Limit 14 to (yr="2004 -Current"; limit not valid in DARE; records were retained)**	196
15	**Total references for screening**	**196**
	The search strategy was rerun June 30th 2014	7
	Total references for screening	**203**

2.3 Inclusion and Exclusion Criteria

Inclusion criteria

- Population: any adult or pediatric patients; clinically classified as high-risk, overweight or obese.
- Interventions: broadly defined as any *strategies* for the prevention/management of the population of interest within primary health settings (e.g. primary care offices, physician-led, nurse-led or multidisciplinary team clinics; community health programs/providers; public health programs/providers).
- Comparator: usual care
- Outcomes: effectiveness, appropriateness, acceptability
- Study design: any

Exclusion criteria

- Studies published prior to 2004 (>10 years)
- Non-English language studies
- Review articles (though bibliographies may be searched)
- Editorials, commentaries, letters
- Papers published from non-westernized countries (non-applicable to western weight goals/diets)
- Studies investigating clinical effectiveness of pharmaceutical, surgical, dietary or exercise *interventions*
- Studies focused on populations not specifically defined as high-risk, overweight or obese (e.g. other chronic conditions, where obesity may be a characteristic of the population rather than the condition of focus)
- Any studies outside of primary health settings (i.e. academic trials, acute care or commercial)

Excluded Full Text Papers

Citation	Reason for exclusion
Sharma, 2007[1]	Diet or exercise intervention (2 papers have been added to the spreadsheet for review)
Melanson KJ, 2004[2]	Diet or exercise intervention (in an Academic Setting)
Whitlock 2014[3]	Duplicate
Whitlock 2014[4]	Duplicate
Hafekost 2013[5]	Duplicate
Baker 2010[6]	Letter, editorial, commentary
Anand 2010[7]	Letter, editorial, commentary
Raynor 2012[8]	Non-healthcare setting (i.e. commercial or academic)
Befort 2010 [9]	Non-healthcare setting (i.e. commercial or academic)
Shelton D 2007[10]	Non-healthcare setting (i.e. commercial or academic)
Crespo NC 2012[11]	Non-healthcare setting (i.e. commercial or academic)
Robinson TN 2008[12]	Non-healthcare setting (i.e. commercial or academic)

Brown 2007[13]	Non-healthcare setting (i.e. commercial or academic)
Moodie 2010[14]	Non-healthcare setting (i.e. commercial or academic)
Karanja N 2010[15]	Non-healthcare setting (i.e. commercial or academic)
Donnelly, J.E. 2007[16]	Non-healthcare setting (i.e. commercial or academic)
Golan M 2006[17]	Non-healthcare setting (i.e. commercial or academic)
Perri 2008[18]	Non-healthcare setting (i.e. commercial or academic)
Rodearmel 2006[19]	Non-healthcare setting (i.e. commercial or academic)
Kokkvoll 2014[20]	Non-healthcare setting (i.e. commercial or academic)
Renault 2014[21]	Non-healthcare setting (i.e. commercial or academic)
Strobl 2013[22]	Non-healthcare setting (i.e. commercial or academic)
Zapico 2012[23]	Non-healthcare setting (i.e. commercial or academic)
Gourlan 2011[24]	Non-healthcare setting (i.e. commercial or academic)
Collins 2011[25]	Non-healthcare setting (i.e. commercial or academic)
O'Connor 2013[26]	Not objective of interest
Dick 2004[27]	Not objective of interest
Stahl 2011[28]	Outcomes not of interest (pilot study)
Jacobson 2012[29]	Outcomes not of interest (Feasibility study)
Jacobson 2011[30]	Outcomes not of interest (not specific outcomes for effectiveness)
Vallis 2013[31]	Outcomes not of interest
Moodie 2008 [32]	Outcomes not of interest (outcomes reported elsewhere)
Tsai 2013 [33]	Outcomes not of interest (outcomes reported in Wadden paper)
Wang 2008[34]	Outcomes not of interest (school based programs)
Roux 2006[35]	Outcomes not of interest (clinical data from 1985-2001)
Leblanc ES 2011[36]	Outcomes not of interest
Dilley 2007[37]	Outcomes not of interest
Brown 2008[38]	Outcomes not of interest
Metz 2009[39]	Outcomes not of interest
van Gerwen 2009[40]	Outcomes not of interest (survey data, no effectiveness)
Hearn 2008[41]	Outcomes not of interest
Avenell 2014[42]	Outcomes not of interest
Adelman 2005[43]	Outcomes not of interest (no effectiveness results reported)
Laws 2004[44]	Outcomes not of interest (survey data, no effectiveness)
Dansinger 2007[45]	Outcomes not of interest
Dorsey 2005[46]	Outcomes not of interest (chart review)
Flocke 2005[47]	Outcomes not of interest (observational, no effectiveness data)
Flynn 2006[48]	Outcomes not of interest (all studies pre-2004)
Jay 2010[49]	Outcomes not of interest (no effectiveness outcomes)

Yoong 2013[50]	Outcomes not of interest
Tsai 2013[33]	Outcomes not of interest (effectiveness outcomes already captured)
ten Have M 2010[51]	Population not diagnosed with overweight/obesity
Kremers 2010[52]	Population not diagnosed with overweight/obesity
Carroll 2011[53]	Population not diagnosed with overweight/obesity
Trueman 2010[54]	Population not primarily obesity (other disease included)
van Sluijs 2014[55]	Population not primarily obesity (other disease included)
Ryan 2010[56]	Prescription pharmaceutical intervention
Sargent 2011[57]	Review article
Hopkins 2011[58]	Review article
Waters 2013[59]	Review article
Flodgren 2010[60]	Review article
Anderson 2008[61]	Review article
Tsai 2009[62]	Review article
Barlow 2007[63]	Review article
Bray 2012[64]	Review article
Bray 2008[65]	Review article
Spear 2007[66]	Review article
Wadden 2012[67]	Review article
Wadden 2013[68]	Review article
Kalavainen 2007[69]	School Setting

3 Evidence Table of Included Studies: Study and Patient Characteristics

Adult Population

Author	Interventions	Age (Mean, SD) & Gender	BMI (Category, Mean or Range) / Weight (and other weight measures)
Wadden TA, et al. 2011[70] Randomized Controlled Trial (RCT) U.S. n = 390	Lifestyle Intervention: one of three types of intervention: usual care, consisting of quarterly PCP visits that included education about weight management; brief lifestyle counseling, consisting of quarterly PCP visits combined with brief monthly sessions with lifestyle coaches who instructed participants about behavioural weight control; or enhanced brief lifestyle counseling. **Excluded from the analysis** was a third condition which provided the same care as described for the previous intervention but included meal replacements or weight-loss medication (orlistat or sibutramine), chosen by the participants in consultation with the PCPs, to potentially increase weight loss	51.5±11.5 years 20.3% male	BMI Mean: 38.5±4.7 Weight: 107.7±18.3 kg
Werrij MQ, et al. 2009[71] RCT Netherlands n= 200	Cognitive Therapy: In the present study, cognitive therapy was added to a standard dietetic treatment for obesity, within the dieticians practice in a local health centre. For the control group, physical education was added to the standard dietetic treatment. In both treatments, the dietetic intervention aimed at a weight loss of 5–10%, because of its realism and the significant health benefits that are reached with this modest weight loss	45 (12) years 19% male	BMI Range: 27.0 to 52.3 Weight: NR
Rodondi N; et al. 2006[72] Observational Switzerland N=523	In a 10- page and 95-item questionnaire about prevention (smoking, cholesterol, diet, and physical activity), we included questions about counselling provided by their primary care physicians in the past three visits and patients' expectations regarding counselling. We enquired specifically about 10 predefined strategies for weight reduction and physical activity. At 1 year, we mailed all patients a questionnaire to record their self-reported behaviour to control weight and their current weight. Non-responders received a second mailing and a telephone call to maximize the response rate.	48.6 years 59% male	Obesity classes: BMI (kg/m2) 25.0–29.9: 68% 30–34.9: 23% ≥ 35.0: 9% Weight: NR
Molenaar EA; et al. 2010[73] RCT Netherlands Intervention N=134 Control N=70	1. Nutritional counselling: All randomized participants were provided with a referral letter from their GP to attend seven individual face-to-face counselling sessions with a dietician during 6 months (with Sessions 4 and 7 fixed at, respectively, 3 and 6 months after the first session) and one follow-up session at 12 months. 2. Nutritional plus exercise counselling: Participants randomized to the D + E group were additionally provided with a referral letter from their GP to attend six individual face-to-face counselling sessions with a physiotherapist during 6 months (with Sessions 4 and 6 fixed at, respectively, 3 and 6 months after the first session) and one	Intervention: 43 ± 9 years Control: 41 ± 11 years Intervention: 58% male; Control group: 63% male	BMI Mean: Intervention: 31.0 ± 1.9; Control: 30.2 ± 1.9 Weight**:** Intervention: 95.5 ± 12.0 Control: 94.4 ± 11.2

Author	Interventions	Age (Mean, SD) & Gender	BMI (Category, Mean or Range) / Weight (and other weight measures)
	follow-up session at 12 months. At the first session, the physiotherapist went through a physical activity questionnaire known as the SQUASH (Short Questionnaire to Assess Health enhancing physical activity). 3. Control group: Participants in the control group received usual care and were not invited to receive structured nutritional or exercise counselling by a dietician or physiotherapist.		
Noel PH; et al. 2012[74] Observational U.S. N=223,246	To examine the association between obesity-related counseling and BMI trend, we used BMI derived from heights and weights obtained during routine clinical encounters.	60 (12.2) years 94.1% male	BMI Mean: 34.6 (4.4) kg/m2 Weight: NR
Ely AC; et al. 2008[75] RCT U.S. Active Arm N=48; Control Arm N=53	The standard of care arm included face-to-face outcome assessments at day 0, 90, and 180, and standardized patient educational materials about obesity (standard arm). The active arm received the same components as the standard arm, and a CCM program integrating a telephone-based counseling regimen with other components of the CCM program.	49 ± 14 (AA); 50 ±15 (CA) 23% male Active Arm: 29% male Control Arm: 17% male	BMI Mean: 37 ± 8 (AA) 36 ± 7 (CA) Weight: NR
Sherwood et al. 2006[76] RCT U.S. n=1293 Mail n=600 Phone n=601 Usual care n=600	One of three conditions: mail intervention, phone intervention, and usual care. Once activated, the two weight loss interventions proceeded in parallel formats. Both were comprised of 10 interactive lessons designed to be completed in sequence with feedback between each lesson from a health counselor. Each lesson included instructional material describing a rationale for a specific behaviour change strategy, behaviour change goals related to that strategy, and homework to be completed before beginning the next lesson. Lesson topics included nutrition, physical activity, and behaviour management techniques (e.g., behavioural assessment, goal setting, stimulus control, social support, and self-motivation). The primary homework assignment was to keep a food and exercise log. Usual care participants had access only to weight management services generally available to members of HealthPartners.	50 (12) years 28% male	Average BMI was 33.5 kg/m2 Weight: NR
Bennett GG; et al. 2012[77] RCT U.S.	We provided the National Heart, Lung, and Blood Institute's "Aim for a Healthy Weight" self-help booklet to the usual care participants at baseline. The intervention used theory-based and evidence-based principles to promote weight loss and hypertension self-management for 24	54.5 years 31.5% male	BMI, mean (SD) 36.99 (5.24) (usual care) 37.03 (4.96) (intervention) Weight, mean (SD), kg Usual Care: 100.60 (18.67) Intervention: 99.70 (16.29)

Author	Interventions	Age (Mean, SD) & Gender	BMI (Category, Mean or Range) / Weight (and other weight measures)
n=365	months. Patients are prescribed 3 tailored goals to modify routine obesogenic lifestyle behaviours. Behavior change goals were modelled on evidence-based recommendations that were tailored to the patient population and phrased so that they could be easily self-monitored. New goals were selected at subsequent 13-week intervals. For the duration of the study, participants maintained a hypertension medication adherence goal (to take their medication as prescribed daily). Trained community health educators delivered counseling calls monthly during the first 12 months of intervention and bimonthly during the second year (18 total scheduled calls). Behavioural Intervention: We randomized participants to usual care or a behavioural intervention that promoted weight loss and hypertension self-management using eHealth components. The intervention included tailored behaviour change goals, self-monitoring, and skills training, available via a website or interactive voice response; 18 telephone counseling calls; primary care provider endorsement; 12 optional group support sessions; and links with community resources.		
Logue E; et al. 2005[78] RCT U.S. AUC n = 336 TM-CD care n =329	Trans-theoretical model-chronic disease (TM-CD) minimal intervention vs. augmented usual care (AUC). AUC included dietary and exercise advice, prescriptions and three 24-hour dietary recalls every 6 months. TM-CD care included AUC elements plus "stage of change" (SOC) assessments for five target behaviours every other month, mailed SOC and target behaviour-matched workbooks, and monthly telephone calls from a weight-loss advisor.	40-69 years of age AUC Group: 33% male TM-CD group: 30% male	20% overweight, 34% Class I obesity, 23% had Class II obesity, and 23% had Class III obesity Weight: NR
Alexander SC, et al 2011[79] Other U.S. n= 40 physicians and 461 of their overweight or obese patients.	Five A's: Ask: Physician asks the patient about weight, nutrition, and/or exercise ("Do you exercise?", "Tell me what you typically eat for breakfast." Advise: Physician provides the patient with clear, strong advice Assess: Physician verbally assesses patient's readiness to change. Assist: Physician provides brief counseling or self-help materials. Arrange: Physician arranges for follow-up with physician or nutritionist.	47.2 years NR	BMI Mean: 33.1 (7.1) Weight: NR
Appel L, et al. 2011[80] RCT	Two behavioural interventions vs control group: One intervention provided patients with weight-loss support remotely – through the telephone, a study-specific Website and e-mail. The other intervention provided in-person support during group and individual sessions, along with the three remote means of support. There was also a control group in which weight loss was self-directed.	All Participants: 54.0±10.2 Control: 52.9±10.1 Remote Support Only: 55.8±9.7	BMI Mean: Control: 36.8±5.14 Remote Support 36.0±4.7 In-Person Support: 36.8±5.2 All Participants: 36.6±5.0

Author	Interventions	Age (Mean, SD) & Gender	BMI (Category, Mean or Range) / Weight (and other weight measures)
U.S. n = 415		In-Person Support: 53.3±10.5 36.4% male	Weight — kg Control: 104.4±18.6 Remote Support:102.1±13.9 In-Person Support: 105.01±20.7 All Participants: 103.4±17.9 Waist Circumference, cm Control: 118.2±13.7 Remote Support: 117.9±12.7 In-Person Support: 118.2±14.4
Bennett, G.G., et al. 2010[81] RCT U.S. n = 101	Usual care—Participants randomized to usual care received the current standard of care offered by the outpatient practice. Individual providers approached patient weight loss as they saw fit; the research team made no attempts to influence any weight loss counseling offered to usual care participants. In addition, at baseline we gave all usual care participants a copy of the the "Aim for a Healthy Weight" materials, published by the National Heart Lung and Blood Institute. Web-based intervention—Step Up, Trim Down utilized a weight loss strategy (iOTA; interactive weight loss approach), which was designed specifically for web-based implementation (Table 1). Briefly, iOTA provides participants with a series of tailored obesogenic behaviour change goals that are subjected to regular self-monitoring. At the start of the intervention, each participant worked with a health coach to select four obesogenic behaviour change goals using an algorithm that prioritized behaviours in need of change, for which the participant had high self-efficacy for change, as well as those behaviours with few barriers to change. The participant was permitted to select new obesogenic behaviour change goals at week 6. Behavioral skills necessary to effectively adhere to the set of obesogenic behaviour change goals (e.g., stimulus control, portion control, label reading, eating out) were presented on the website and updated biweekly. Additional website features included a social networking forum, recipes, and a messaging feature that allowed for direct communication with the coach. A health coach conducted two, 20-min motivational coaching sessions in person (baseline and week 6), and two, 20-min biweekly sessions via telephone (week 3 and 9). The health coach was a registered dietitian and was trained to use principles of motivational goals; during each session, the coach reviewed self-monitoring data, discussed behaviour change skills relevant to the assigned goals, and engaged in problem solving exercises. The health coach participated in weekly supervision with senior study staff for the duration of the trial. The coach provided counseling only on the assigned obesogenic	Total 54.4 (8.1) Intervention 54.4 (7.4) Usual care 54.5 (8.9) 52.5% male Intervention 58.8% male Usual care 46% male	BMI Mean: Total: 34.6 (3.2) Intervention: 35.0 (3.5) Usual care: 34.6 (3.2) Weight (kg) Total: 97.3 (10.9) Intervention: 101.0 (15.4) Usual care: 97.3 (10.9)

Author	Interventions	Age (Mean, SD) & Gender	BMI (Category, Mean or Range) / Weight (and other weight measures)
	behaviour goals; during each session, the coach reviewed self-monitoring data, discussed behaviour change skills relevant to the assigned goals, and engaged in problem solving exercises. The health coach participated in weekly supervision with senior study staff for the duration of the trial.		
Laws, R. et al. 2004[82] Other U.K. n =1256	Individual interventions. Individual intervention was encouraged when the group programme was not feasible in the practice or inappropriate for the patient. The two types of individual interventions used were goal-setting approach or a structured prescribed eating plan approach based on 500– 600-kcal energy deficit. These were designed to be used independently based on the needs and preferences of the patient. Goal setting is based on the PN and patient working together to mutually agree goals for dietary and lifestyle change. Once initial goals have been achieved, the clinician encourages the patient to set further goals, with the aim of making small but permanent changes in lifestyle. Practice nurses were coached in the skills of negotiating goals to change lifestyle, as collaborative goal setting has been found to be more effective in weight management than health professional-selected goals (Alexy, 1985). A goals booklet was devised to prompt the patient and PN to set goals that were specific, measurable, achievable, realistic and time specific (SMART). The prescribed eating plan (PEP) is an individualized food portion plan based on a 500– 600-kcal deficit, with approximately 30% energy from fat. Practice nurses were provided with a table to select the appropriate calorie amount depending on the patient's age, gender, weight and activity level. Another table detailed the number of portions of each food group corresponding to the calorie level calculated. The appropriate number of portions could then be written into a patient education booklet detailing exchange lists for each food group to promote dietary variety. Group intervention. A group programme has been developed and is offered to practices as a first line treatment option if appropriate facilities are available. The programme is based around six one hour sessions run bi-weekly for a three month period. Sessions include discussions on weight loss targets, healthy eating, shopping, cooking, eating out, physical activity and relapse prevention. Each group aims to recruit 10–15 participants and sessions are based around the principles of adult learning, designed to encourage group interaction and active learning. Session plans, and teaching materials are provided to practices and the WMA typically facilitates the first patient group over three months with the PN observing. Following this the PN(s) is encouraged to take responsibility for facilitating the group.	50.6 (14)years 26% male	Mean BMI: 36.9 kg/m2 (SD 5.4) 25% having a BMI >40 kg m2 (classified as severely obese) Weight: NR

Author	Interventions	Age (Mean, SD) & Gender	BMI (Category, Mean or Range) / Weight (and other weight measures)
Jebb, S.A., et al. 2011[83] RCT Germany, Australia & UK n = 772	Participants in the commercial programme group received free access to weekly community-based Weight Watchers meetings for 12 months. They were requested not to mention their participation in the study to the group leader or other attendees. This commercial programme promotes a hypoenergetic, balanced diet based on healthy eating principles, increased physical activity, and group support. Weight loss goals are self-selected with input from the group leader, and participants are encouraged to attend weekly meetings for a weigh-in and group discussion, behavioural counselling, and motivation. Participants were able to access internet-based systems to monitor their food intake, activity, and weight change; to participate in community discussion boards; and to access a library of information, recipes, and meal ideas. Participants in the standard care group received weight loss advice from a primary care professional at their local general practitioner (GP) practice. Professionals delivering this intervention were provided with, and encouraged to use, Australian, German, and UK national clinical guidelines for treatment, and were made aware of information providing advice about weight loss. Bodyweight, height, fat mass, waist circumference, and blood pressure were measured at baseline, and at 2, 4, 6, 9, and 12 months.	Commercial programme: 46.5 (13.5) Standard care: 48.2 (12.2) Commercial programme: 12% male Standard care: 14% male	BMI (kg/m.) Commercial: 31.5 (2.6) Standard care: 31.3 (2.6) Weight (kg) Commercial: 86.9 (11.6) Standard care: 86.5 (11.5) Fat mass (kg) Commercial: 33.3 (7.0) Standard care: 32.9 (7.4) Waist circumference (cm) Commercial: 100 (9.2) Standard care: 99.9 (9.3)
Jolly, K., et al. 2011[84] RCT U.K. n= 740	The participants allocated to the commercial operators Weight Watchers, Slimming World, and Rosemary Conley had a choice of locations and times for the programme. Participants were provided with vouchers that exempted them from paying for 12 consecutive weeks of the programmes. Each programme was provided in accordance with the respective organisation's guidance and ran continuously, with no set start date; the group leaders were trained by the respective organisations. The trial participants attended alongside people who paid to attend the programmes. The Size Down Programme is an NHS group based programme led by food advisers recruited from the local community and trained by the dietetics department; sessions took place in various community venues. All members of the group started together and followed a prescribed course of six sessions, with follow-up weighing sessions at nine and 12 weeks. Participants randomised to the general practice or pharmacy arms attended 12 one to one sessions in the general practice or pharmacy. Staff delivering these programmes had attended a three day training course on weight management in adults delivered by dietitians experienced in the management of obesity. Participants allocated to the comparator group were sent vouchers for 12 free sessions at a local authority run leisure centre (a council run facility open to all members of the public and usually consisting of a	Weight Watchers 50.71 (14.56) Slimming World 48.84 (14.91) Rosemary Conley 49.76 (14.51) Size Down 48.75 (15.63) General Practice 50.48 (13.79) Pharmacy 48.94 (15.82) Choice 47.45 (14.35) Exercise/Comparator49.67 (13.83) Weight Watchers 28% male Slimming World 35% male Rosemary Conley 31% male Size Down 36% male General Practice 33% male Pharmacy 27% male Choice 30% male Exercise/Comparator 25% male	Mean (SD) BMI Weight Wathcers: 33.96 (3.9) Slimming World: 33.83 (3.8) Rosemary Conley: 33.38 (3.5) Size Down: 33.77 (3.9) General Practice: 33.06 (3.5) Pharmacy: 33.44 (3.5) Choice: 33.41 (3.4) Exercise/Comparator: 33.88 (4.4) Mean (SD) starting weight(kg) Weight Watchers: 93.47 (14.15) Slimming World: 94.35 (13.38) Rosemary Conley: 93.72 (13.68) Size Down: 95.47 (17.88) General Pracitce: 92.04 (14.75) Pharmacy: 92.81 (13.71) Choice: 91.72 (12.49) Exercise/Comparator: 93.14 (15.13)

Author	Interventions	Age (Mean, SD) & Gender	BMI (Category, Mean or Range) / Weight (and other weight measures)
	swimming pool, fitness suite, and other sports halls or courts). Participants were not given an appointment to attend and were given no individual advice or support on diet or physical activity.		
Kumanyika SK, et al. 2012[85] RCT U.S. All n = 261 Basic n = 137 Basic Plus n = 124	Think Health! advised a dietary pattern consistent with the US Dietary Guidelines while reducing dietary fat and other sources of calories .The 16 core DPP sessions w ere modified based on a prior DPP adaptation. The DPP initially offered high intensity contact (30–60 min sessions, weekly, for about 6 months, or 8–16 contact hours over 6 months). Contact was then tapered to every-other month at a minimum for the remainder of the first year. By contrast, the moderate-intensity Think Health! condition ("Basic Plus") offered about 2–4 h total contact over an entire year (10–15 min sessions every 4 months with the PCP and similarly brief contacts with a LC monthly. The comparison condition ("Basic") offered only the brief PCP counseling every 4 months and was, therefore, not expected to result in significant weight loss .PCPs were trained to deliver brief counseling sessions, beginning with an initial session at which they gave the participant the manual, reviewed the weight measurement, program goals and session 1–4 handouts, and helped the patient set a short-term, realistic goal to accomplish before the next program-related PCP visit. Visits 2 and 3 with the PCP followed a similar format, focusing on sessions 5–8 or 9–12, respectively. Visit 4 was devoted to a year 1 review but otherwise followed the same format. The LC component was implemented by a medical assistant or other staff member with the appropriate level of interest and interpersonal skill. Staff identified as LCs were trained to conduct sessions following lesson materials for that month and, where applicable, for any prior missed visits. The LC also reviewed weight change from the prior visit, as well as food and activity records, and helped the participant select behavioural goals for the ensuing month.	All 47.2 ± 11.7 years Basic 46.8 ± 11.6 years Basic Plus 47.6 ± 11.9 years NR	BMI (kg/m2) (mean ± s.d.) All: 37.2 ±6.4 Basic: 37.3 ±6.4 Basic Plus: 37.2 ±6.5 Weight (kg) (mean ± s.d.) All: 101.2 ±19.9 Basic:101.6 ± 20.9 Basic Plus: 100.7 ±18.7 Waist circumference (cm) (mean ± s.d.) All: 111.4±15.1 Basic: 110.6±15.6 Basic Plus: 112.2±14.6
Martin PD, et al. 2008[86] RCT U.S. n= 137	Physician training—All physicians received 2 h of instruction on general obesity treatment, as outlined by the National Heart, Lung, and Blood Institute's clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults . The four physicians providing tailored interventions received an additional 5 h of training, which addressed the assessment of stage of change, motivational interviewing, and techniques for the behavioural treatment of obesity. Training also included instruction on appropriate dietary recommendations, such as ways to reduce dietary fat intake, appropriate fruit and vegetable intake, how to read food labels, and how to modify recipes.	41.8 ± 12.0 years Intervention: 40.8 (12.7) years Standard Care: 42.6 (11.4) years NR	BMI (kg/m2) Intervention: 38.3 (7.5) Standard care: 39.8 (7.8) Weight (kg) Intervention: 101.2 (20.6) Standard care: 103.4 (18.0)

Author	Interventions	Age (Mean, SD) & Gender	BMI (Category, Mean or Range) / Weight (and other weight measures)
	Tailored interventions were derived from information provided by participants during the initial assessment. Participants in the tailored intervention group received five physician-counseled office visits on a monthly basis. Topics of the monthly meetings included introductory information on weight loss (month 1), ways to decrease dietary fat (month 2), ways to increase physical activity (month 3), dealing with barriers to weight loss (month 4), and healthy alternatives when eating out and shopping (month 5). They also received one maintenance session at month 6, which addressed ways to stay motivated during weight loss efforts. Each visit lasted ~15 min, resulting in a total of ~90 min of physician–patient contact. Physicians received protocols for each monthly visit, and participants received both oral recommendations from their physician as well as handouts summarizing the focus of each visit. Tailored intervention participants received messages consistent with standard weight loss protocols, including gradual increases in physical activity with a goal of 150 min per week, decreased consumption of energy-dense foods, and increased consumption of fruits and vegetables. Both dietary and physical activity recommendations were personalized for participants based on their activity and food preferences, physical and environmental limitations, normal eating patterns, and caloric intake requirements needed to achieve weight loss. Participants received culturally specific menus and recipe books as well. In comparison, standard care participants received no special instructions regarding weight loss and were seen as needed for regular medical care. Physicians providing standard care had received training on current guidelines for the treatment of obesity though no specific weight loss protocol was provided for physicians to use with study participants. Standard care physicians were instructed to provide their usual obesity management conducted during a typical office visit. It was ultimately up to the physician (in collaboration with his/her patients) to determine how much (if any) weight loss counseling was included in primary care encounters during the study.		
Martin, P.D., et al. 2006[87] RCT U.S. Standard care n = 73 Tailored intervention n =71	Physician Training: All physicians, regardless of treatment condition, initially received 2 hours of instruction on general obesity treatment, as outlined by the National Heart, Lung, and Blood Institute clinical practice guideline on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults. The four physicians providing tailored interventions then received an additional 7 hours of training, which addressed the assessment of stage of change, motivational interviewing, and techniques for the behavioural treatment of obesity. This training also included instruction on appropriate dietary recommendations, such as ways to reduce dietary fat intake,	Standard care 42.97 ±11.38 years Tailored intervention 40.69±12.59 years NR	BMI, mean ± SD, kg/m2 Standard care: 39.59 ± 7.72 Intervention: 38.09 ± 7.52 Weight, mean ± SD, kg Standard care: 103.0 ± 17.95 Intervention: 100.86 ± 20.8 Waist, mean±SD, cm Standard care: 111.71±14.32 Intervention: 108.83 ± 15.03

Author	Interventions	Age (Mean, SD) & Gender	BMI (Category, Mean or Range) / Weight (and other weight measures)
	appropriate fruit and vegetable intake, how to read food labels, and how to modify recipes. Tailored Intervention: Participants in the tailored intervention group received six monthly active treatment visits during which their physician delivered the intervention. Each visit lasted 15 minutes. Physicians received protocols for each monthly visit, and participants received both oral recommendations from their physician and handouts summarizing the focus of each visit. The treatment materials delivered by the physician were individually prepared and tailored to each patient by a multidisciplinary research team consisting of the physician, a health psychologist, a registered dietitian, and an exercise physiologist.		
McTigue KM, et al. 2009[88] Controlled Cohort Study U.S. Total n = 155 Enrolled n = 72 Nonenrolled n = 82	A 12-session, group-based version of the DPP lifestyle curriculum (versus the original 16 sessions delivered via one-on-one counseling) was implemented. WiLLoW sessions are led by the clinic's nurse educator. Each session includes discussion of a specific content area and provides opportunities for participants to share their personal experiences. Relevant demonstrations (eg, healthy portion sizes, food labels) accompany most lessons. Behavioral techniques include goal setting, self-monitoring, and problem solving. For participants who want continued support, monthly phase 2 sessions are offered. Eight phase 2 lessons were assembled, adapted from supplemental DPP materials, and they were presented to the participants interspersed with moderated support sessions in which participants share their challenges and successes. Because major health insurers in the region do not cover obesity treatment, the program is available on a fee-for-service basis, with a charge of $100 for the first 12 weekly sessions and $50 for each set of 6 phase 2 sessions.	Total: 49.91 (1.46) years Enrolled: 53.01 (1.34) years Nonenrolled: 47.18 (1.46) years NR	BMI Mean: kg/m2 Total: 39.65 (0.73) Enrolled: 38.89 (0.96) Nonenrolled: 40.3 (1.08) Weight Category 10% Overweight; 24% Class I; 25% Class II; 41% Class III
Tsai, A.G., et al. 2010[89] RCT U.S. Control n = 26 Brief Counseling n = 24	Control group. Patients in the Control group met quarterly with their PCPs during the 1-year study. At these visits, patients were provided 1–2 page handouts developed by the Weight-Control Information Network of the National Institutes of Health. They also received a calorie counter, a pedometer, and a sample meal plan. PCP visits were routine clinical encounters that were billed fee-for-service. Because obesity is not a billable diagnosis for most insurance plans, the large majority of the visit was spent on other diagnoses. Thus, the weight management component of each PCP visit lasted ~2–3 min. PCPs were instructed to encourage patients to lose weight, using the materials provided, but they did not give participants specific behavioural strategies for weight management. Brief Counseling group. Patients in this group had the same schedule of PCP visits and received the same materials as individuals in the Control group. In addition, these participants received a series of eight brief (15–20 min) individual visits with a MA at weeks 0, 2, 4,	Control: 47.6 ± 2.5 years Brief Counseling: 51.3 ± 2.3 years NR	BMI (kg/m2) Control: 37.6 ± 1.1 Brief Counseling: 35.4 ± 1.2 Weight (kg) Control: 103.1 ± 3.5 Brief Counseling: 97.0 ± 3.4 Waist (inches) Control: 45.1 ± 1.1 Brief Counseling: 43.3 ± 1.1

Author	Interventions	Age (Mean, SD) & Gender	BMI (Category, Mean or Range) / Weight (and other weight measures)
	8, 12, 16, 20, and 24. Visits were conducted by the MAs using handouts adapted from the Diabetes Prevention Program. Patients were instructed to consume 1,200–1,500 kcal/day (if <250 lb) or 1,500–1,800 kcal/day (if ≥250 lb), to keep daily records of their food intake (in diaries provided), and to gradually increase their physical activity to 175 min/week (e.g., by walking). Patients were weighed at each visit and then reviewed their food and activity records with the MA. MAs called patients who missed visits. These visits could be made up in person (if completed before the following month's visit) or by phone. Most missed visits were made up in person, and a small number (<15) occurred by phone. Transportation to visits was not reimbursed. However, patients were provided an honorarium of $50, upon completing their final outcomes assessment, which could be used to cover travel expenses.		
Read A, et al. 2004[90] Non-RCT U.K. N=216 at initial assessment	Seven 2-hour education and support group sessions were run by the dietitian at intervals of 2 weeks. Further 2-hour sessions were delivered at 4 months, 6 months, 9 months, and 12 months. Each session commenced with a confidential 'weigh in' and refreshments, followed by a topic presentation. A variety of teaching methods were used to encourage patient participation, and each session concluded with patients being guided in setting themselves personal aims. The topics covered in each session are outlined in Box 1. Each patient was given a personal folder for information handouts and progress sheets.	50.4 (12.4) years 25.9% male	BMI (kg/m2): 39.7 (6.9) Weight in kg: 108.0 (20.0); range: 68.2–175.0 Waist measurement (cm): 120.1 (14.0); Range 91.4–160.0 Percentage body fat: 45.4 (6.9)
Bolognesi M, et al. 2006[91] RCT Italy N=96 (experimental group n = 48; usual-care control group n = 48)	The PACE protocol is an innovative method of physical activity counseling (9,10,12) incorporating objectives of the U.S. Department of Health and Human Service's Healthy People 2000. It is based on the stages-of-change model and includes preliminary assessment and subsequent standardized protocols that help to increase the adoption, frequency, and adequacy of exercise counseling within primary care (11). The GPs should spend less effort with precontemplators and individuals in the active stages (action and maintenance) and should devote most of their attention to those individuals who are ready to adopt physical activity (contemplation and preparation). Because these patients are ready to change their behaviour, they need more assistance. Before seeing the counselor, the patient is given a PACE assessment form, which takes 1 min to complete. The PACE protocol requires about 2 to 5 min of interaction between counselor and patient and is recorded in the patient's medical chart. In addition, a 2- to 3-week follow-up is conducted, by telephone or through the mail, focused on reinforcing the themes within the stage specific protocol. On the basis of the stage chosen on the PACE assessment form, a specific counseling protocol is followed. The individual protocols are used to offer advice tailored specifically to the patient's stage of readiness. For patients classified as precontemplators (who are not active and not ready to change), the protocol "Stand Up From the	Range: 21 to 70 years Total: 46.9% male Control: 37.5%; Experimental Group: 56.3%	Baseline BMI (kg/m2) - Mean (SD) Male: Control 31.86(0.82); Intervention 30.26(0.67) Female Control 30.69(0.64); Intervention 30.61(0.76) Baseline - Abdominal Girth (cm) - Mean (SD) Male: Control 109.72(2.92); Intervention 108.81(2.38) Female: Control 104.42(2.26); Intervention 104.43(2.70)

Author	Interventions	Age (Mean, SD) & Gender	BMI (Category, Mean or Range) / Weight (and other weight measures)
	Chair" is used. This protocol allows the counselor and the patient to detect the barriers of physical activity adoption, in order to overcome them. The counselor tries to increase the pros of change, providing clear explanations on the advantages and beneficial effects of exercise (19). The goal for precontemplators is a consideration of the adoption physical activity. The protocol "Planning the First Step" is used for contemplators or preparers (not regularly active, but ready to change). Patients are asked to plan a realistic physical activity program, specifying the kind of physical activity and the time, place, and support they need. It is also useful to identify the potential barriers, so that the counselor may take steps to decrease the cons (19). Once the physical activity plan is devised, both patient and counselor sign their names, thus declaring their willingness to carry it out, and they start to devise the follow-up. Patients are provided with a diary in which they are asked to record the kind of physical activity in which they engage and the time devoted to it, plus any obstacles that arise. The goal for contemplators and preparers is to adopt regular physical activity. The third protocol, called "Keeping to the Objectives," is used for active individuals, who are congratulated and provided with useful information for physical activity maintenance and injury prevention. For people in this stage, the most important task is to prevent relapse through the development of strategies to overcome the possible barriers (19). The goal for people in the action and maintenance stages is to maintain their physical activity quantitatively and increase their activity qualitatively.		
Ter Bogt, N.C.W. et al. 2009[92] RCT Netherlands N=457	In the intervention group, four individual visits to a nurse practitioner (NP) and one feedback session by telephone were scheduled for lifestyle counseling with guidance of the NP using a standardized computerized software program. The control group received usual care from their general practitioner (GP). The NPs (contracted by the GPs) followed a specially developed training program (four sessions of 4 hours each) and received individual instruction about the software program. The lifestyle intervention consisted of four individual visits and one feedback session by telephone in the first year. During these contact sessions, the NP was guided by the standardized computerized software program that contained instructions on lifestyle counseling defined by international guidelines (4,5) and allowed data entry of the measurements.	NP Group: 55.3(7.7) years; GP-UC Group 56.9(7.8) NP Group = 50.2% male; GP-US group = 46.1% male	BMI ≥30 kg/m2 (cm), M (SD): NP group = 79 (35.1); GP-UC group = 85 (36.6) BMI (kg/m2) M (SD): NP group = 29.5 (3.1); GP-UC Group = 29.6 (3.6) BMI Range = 25–40 kg/m2 Waist circumference for men (cm), M (SD): NP group = 104 (7.8); GP-UC group = 105 (9.5) Waist circumference for women (cm), M (SD): NP group = 97 (9.8); GP-UC group = 97 (11.8)

Pediatric Population

Author, Year / Study Design / Country / Sample Size	Intervention	Age (Mean, SD), Years & Gender (male)	BMI (Category, Mean (SD) or Range)
Marild S, et al. 2013[93] RCT Sweden N=127	Both treatment arms had a total of 12 appointments. (NDT) A paediatric nurse and a dietician were responsible for this treatment option, the nurse offering 8 visits and the dietician offering 4 visits during 12 months (12 visits in total). Ten sessions were in an individual setting, and two were arranged as group meetings with cooking and advice about buying food. Key messages were: to eat breakfast; to eat at regular times; to eat meals together with the family; and to reduce processed sugar of any kind, especially in soft drinks. (NDPT) This programme was designed to put a special emphasis on physical activity. A physiotherapist was engaged to highlight this component, substituting for the nurse in the NDT programme at 4 of the 12monthly appointments, i.e. each professional had 4 visits or one-third of the 12 sessions. The following elements were discussed and introduced by the physiotherapist using a stepwise approach: • Stimulate the child to reach the recommended duration of 60 min of daily moderated and vigorous intensity physical activity. • Use pedometers for motivation. • Make use of a special diary to register the daily number of pedometer steps, sport activities, inactivity and screen time. Registrations were used to set individual goals and stepwise improve the level of physical activity. • Change transportation to and from school from passive to active (i.e. walking or cycling). • Stimulate the child to participate in physical exercise lessons at school and to have three occasions each week with some kind of special training. • Reduce inactivity; a maximum of 3 h in front of the television or computer was recommended throughout 1 year. The duration of each treatment session was approximately 60 min.	Normal weight: 11.1 (1.08) years overweight: 11.1 (1.10) obesity 10.7 (1.21) Non-intervention group of children with obesity: 10.8 (0.91) Female, n(%) normal weight: 17 (59%) overweight: 15 (56%) Obesity: 30 (55%) Non-intervention group of children with obesity: 77 (56%)	BMI, kg m-2 A(Children with normal weight) 18.1 (1.83) B (Children with overweight) 23.2 (2.01) C(Children with obesity) 29.2 (3.28) D(Childrenwith obesity n) 29.2 (3.27) BMI Range: A: 14.7–21.6 B: 19.9–27.4 C: 23.1–37.3 D: 24.9–41.6 Weight, kg normal weight: 39.8 (7.85) overweight: 55.7 (8.11) obesity: 68.9 (14.18) Non-intervention group of children with obesity: 67.4 (13.57) Waist circumference, cm Normal Weight: 67.4(6.51) Overwieght: 84.3 (6.56) Obesity: 95.5 (11.0)
DeBar LL, et al. 2012[94] RCT U.S. N=208	The teen intervention compromised 90-potential barriers to success. In addition, parents were encouraged to in-crease or maintain the frequency of family meals, which are associated with improved nutrition and decreased risk for unhealthy weight control practices among youth. To improve interactions with all of their overweight teen patients, pediatric providers received study-sponsored training in motivational enhancement techniques for health behaviour change. This training used the FRAMES approach (provide feedback about personal risk, responsibility of patient, advice to change, menu of strategies, empathic style, and promote self-efficacy) minute group meetings conducted over 5 months. Groups met 16 times, weekly for 3 months and biweekly during months 4 and 5. At each session, teens were weighed and reviewed dietary and physical activity self-	14.1 (1.4) years 0 (all female)	Mean BMI: 97.09 (2.27) Weight, mean (SD), lb Intervention: 189.68 (33.47) Usual Care: 186.4 3 (34.39)

Author, Year / Study Design / Country / Sample Size	Intervention	Age (Mean, SD), Years & Gender (male)	BMI (Category, Mean (SD) or Range)
	monitoring re-cords. If unable to attend a particular session, teens were offered telephone sessions. The multicomponent intervention included the following: (1)change in dietary intake and eating patterns; (2) increasing physical activity by using developmentally tailored forms of exercise (eg, exergaming); (3) addressing issues associated with obesity in adolescent girls (eg, depression, disordered eating patterns, poor body image); and (4) training participants' PCPs to support behavioural weight management goals collaboratively (Table 1). Over the intervention's first 3 months, parents were invited to separate, weekly group meetings, during which staff explained the nutritional and physical activity principles the teens would learn so that parents could help support their daughters.		
Hystad HT, et al. 2013[95] RCT Norway N=99	The focus of both the TLG and SHG interventions was to establish regular mealtimes, increase the intake of fruits, vegetables and other high-fibre food, reduce the intake of added sugar and fat, conduct at least 1 h of moderate physical activity per d and reduce sedentary behaviour gradually, towards a maximum of 2 h per d. The main focus of the TLG sessions was to enhance the parents' competence to accomplish the targeted lifestyle changes. A detailed treatment manual was devised. A total of ten sessions were conducted with the following topics: expectancies and goal setting; communication about obesity, diet and physical activity; daily physical activity; everyday dietary habits; mastery and motivation; guidance and setting boundaries; the role of siblings and the social network; parent's history of diet and physical activity; self-concept and body image; vacations and birthday parties. The SHG were based on the principle of mutual help, derived from the participants' own experiences and know-ledge. A health professional attended the two first and the last meeting to organise the group and facilitate group rules, but did not offer any education or guidance regarding how to reduce adiposity. All children, regardless of their parents' group affiliation participated in age-matched groups of six to twelve children led by a clinical dietitian and a physiotherapist. All families attended five individual counsel-ling sessions with a clinical dietitian and a physiotherapist to discuss the family's progress and to define new goals.	10.2 (1.7) years 51.5% male	Mean BMI: 28.6 (4.0) Weight (kg): 62.3 (15.9) Waist circumference (cm): 94.8 (11.3)
Arauz Boudreau AD; et al. 2013.[96] RCT U.S. Control n=12; Intervention n=14	The intervention consisted of two components: (1) Power Up classes that educated children and caregivers about healthy behaviours surrounding nutrition, activity, and stress management and (2) culturally sensitive coaching to empower families to incorporate learned behaviours and address both family and social barriers to lifestyle changes. Classes were conducted in five consecutive weekly sessions, with a sixth 3 months later. Coaching began con-currently with the group classes and continued for a total of 6 months; meetings were in-person at the health centre, at the families' home, or by phone.	Control: 10.4 (1.2) years Intervention: 10.2 (1.3) years n=10 male	Child percent BMI Control: 97.8 (3.1) Intervention: 97.3 (2.1) Weight: NR

Author, Year / Study Design / Country / Sample Size	Intervention	Age (Mean, SD), Years & Gender (male)	BMI (Category, Mean (SD) or Range)
Henes ST; et al. 2010[97] Non-RCT U.S. N=109	In 2004, registered dietitians (RDs) in the rural southern community of Pitt County, NC developed a standardized MNT protocol with patient education handouts for the purpose of delivering individualized care to overweight youth in their primary care medical home. This effort is called KIDPOWER. The goals of KIDPOWER were to outline behaviours believed to be important for the prevention of and/or treatment of overweight and obesity including increased consumption of fruits and vegetables; decreased consumption of soda and other sugar sweetened beverages, eating out, and decreased TV viewing time. Based on the limited evidence available and local clinical experience, KIDPOWER was designed to include a 60 min initial session followed by six, 30–45 min follow-up sessions scheduled every 2–4 weeks.	Age: 8.3% 2-5 years; 49.5% 6-11 years; 42.4% 12-20 years 36.7 % male	NR Weight: NR
Ariza AJ; et al. 2012[98] Observational U.S. n=432	Between 2004 and 2007, 5 primary care practices developed obesity clinics specific for their needs: 2 independently and 3 following participation in quality improvement programs. Practices were invited to join this evaluation; 4 participated, including one with 2 locations. The hospital institutional review board approved the study. Semi-structured interviews were used to explore clinic development and processes. Interviews were conducted by 2 individuals who debriefed after each and prepared reports. Preliminary findings were presented to clinicians from all practices. Meeting notes were summarized and themes identified. Summaries from interviews and group discussions were compiled from notes. Medical records of children <18 years seen for a first visit over a defined period, varying by site from 11-29 months due to access issues, were reviewed.	Age at 1st obesity visit, %: 1% <2years; 32% 2-6years; 50% 7-11 years; 18% 12-17 years. 53% male	At the 1st visit, 6% were <85th ; 16% were 85th-94th; and 74% were ≥95th Weight: NR
Taveras EM; et al. 2011[99] RCT U.S. n=445	Participants randomized to usual care received the current standard of care offered by their pediatric practice. This included well child care visits and follow up appointments for weight checks with their pediatrician or a subspecialist (e.g. nutritionist). The overarching model for this intervention was the Chronic Care Model 24 which posits that changes in primary care to produce functional patient outcomes require changes for all members of the practice team (Figure 1). Major components of the intervention involved changes to the health care system. We trained all members of the practice team to play an active role in the intervention. We enhanced the electronic medical record system to assist clinicians with decision support, patient tracking, follow up, scheduling, and billing (Figure 1). We trained the pediatric nurse practitioners to be the key intervening clinicians and to use motivational interviewing (MI) during four, 25 minute, in-person, chronic disease management visits and three, 15 minute telephone calls in the first year of the intervention.	4.9 (1.2) years 52% male	44% in the 85th to 94th percentile; 56% ≥ 95th percentile Mean (SD) BMI: Intervention: 19.2 (2.6) Usual Care: 19.1 (2.0) Weight: NR

Author, Year / Study Design / Country / Sample Size	Intervention	Age (Mean, SD), Years & Gender (male)	BMI (Category, Mean (SD) or Range)
Bocca G; et al. 2012[100] RCT Netherlands n=75	Children and parents in the multidisciplinary intervention pro-gram received dietary advice, physical activity sessions and, for parents only, psychologic counselling. In total, the multidisciplinary intervention program consisted of 25 sessions, together approximately 30 hours in 16 weeks. Children and parents in the usual-care group were followed up by a pediatrician, also during a period of 16 weeks.	4.7 years Intervention: 30.0% male Usual Care: 25.7% male	Mean BMI: Intervention group 21.2 Usual-care group 21.0 Intervention; Mean (SD): Weight, kg: 28.4 (6.3) WC: 64.6(7.1) HC: 69.0(7.9) UAC: 22.6(2.3) Body Fat %: 29.0(7.8) Usual Care; Mean (SD): Weight, kg: 28.1 (6.8) WC: 65.2(8.0) HC: 68.6(7.2) UAC: 22.4(2.4) Body Fat %: 28.6(6.3)
Wake M; et al. 2013[101] RCT Australia n=118	Approximately two months after enrolment, intervention children attended a one hour appointment with a specialist tertiary weight management service at Melbourne's Royal Children's Hospital. The research team then scheduled a "long" appointment (20-40minutes, Medicare Australia Benefits Schedule 36) with the child's general practitioner, to be followed by regular four to eight weekly "standard" consultations (6-20 minutes, Medicare Benefits Schedule 23) to review lifestyle and body mass index progress, identify and solve problems, and set new goals by using brief solution focused techniques.	Intervention: 7.2 (2.3) years Control: 7.4 (2.2) years Intervention: 50% male, Control: 59% male	Mean BMI: Intervention: 22.3 (2.7) Control: 22.8 (3.6) Weight: NR
Vos RC; et al. 2012[102] RCT Netherlands n=79	The multidisciplinary cognitive behavioural treatment of the intervention group consisted of a screening phase (of 3 months), followed by an intensive phase (of 3 months) and booster sessions thereafter for a total period of 2 years. The control group was given an initial advice on physical activity and nutrition. After 1 year, the children in the control group were offered to participate in the multidisciplinary cognitive behavioural treatment.	Intervention: 13.3 ± 2.0 Control: 13.1 ± 1.9 n =18 male (intervention) n =19 male (control)	BMI-SDS Intervention: 4.2 ± 0.7 Control: 4.3 ± 0.6 Weight: NR
Dolinsky DH; et al. 2012[103] Observational U.S. n=282	We conducted a retrospective cohort study of obese children and adolescents (BMI ≥ 95th percentile for age and sex) 11first evaluated in the HLP between October 2006 and December 2008, who were 2 through 19 years of age at their first visit, and who had a follow-up visit in the HLP between the sixth and eighth month after their initial evaluation. We abstracted demographic and anthropometric data from clinical charts and the Duke University Medical Center clinical data warehouse.	Median Age: 11 years 43% male	39% were obese; 61% were severely obese BMI (kg/m2): 32.7 (8.4) Weight: NR

Author, Year / Study Design / Country / Sample Size	Intervention	Age (Mean, SD), Years & Gender (male)	BMI (Category, Mean (SD) or Range)
Ewing LJ; et al. 2009[104] Non-RCT U.S. n= 73 child–parent dyads	The intervention consisted of 11 sessions adapted for the primary care setting from the work of Epstein et al. The first 8 sessions occurred weekly, and the remaining sessions occurred monthly. Thus, the intervention was offered over a 5-month period. During the first 8 sessions, children and their parents met weekly in separate groups. In addition, each child–parent dyad met individually with an interventionist for 10 to 15 minutes to review progress, address specific challenges, and set individual goals for the subsequent week. The 3 monthly follow-up sessions occurred in the pediatric office. Each parent–child dyad met with the nurse educator for approximately 15 minutes to measure weight and discuss successes and challenges that the child and parent had experienced. No monetary incentives were provided for the families. The 8-week group intervention focused on adopting a healthy lifestyle with attention to dietary and physical activity behaviours. The treatment consisted of self-monitoring of daily food intake, physical activity and sedentary behaviour, positive reinforcement, and other evidence-based behaviour change skills. Children and adults received instruction about the nutritional value of foods, appropriate portion sizes, and the use of the Stoplight Food Reference Guide. Additionally parents were coached in effective parenting strategies to help them support their child's behaviour changes.	10.2 years 48% male	4 participants fell in the 85-94 percentile; 69 were in the ≥95 percentile Baseline weight (lb), Mean (SD) Completers: 131.1 (31.3) Noncompleters: 141.2 (36.0)
Wald ER; et al. 2011[105] Prospective Cohort Study U.S. N= 78 children and families entered treatment; 23 children served as quasi-controls.	The intervention was adapted from an evidence informed, family-based behavioural weight management treatment program offered in the primary care setting by health psychologists and master's prepared psychology graduate students supervised by a licensed staff psychologist. Each group of participants met in the office of their own primary care provider. Providing the program in a familiar setting (presumably close to home) and being referred by the primary care provider (a trusted advocate for the child) theoretically overcomes several barriers to family participation. The initial program consisted of 11 sessions: 8 were offered weekly and the remaining 3 at 2- to 3-week intervals over a total of 15 weeks. At the 8 weekly sessions, parents and children each met separately with their own psychologist for 45 minutes. The 8-week group intervention focused on adopting a healthy lifestyle with attention to dietary and physical activity behaviours. In addition to providing a calorie goal for children, behaviour change components of the intervention included: self-monitoring of daily food intake, physical activity and sedentary behaviour, positive reinforcement, and other evidence-based behaviour change skills. Children and adults received instruction about the nutritional value of foods, appropriate portion sizes, and the use of a modified Stoplight Food Reference Guide. Parents were also coached in effective parenting strategies to help them support their child's behaviour changes. After the group session, each parent–child dyad met for approximately 10 to 15	10.6 (Range: 9.0-12.8) years Male/female, n Intervention: 28/50 Quasi-Control: 9/14 Total: 37/64	NR Weight: NR

Author, Year / Study Design / Country / Sample Size	Intervention	Age (Mean, SD), Years & Gender (male)	BMI (Category, Mean (SD) or Range)
	minutes with one of the interventionists to review their individual progress and address problems. Each of the 3 remaining sessions was a 30-minute individual session with the child–parent dyad and the interventionist. After the first 15 weeks, individual meetings were held with the parent and child at 3-month intervals for 2 years to discuss progress. Between 3-month sessions the families received a monthly newsletter that included a message focused on nutrition or physical activity, a list of options for physical activity, one or more recipes, a suggested meal plan for a week, and a fun activity for the children in our community, many of which were free.		
Nguyen B; et al. 2012[106] RCT Australia N= 151	The Loozit group program adheres to Australian clinical practice guidelines for the management of child and adolescent overweight and obesity in its healthy lifestyle recommendations and is based on a cognitive behavioural approach. The 24-month intervention consists of an intensive treatment phase followed by a longer maintenance phase. In phase 1 (baseline to 2 months), participants receive the Loozit group program, which involves seven 75-minute weekly group sessions held separately for adolescents and their parents or caregivers. In phase 2 (2-24 months), adolescents continue to attend booster group sessions approximately once every 3 months during each school term (in total, seven 60-minute sessions, including 2 outcome assessment sessions held at 12 and 24 months). All sessions are facilitated by trained dietitians. In addition, adolescents in one study arm (Loozit and ATC) receive ATC during phase 2 approximately once every 2 weeks in the form of telephone coaching, e-mails, and/or short message service text messages (total of 32 electronic messages and 14 telephone coaching sessions).	Total Sample: 14.1 (0.9) years 48.3% male	Mean BMI: Total Sample: 30.8 (3.9) Loozit Only: 30.8 (3.5) Loozit and ATC Group: 30.8 (4.2) Weight, kg: Total Sample: 83.2 (14.4) Loozit Only: 82.4 (12.4) Loozit and ATC Group: 84.2 (16.3) Waist Circumference: Total: 96.5(10.9) Loozit: 95.6 (9.8) Loozit +ATC: 97.4 (12.0)
Wake M, et al. 2009[107] RCT Australia Intervention group n=139 Control group n=119	Intervention design: The intervention had the same components as in the LEAP1trial, designed using an intervention mapping technique within a behavioural epidemiology framework. GPs used a brief, solution focused approach to set and record appropriate, healthy lifestyle goals, assisted by a 16 page “family folder” written at a 12 year old reading level to be sure that virtually all parents could understand it. This folder included five topic sheets, each targeting one area of behavioural change (sedentary time, physical activity, water consumption, family eating habits, and lower fat options for food). Each sheet summarised supporting evidence, modelled solutions to challenges, and made suggestions as to how each goal might be reached. Intervention delivery: Before the first appointment, the GP received the child’s named intervention materials, BMI, and a two page summary of parent responses from the baseline questionnaire regarding current nutrition, physical activity patterns, and concern regarding their child’s weight status. Parents were offered four consultations over a 12 week period. Visit date, content discussed,	Intervention group 7.4 (1.4) years Control group 7.6 (1.4) years NR	BMI Category: Intervention Group: 75% overweight, 25% obese Control group: 78% overweight; 22% obese Mean (SD) BMI Intervention group: 20.2 (2.3) Control group: 20.3 (1.9) Weight: NR

Author, Year / Study Design / Country / Sample Size	Intervention	Age (Mean, SD), Years & Gender (male)	BMI (Category, Mean (SD) or Range)
	and contracts made were recorded on a LEAP2 form in the child's medical record. If any "non-LEAP2" visits occurred, the GP was asked to reinforce any LEAP2 strategies previously discussed.		
McCallum Z, et al. 2007[108] RCT Australia Total n=163	Intervention design: When developing the intervention, modifiable behavioural determinants of obesity were identified using an intervention mapping approach, in which known and theoretic barriers and facilitators of change were identified and explicitly translated into a concrete and practical intervention. 14 GPs used a brief solution-focused approach10 to set and record appropriate, healthy lifestyle goals with the family, assisted by a personalized 20-page 'Family Folder' designed at a 12-year-old reading level and previously piloted. This included seven topic sheets, each targeting one area of behavioural change required to reduce overweight and comprising a brief summary of supporting evidence, modelled solutions to challenges and additional suggestions as to how each goal might be reached. Intervention delivery: Intervention families were notified by telephone and assisted in making the first doctor's appointment. Before this appointment, the LEAP team provided the GP with the child's personalized intervention materials, BMI and a two-page summary of parent responses extracted from the baseline questionnaire regarding current nutrition, physical activity patterns and concern regarding their child's weight status. Parents were asked to attend four consultations over a 12-week period. GPs did not routinely weigh or measure children at these visits, as the intervention focused on behavioural change rather than weight change. Visit date, content discussed and contracts made were recorded on a LEAP form in the child's medical record. If any 'non-LEAP' visits occurred (e.g. acute care consultations), the GP was also asked to briefly encourage and reinforce any strategies previously discussed.	Total 7.4 (1.6) years Intervention group 7.5 (1.6) years Control group 7.4 (1.6) years NR	72% were overweight; 28% were mildly obese (Intervention – 70% overweight; 30% mildly obese; Control: 74% overweight; 26% mildly obese) BMI, mean (SD) Total: 20.3 (2.0) Intervention Group: 20.5 (2.2): Control Group 20.0 (1.8) Weight: NR
Schwartz RP, et al. 2007[109] RCT U.S. n= 91	The study had 3 arms: (1) control (standard care); (2) minimal intervention (physician only); and (3) intensive intervention (physician and RD). Pediatricians and registered dietitians in the intervention groups received motivational interviewing training. Parents of children in the minimal intervention group received 1 motivational interviewing session from the physician, and parents of children in the intensive intervention group received 2 motivational interviewing sessions each from the pediatrician and the registered dietitian.	Control group:, 5.3 years Minimal and intensive groups: both mean ages, 4.7 years 41% male	57% of the children met the criteria of BMI at the 85th percentile or greater but below the 95th percentile for age with or without an overweight parent. The remaining 43% qualified by having a BMI at the 50th percentile or greater but below the 85th percentile and having a parent with a BMI of 30 or greater Weight: NR

Author, Year / Study Design / Country / Sample Size	Intervention	Age (Mean, SD), Years & Gender (male)	BMI (Category, Mean (SD) or Range)
Korsten-Reck U, et al. 2005[110] Non-RCT Other n = 31 groups comprising 496 children	The program consisted of regular physical exercise (three times a week) plus comprehensive dietary and behavioural education. A manual and audiovisual materials were used. During the program, there were no changes in the team personnel, which consisted of a physician, a nutritionist, a sports teacher and a psychologist. At 4- to 6-week intervals during the 8-month program, seven information sessions with parents and seven with their children were held. At these meetings, staff members gave parents theoretical and practical information on obesity and nutrition and answered individual questions. Children were separately given the same basic information. Questionnaires concerning nutrition (food frequencies) and behaviour were regularly completed.	Boys: 10.6 (1.5) years Girls 10.5 (1.6) years 46% male	BMI >97th percentile, or 90th–97th with a somatic comorbidity or one overweight parent Weight: NR
Golley RK, et al. 2007[111] RCT Other N=111	Parenting skills training with intensive lifestyle education (P + DA) and parenting-skills training alone (P). These interventions were compared with each other and with a control group wait-listed for intervention for 12 months (WLC). All intervention sessions were conducted by the same dietitian who had developed the lifestyle education component and undertaken accredited training for the parenting component. The mode of both interventions was "parent only," with parents having sole responsibility for attending program sessions and implementing family lifestyle change. Children did not attend any education sessions, and families were encouraged to implement change at the family, not child, level.	All: 8.2 ± 1.1 years Boys: 8.6± 1.0 years Girls: 7.9 ± 1.2 years 37% male	Mean BMI: All: 24.3 ± 2.6 Boys: 24.5 ± 2.8 Girls: 24.1 ± 2.5 . BMI, z score All: 2.75 ± 0.52 Boys: 2.84 ± 0.43 Girls: 2.70 ± 0.56 Mean ± SD Weight, kg All: 45.6 ± 9.0 Boys: 48.7 ± 10.1 Girls: 43.8 ± 7.8 Mean ± SD Waist circumference, cm All: 77.3 ± 7.3 Boys:80.0 ± 7.5 Girls: 75.8 ± 6.8 . Waist circumference, z score All: 3.20 ± 0.65 Boys: 3.53 ± 0.67 Girls: 3.02 ± 0.57
Savoye M, et al. 2007[112] RCT U.S. N=174	Participants were randomly assigned to either a control or weight management group. The control group (n=69) received traditional clinical weight management counseling every 6 months, and the weight management group (n=105) received an intensive family-based program including exercise, nutrition, and behaviour modification. Intervention occurred biweekly the first 6 months, bimonthly thereafter. The second randomization within the weight management group assigned participants (n=35) to a structured meal plan approach (dieting), but this arm of the study was discontinued while enrollment was ongoing due to a high dropout rate.	Weight Management Group: 11.9 (2.5) years Control Group: 12.4 (2.3) years Weight Management Group: 43.8% male Control Group: 31.8% male	Mean BMI: WMG: 35.8 (7.6) Control: 36.2 (6.2) Weight, kg WMG: 87.0 (25.1) Control: 91.2 (23.3) % Body Fat: WMG: 47.0% Control: 45.8%

4 Evidence Table of Included Studies: Outcomes

Adult Population

Author	Primary outcome results / Effectiveness	Acceptability / Appropriateness	Limitations
Wadden TA, et al. 2011[70] RCT U.S.	The principal finding of this study was that PCPs, collaborating with medical assistants, helped one group of their obese patients lose an average of 4.7% of their initial weight at 24 months. This loss, which was accompanied by improvements in cardiovascular risk factors, was achieved with enhanced brief lifestyle counseling, which combined quarterly PCP visits, brief lifestyle coaching delivered monthly, and the use of meal replacements or weight-loss medication. Thirty-five percent of the participants assigned to this intervention lost 5% or more of their initial weight, which is a common criterion for clinically meaningful weight loss.	Participants in the usual-care, lifestyle-counseling, and enhanced-lifestyle-counseling groups attended 71.8±28.6%, 69.0±29.1%, and 76.7±27.4% of the 8 scheduled PCP visits, respectively. The frequency of attendance (across groups) declined from year 1 (81.7±24.9%) to year 2 (61.0±39.2%) (P<0.001). Participants in the lifestyle-counseling group and those in the enhanced-lifestyle-counseling group attended 56.1±28.8% and 64.7±25.8% of the 25 scheduled coaching visits, respectively. Attendance was higher in the enhanced-lifestyle-counseling group than in the lifestyle-counseling group (P = 0.01) and declined across both groups from year 1 (72.1±25.4%) to year 2 (45.6±35.2%) (P<0.001).	Limitations included the provision of free treatment enhancements (which may limit the generalizability of the results); the need for longer follow-up; and the withdrawal of sibutramine from the market, which clouded interpretation of the findings for the group of participants who received enhanced brief lifestyle counselling.
Werrij MQ, et al. 2009[71] RCT Netherlands	The main finding of the present study is that adding cognitive therapy to a dietetic treatment for obesity is associated with long-term weight (loss) maintenance in this group. The pattern of findings clearly shows that the usual weight regain after behaviour treatment [12–14] did occur in participants treated by the exercise dietetic treatment, but not in those who received the cognitive dietetic treatment. Although the absolute weight loss was not excessive (4.1% and 4.3%), this was almost in line with our goals (modest weight reduction of 5–10%). Hypothesis 1. The treatment effectiveness analyses showed significant main effects of time on dysfunctional thinking. In sum, both the CDT and the EDT interventions were quite successful in reducing the belief in dysfunctional thoughts. Hypothesis 2. In sum, both the CDT and the EDT interventions were quite successful in reducing shape-, weight- and eating concerns, and eating psychopathology, and in improving mood and self-esteem. Hypothesis 3. The treatment effectiveness analyses showed significant main effects of time: after treatment, eating restraint was increased and binge eating was reduced. However, again none of the short-term Time×Treatment interactions was significant, showing that CDT and EDT did equally well in reducing binge eating and inducing more eating restraint. Hypothesis 4. Thus, although both groups lost a significant amount of weight, this weight loss was close to, but somewhat less than, the predicted and	Participants in the EDT rated treatment suitability significantly higher than participants in the CDT, both at Session 2 [t(185)=2.9, P<.01] and at Session 10 [t(161)=2.2, P<.03]. Inspection of the means reveals that both treatments were considered suitable [Session 2 (mean): CDT=6.8; EDT=7.4 on a nine-point scale; Session 10: CDT=6.6, EDT=7.3). Although the treatment suitability of the exercise dietetic treatment appeared to be significantly higher than the treatment suitability of the cognitive dietetic treatment, the dropout analysis revealed a selective dropout with increasing chances of dropping out of the exercise dietetic treatment. This might mean that before treatment the participants expected less of the cognitive intervention than of physical exercise, but during treatment, they were better able to carry on cognitive therapy than physical exercise. This is an extra argument to implement cognitive therapy into the regular dietary practices of obesity treatment.	NR

Author	Primary outcome results / Effectiveness	Acceptability / Appropriateness	Limitations
	desired 5%. However, participants who received cognitive therapy maintained their weight loss in the long-term, whereas the physically exercising participants partially relapsed, as the long-term significant weight increase after EDT demonstrates. To sum up, the main difference in the long run between both treatments is that cognitive therapy prevented long-term weight relapse and led to long-term reduced eating and weight concerns, whereas the exercise therapy showed partial relapse in weight and in the concerns related to eating and weight.		
Rodondi N; et al. 2006[72] Observational Switzerland	A total of 65% of patients received some form of counselling on weight reduction, whereas 35% received no advice at all (Table 2). Physicians utilized few strategies with a median score of 2 out of 10 (25–75%: 0–4). They infrequently recommended weight loss and physical activity (38–44%), informed on health risks (32–38%) or assessed motivation to lose weight (33%). After 1 year, patients who received any form of counselling lost on average (SD) 1.0kg (5.0), whereas those who received no counselling gained 0.3kg (5.0) (P= 0.02) (Table 3). The mean weight loss increased with the number of strategies used by their physician (P for trend 0.007) (Fig. 2). After adjustment for demographics, cardiovascular risk factors and baseline BMI, each additional strategy was associated with a mean weight loss of 0.2kg (95% CI 0.03–0.4,P= 0.02). Patients counselled by their physician were more likely to report at least one behaviour change to reduce weight (82 versus 62%). They had more often set a target weight (56 versus 36%), or visited a dietician (23 versus 10%, all P< 0.001). They also tended to modify their diet to lose weight and to read self-help material about weight loss. Patients' counselling expectations were high, ranging from 87% who expected to receive recommendations about physical activity to 96% who expected information about dietary changes (data not shown).	Patients' counselling expectations were high, ranging from 87% who expected to receive recommendations about physical activity to 96% who expected information about dietary changes (data not shown). There was no difference in expectations between counselled and non-counselled patients (all P >0.2).	• Recall bias and self-reporting about counselling and weight might have influenced the results.
Molenaar EA; et al. 2010[73] RCT Netherlands	In the present randomized clinical trial, conducted in a multidisciplinary primary care setting, we found that adding exercise counselling by a physiotherapist did not significantly enhance the effect on weight, while a small additional beneficial effect on waist circumference may be present. Participants in the D and D + E group lost statistically significant more weight than those in the control group.	Twenty-four participants (18%) did not complete the 6-month intensive intervention period and an additional nine participants (7%) dropped out during the 6-month follow-up period (Fig. 1). Participants dropped out of the study because of personal reasons (n=14), unmet expectations of the counselling sessions (n=6), medical reasons (n=6), unknown reasons (n=6) or logistic problems (n=1). The relatively small reductions in weight in our study may be partly explained by the fact that participants did not sought weight loss on their own initiative but were approached by their primary care physicians.	• The attrition rate in our study (25% at 12months) may potentially bias the results. • Another limitation is that the control group was not randomly selected. • This trial was carried out in a multidisciplinary primary care setting, which may not be available in all countries.

Author	Primary outcome results / Effectiveness	Acceptability / Appropriateness	Limitations
Noel PH; et al. 2012[74] Observational U.S.	"The covariate-adjusted BMI trend of patients who received "intense-and-sustained" obesity-related counselling did not significantly differ from those who had "intense-only" (−0.04 BMI units per year; P= 0.43) or "irregular" obesity counselling (−0.04 BMI units per year; P=0.22; Ta b l e 2). In contrast, patients who received "no counselling" or only "limited" obesity-related counselling had significantly lower baseline BMI values (i.e., their baseline BMIs were significantly lower by 0.21 BMI unit; P= 0.01 for both groups) and a significantly lower rate of increasing BMI (i.e., their BMIs increased at a significantly lower rate: 0.12 BMI unit less per year for the "no counselling" group and 0.08 BMI unit less per year for the "limited" group; P< 0.01 for both groups), compared with patients who received "intense-and-sustained counselling." When obesity-counselling–by–age group interaction terms were added to the GEE model, the association between BMI trend and "intense-and-sustained" obesity-related counselling differed significantly between the oldest age group (73+ years old) and those who were in their 50s or 60s. Whether compared with "limited counselling" or "no counselling," the difference in the adjusted rate of annual BMI change for those who received "intense-and-sustained counselling" was significantly greater in the oldest age group compared with those 50–60 years old (−0.25 BMI units vs. −0.23 BMI units per year, respectively) or those 61–72 years old (−0.23 BMI units vs. −0.22 BMI units per year, respectively)."	NR	• Reliance on heights and weights recorded during routine clinical practice, which may contain some data entry errors or other measurement errors. • Our inability to capture potentially important confounders from the administrative data, such as socioeconomic status, education level attainment, and employment status, is another limitation that must also be acknowledged. • Because clinicians' notes are not captured in the VHA's national administrative data, we were not able to identify any instances of brief physician counselling that may have occurred during routine visits or of patients' reports of using commercial weight-loss programs or self-directed weight-loss attempts. • Another major study limitation is our inability to assess patients' levels of motivation and social support, which clearly play important roles in deter-mining patients' adherence and response to obesity care.
Ely AC; et al. 2008[75] RCT U.S.	The day 90 mean ± SD weight change for the active arm and control arms, respectively, was −4.5 ± 7.7 pounds and −2.4 ± 8.1 pounds (P=.27 for difference). The day 180 mean ± SD weight change for the active and control arms, respectively, was −9.4 ± 10.3 pounds and −2.1 ± 10.7 pounds (P=.01 for difference). We found that active arm participants lost more weight than the control arm, although the changes were not significantly different either clinically or statistically at day 90. We are encouraged that participants who completed the intervention showed a significant weight loss at day 180 (−7.3 pounds compared with control, P<0.05). Nonetheless, the high recidivism (i.e., only 50% response at day 180) renders that estimate inherently biased.	Nineteen participants lost ≥ 5 kg, or 5% body weight on average. Several of these participants revealed that they appreciated the accountability and support provided by the counselling regimen, and that the intervention heightened attention to obesity care in subsequent visits with their primary care doctor. Several participants expressed frustration at their control arm status, and the relative lack of support from the health care team with their weight control efforts. Many participants described needing more intensive interventions for obesity care, and suggested that these be more inclusive. Although we have not formally interviewed providers following the intervention, one physician expressed that the electronic feedback was helpful, and that he appreciated the support that the intervention offered his patients.	• First, our low retention rate at day 90 (63%) and day 180 (50%) renders it difficult to assess the effectiveness of the intervention. • Second, we had much difficulty reaching our target enrollment of 150 persons, which was the projected sample size to detect a 5 kg difference between arms (alpha error .05, 80% power). • Third, generalizability of these findings to other populations must be considered. • Finally, the multifaceted nature of the intervention and the non-significant findings make it difficult to detect which aspects of the intervention are most helpful.
Sherwood et al. 2006[76] RCT	Although on average participants across the study conditions lost weight (i.e., weight loss in each group was significantly different from 0), no statistically significant group differences in weight change were observed at 18 months (Cohen's d, Mail vs UC = 0.03; Phone vs UC =0.04) – or 24-months	NR	NR

Author	Primary outcome results / Effectiveness	Acceptability / Appropriateness	Limitations
U.S.	(Cohen's d, Mail vs UC =0.01; Phone vs UC= 0.03). At 18-months, about 24% of participants lost 5% of their body weight, with almost 10% losing 10% of their body weight. At 24-months, about 13% of participants lost 5% of their body weight, with about 5% losing 10% of their body weight. The cost-effectiveness ratios show that phone counselling appeared to be least efficient at a price tag of $132 in producing 1 kg of weight loss while mail and usual care group achieved similar efficiency of $72 per 1 kg weight loss. Despite room for optimism, our data clearly show that weight-loss efficacy needs improvement. At best, the 24 month results show that the interventions, including those that usual care participants took part in, served as effective weight gain prevention as opposed to weight loss programs.		
Bennett GG; et al. 2012[77] RCT U.S.	Intervention participants had greater 24-month weight losses compared with those receiving usual care (difference, −1.03 kg; 95% CI, −2.03 to −0.03 kg; Table 2). In addition, the intervention promoted larger mean weight losses in 24 months relative to usual care (AUC difference, −1.07 kg; 95% CI, −1.94 to −0.22 kg). The proportion of those who lost at least 5% of their initial body weight during the 24 months was 19.5% for usual care and 20.0% for intervention participants.	At 24 months, intervention participants completed 70.6% of telephone counselling calls; this included 80.4% completion of calls 1 to 6, then 65.0% completion of calls 7 to 12, and then 66.7% completion of calls 13 to 18. Across both self-monitoring platforms, 40.0% of intervention participants tracked their behaviour change goals weekly for at least 50% of trial weeks; 25.0% tracked weekly for at least 75% of trial weeks.	NR
Logue E; et al. 2005[78] RCT U.S.	The mean weight change from baseline for the TM-CD group to the end of follow-up was -0.39 kg (SE = 0.38; 95% CI - 1.1, 0.4). The mean weight change for the AUC group was -0.16 kg (SE = 0.42; 95% CI=-1.0, 0.7). The difference of 0.23 kg greater weight loss in the TM-CD group was not significant (p = 0.50) and had a 95% CI of -1.4, 0.9. The difference after adjusting for baseline weight and other covariates was highly similar at 0.22 kg greater weight loss in the TM-CD group. For the final weight analysis, 70% of patients made their final visits; for another 18% of patients, medical chart weights were obtained for the same period (within 1 month of the 18- to 24-month range). The chart weights correlated 0.99 with measured weights when both were available. A sensitivity analysis of these results substituted baseline weights for the 12% with missing final weights data, i.e., no change was substituted for these 12%. This gave highly similar results, with a 0.21 kg greater weight loss in the TM-CD group. The mean change from baseline for both groups combined was -0.29 kg (95% CI =- 0.9, 0.3). The estimate of the 18- to 24-month weight change difference between the TM-CD and AUC groups was not statistically	NR	NR

Author	Primary outcome results / Effectiveness	Acceptability / Appropriateness	Limitations
	different from zero, and the 95% CI had a narrow range of 1.1 kg on either side of a 0.23 difference in favor of TM-CD. Thus, the data do not support our a priori hypothesis that overweight and obese primary care patients would lose more weight if they were exposed to the TM-CD intervention (plus AUC) vs. AUC alone.		
Alexander SC, et al 2011[79] Other U.S.	Association Between Five A's and Weight Loss When physicians Advised, patients had significantly higher improvements in confidence to lose weight (Mpre=3.7, SE=.07 versus Mpost=4.0, SE=.07) compared to patients in the Not Advised group (Mpre=3.8, SE=.10 versus Mpost=3.8, SE=.10, P =.05). Patients also were more likely to improve their confidence when their physician Assessed (Mpre=3.6, SE=.27 versus Mpost=4.3, SE=.27) compared to patients whose physicians did Not Assess (Mpre=3.7, SE=.06 versus Mpost=3.9, SE=.06, P=.05). We found a significant difference in measured weight loss for patients whose physicians Arranged (Mpre=101.4 kg, SE=3.49 versus Mpost= 99.9kg, SE= 3.51) compared to patients whose physicians did Not Arranged (Mpre= 91.1 kg, SE=.76 versus Mpost= 91.2kg, SE= .76 P=.05). No other differences were found. We report three important findings. Physicians use some components of the Five A's framework to deliver weight loss counselling. Physicians tailor the intensity of their counselling based on patient characteristics. Some components of the Five A's seem to be related to patients changing their behaviours.	Despite receiving little or no formal training in the Five A's for discussing obesity, we found that physicians were using at least some portion of the Five A's technique in most encounters with overweight and obese patients. Physicians seem to tailor their weight loss advice. Encouragingly, physicians provided more comprehensive counselling—used a greater number of Five A's—with heavier patients, who perhaps need it more.	• First, the results may not generalize to younger, lower income patients. • Second, the study was observational. Though we adjusted for a broad set of patient, physician, and visit covariates, unmeasured confounding variables may still account for at least part of the observed associations. • Third, multiple comparisons were done, so significant associations with P values near 0.05 must be interpreted with caution. • Fourth, there were low frequencies found for Assessing, Arranging, and Assisting. Although this is not surprising, the low frequencies of these techniques make it difficult to detect the effectiveness of these techniques on weight loss. • Finally, the analysis is limited by the use of self-reported dietary fat and fiber intake and physical activity measures. A food diary and an accelerometer may have been more accurate; however, such involved measures could invoke changes in behaviour, which would have made the interpretation of results more complicated.
Appel L, et al. 2011[80] RCT U.S.	At 24 months, mean change in weight from baseline: Control: −0.8 kg Remote-Support: −4.6 kg (P<0.001 for comparison with control group) In-Person Support: −5.1 kg (P<0.001 for the comparison with the control group). In this comparative effectiveness trial, in which obese medical patients with at least one cardiovascular risk factor were enrolled, two behavioural interventions — one involving no in-person contact with weight-loss coaches associated with the study or with other participants — achieved clinically relevant weight loss.	In the group receiving remote support only, the median number of completed phone calls was 14 in the first 6 months and 16 for the remainder of the trial. In the group receiving in-person support, most contact with coaches during the first 6 months occurred in face-to-face group sessions. Participation in group sessions, although strongly encouraged, was initially low and declined further over the course of the study. The median number of group sessions attended was 6.5 in the first 6 months and 1 in the next 18 months, and the median number of individual sessions attended was 4 in the first 6 months and 1 in the last 18 months. In the group receiving in-person support only, the median number of phone calls was 4 in the first 6 months and 11 in the last 18 months. Both intervention groups used the Web site frequently. The number of reports reviewed by the PCPs was similar in the two groups. The percentage of participants who dropped out of the intervention	• Its duration, although longer than that of many weight-loss trials, was only 2 years. • Second, the study was a single-centre trial, although it did involve six clinics. • Third, the relative contribution of each component of the interventions (personalized counselling, reinforcement by PCPs, and Web-based support) is difficult to assess. • Fourth, although we collected data on cardiovascular risk factors (in the Supplementary Appendix), we did not design the trial to reconfirm the well-established relationship between weight reduction and improvements in blood pressure, lipid profile, and glucose levels.

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		(defined as having no contact with a coach and no use of study Web site for 2 months) was 5.0% at 6 months and 13.0% at 24 months for the group receiving remote support and 8.7% at 6 months and 15.9% at 24 months for the group receiving in-person support.	
Bennett, G.G., et al. 2010[81] RCT U.S.	Mean (s.d.) weight loss among intervention participants was –2.281 ± 3.21 kg, compared to a mean weight gain of 0.28 ± 1.87 kg in usual care (mean difference: –2.56 kg; 95% CI –3.60, –1.53). Participants randomized to the intervention group lost a greater percentage of baseline body weight (–2.6% ± 3.3%), compared to 0.39% ± 2.16% among those in usual care (mean difference: –3.04%; 95% –4.26, –1.83). More than a quarter of intervention participants (25.6%) and no control participants lost >5% of their initial body weight by the 12-week follow-up. We found that participation in a 3-month moderate-intensity web-based behavioural weight loss intervention with coach support was associated with 3.05 kg greater weight loss among obese, hypertensive primary care patients (completers) than usual care alone. These findings contribute to a growing body of evidence supporting the utility of the Internet as a platform for the delivery of weight loss interventions.	Most intervention participants (80.4%) successfully received all of the coaching sessions within 1 week of their scheduled appointment. Likely given the high adherence rates, we found no association between participation in all (4) coaching sessions and weight loss.	• Though fully powered, our sample size was small, limiting the extent of additional analyses. Our outcomes can be generalized only to patients with Internet access in similarly structured primary care settings. • Our follow-up period was of short duration; trials of longer duration are needed in this setting. Our study design did not allow us to estimate costs of intervention components. • We were also unable to isolate the independent contribution of discrete intervention components (e.g., coaching calls, raffle).
Laws, R. et al. 2004[82] Other U.K.	The Counterweight Programme is an evidence based model to improve obesity management in the primary care setting. Preliminary results indicate that the uptake of the programme into primary care has been well received, with three quarters of practices continuing to recruit patients despite no additional funding being provided. Practices have been successful in implementing a structured approach to care with over 90% of patients receiving one of the core Counterweight interventions of individual or group therapy and over a third of all patients followed up achieving a 5% weight loss or more at 12 months.	Results to date indicate that practices are successfully implementing the treatment model with over 90% of patients receiving one of the core lifestyle approaches, and over 50% of the patients completing the required number appointments.	NR
Jebb, S.A., et al. 2011[83] RCT Germany, Australia & UK	In all analyses, participants in the commercial programme group lost twice as much weight as did those in the standard care group. Mean weight change at 12 months: Commercial: –5·06 kg (SE 0·31) Standard Care: –2·25 kg (0·21) This trial provides important data to inform weight management interventions in primary care. Participants referred to a community-based commercial provider lost more than twice as much weight during 12 months as did those who received standard care, even in the most conservative analyses	NR	• Most participants were women. • As with many other clinical obesity trials, the drop-out rate was high; however, this rate was anticipated in the sample size calculations. • Additionally, the diverse sites, both within and between countries, made introduction of a consistent model of standard care impractical.

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	(BOCF). The similar weight losses achieved in Australia, Germany, and the UK imply that this commercial programme, in partnership with primary care providers, is a robust intervention that is generalizable to other economically developed countries. These results are broadly similar to previous investigations of the commercial programme compared with other community based programmes or self-help treatments.[7,8]		
Jolly, K., et al. 2011[84] RCT U.K.	The primary outcome of weight change at programme end was available for 587 (79.3%) participants, of which 233 (39.7%) weights were self-reported. All programmes, including the minimal intervention comparator group, achieved statistically significant weight loss from baseline to the three month end of programme, with the mean weight loss ranging from 4.4 (SD 4.3) kg (Weight Watchers) to 1.4 (4.1) kg (general practice provision) in the primary analysis (missing data imputed with baseline value). In the between group analyses, only the commercial providers (Weight Watchers and Rosemary Conley) had a statistically significantly greater weight loss and percentage weight loss than the exercise only comparator (tables 3⇓ and 4⇓). The findings did not differ when we adjusted the results for baseline weight, age, sex, or ethnic group. In the sensitivity analysis (with last recorded value used to impute missing data), the arm randomised to Slimming World also achieved a statistically significantly greater weight loss than the minimal intervention comparator in the unadjusted analysis (web appendix). The proportion of participants in each arm who achieved at least 5% weight loss at programme end ranged from 16% to 46% (between general practice and Weight Watchers).	The pharmacy and general practice groups had the highest proportions of participants attending less than 25% of sessions (54% (n=38) and 44% (31)), whereas Weight Watchers and the choice groups had the highest proportions attending 50% or more sessions (70% (70) and 74% (74)). In the open ended feedback, 10participants allocated to Rosemary Conley reported difficulties with completing the exercise part of the classes owing to arthritis and other musculoskeletal problems. We found no evidence that outcomes were worse for men attending the commercial group based programmes. We did assign some of the commercial groups as “male friendly” so that men would know that there would be other male attendees, and in the case of a Rosemary Conley class a group walk was available as an alternative to the group exercise session. Men in the choice arm were more likely to select the NHS programmes, including the group based Size Down programme, possibly because of the female image of the commercial programmes, although almost half did select a commercial programme.	• It was powered only to compare individual programmes with the comparator group, not to make head to head comparisons between programmes. • Where we were unable to get an objective weight measurement, we asked participants to self-report. • The response rate to the invitation was 11.5%. These are likely to be people who were most motivated to change. • Attendance data were provided by the providers of the weight management programmes and could not be independently validated, so they may be subject to some errors. • We could not unpick the elements associated with greater weight loss in people who attended the commercial programmes. This might have been due to the group based approach, the skills and background of the group leaders, the regularity of sessions, or easy booking for the first session and no scheduling requirements thereafter.

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Kumanyika SK, et al. 2012[85] RCT U.S.	Mean 1-year weight change [mean (95%CI) : Basic Plus vs Basic: -1.61kg (-2.68, -0.53) vs. -0.62kg (-1.45, 0.20) (P = 0.15) The present results are encouraging with respect to the acceptability and general feasibility of our intervention as a primary care counselling strategy. However, the findings suggest that Basic Plus is associated with only modest weight loss overall, and with clinically significant weight loss for a relatively small proportion.	A total of 116 (85%) of 137 randomized participants in Basic and 118 (95%) of the 124 participants in Basic Plus initiated treatment by attending at least one visit with a PCP or LC within their first 12 months in the study. More than half (58 and 66%, respectively) of Basic and Basic Plus participants attended at least two of the four possible year 1 PCP visits, and about 40% in each treatment group attended at least three of four visits. In Basic Plus, 44% of participants attended at least five of the possible 13 LC visits. Participant perceptions of the program were obtained from the 62% of participants who attended the annual measurement visit, completed the feedback questionnaire, and had attended at least one treatment visit (referred to as "respondents"): 64% in Basic (n = 88) and 60% (n = 74) in Basic Plus. Responses, which were similar by treatment, confirmed that sessions with PCPs involved distribution of study materials and goal setting. In response to a question asking which of six activities PCPs could do "to help keep you motivated to manage your weight", the most frequent responses, each chosen by about 65% of respondents, were "keep me up to date about how my weight relates to my health" and "encourage me to keep following the program." "Help me with managing stress" and "make it easy for me to schedule appointments for our visits" were each chosen by about one third of respondents. About 20% of respondents also indicated that reviewing some of the information with the PCP could be helpful. Basic Plus respondents were also asked how the LC could help keep them motivated. The three responses offered—providing encouragement, facilitating scheduling, and reviewing some program information—were chosen, respectively, by 74%, 41%, and 30% of respondents. Three-fourths or more of respondents in both treatment groups found the calorie counter useful. More Basic Plus than Basic respondents indicated the usefulness of the binder (87 vs. 71%, P = 0.015), session materials (78 vs. 61%; P = 0.02), additional handouts (61 vs. 46%, P = 0.051), and Keeping Track logs (62 vs. 41%, P = 0.01). About 25% indicated that the audio CD, and 50% that the resistance band, was useful. This was similar by treatment.	• Difficulty of separating research and practice issues related to feasibility and effectiveness. • We also cannot assess the impact of other clinical site or provider variables that might be relevant, such as prior experience with conducting research studies, and other practical implementation issues. • We also cannot assess possible differences in how PCPs counseled participants in Basic vs. Basic Plus (based on their inadvertent knowledge of the participant's randomization assignment) and do not know the degree of individual tailoring that occurred within counselling sessions. • The absence of an unstructured usual care condition limits the ability to estimate the achieved weight loss that would have occurred in the absence of any counselling or in the presence of the counselling that PCPs would have provided if not adhering to the Think Health! protocol. • The participating PCPs were highly motivated to provide weight loss counselling, and some might have otherwise provided a similar level, although differently.
Martin PD, et al. 2008[86] RCT	9-Month follow-up Results indicated that the weight change from baseline of the tailored intervention group (−1.52± 3.72kg) differed significantly from the weight change of the standard care group (0.61 ± 3.37kg) at 9 months post randomization, F(1, 6) = 12.32, P = 0.01 (see Figure 1).	NR	• Although the intervention was relatively brief compared with many behavioural programs, the time constraints and reimbursement policies associated with primary care could make such an intervention impractical for many clinical

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U.S.	Therefore, the intervention group was more successful in maintaining a lower weight from baseline than the standard care group. Figure 1 illustrates that although the standard care group gained a slight amount of weight between the end of treatment and the first follow-up, the tailored intervention group demonstrated small but continued weight loss during this period. Only 13% of intervention participants maintained at least 5% weight loss from their baseline weights at month 9, compared with 7% of the standard care group, P = 0.39. Twelve months after baseline, the weight change of the tailored intervention group (−1.38 ± 3.69 kg) was no longer significantly greater than the weight change of the standard care group (−0.16 ± 3.63 kg), F(1, 6) = 3.80, P = 0.10. As seen in Figure 1, the tailored intervention group maintained an average weight nearly identical to that achieved immediately following treatment 6 months earlier. Somewhat surprisingly, the standard care group demonstrated a decrease in weight between the 9-month and 12-month follow-ups. The proportion of participants in each group who maintained at least 5% weight loss at month 12 was nearly identical (10% in the tailored intervention, 11% in standard care), P = 0.81. 18-Month follow-up: Eighteen months after baseline, the weight change of the tailored intervention group (−0.49 ± 3.33 kg) was not significantly greater than the weight change of the standard care group (+0.07 ± 3.75 kg), F(1, 6) = 0.85, P = 0.39. Although the intervention group demonstrated weight below their baseline levels, they had regained most of the weight lost during the active treatment phase (see Figure 1). At month 18, only 7% of the intervention group demonstrated at least 5% weight loss, whereas 12% of standard care participants achieved this level of success, P = 0.40.		settings. • The current sample included low-income African- American women aged between 18 and 65 years, which limits the generalizability of these findings. • Attrition is another potential problem of the current study, as 37% of the original sample was lost to follow-up by the 18-month assessment visit.
Martin, P.D., et al. 2006[87] RCT U.S.	Weight loss at 6 months [mean (SD)]: Standard Care: gained 0.2 (2.9) kg Intervention: lost 2.0 (3.2)kg (p = 0.03) More participants in the tailored group lost weight (79% vs. 47%; p = 0.04). The current results suggest that regularly scheduled, physician-delivered, tailored weight loss interventions can result in significantly greater weight loss compared with standard care. Intervention participants demonstrated a statistically significant reduction in percentage body weight, and, compared with controls, a statistically significantly greater proportion of the intervention participants lost weight. Although the differences between groups were significant, it should be noted that the weight loss achieved by the	NR	• The issue of selection bias is of concern in any study that is dependent on volunteers. • Dropouts constitute a second source of selection bias. • Reimbursement for participation may also be a concern regarding the generalization of the current results.

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	intervention participants was modest.		
McTigue KM, et al. 2009[88] Controlled Cohort Study U.S.	Over an average of 357.81 (SD, 74.02) days of followup, mean weight change was –5.19 kg (CI, –7.71 to –2.68) among WiLLoW enrollees and +0.21 kg (CI, –1.50 to 1.93) among the non-enrollees with follow-up data (P < .001). The effect size was similar when calculated using the age-adjusted analysis of covariance technique (–5.74 kg; CI,–8.82 to –2.66). Furthermore, clinically significant weight loss was more common among enrollees than among non-enrollees (Figure 2), with a loss of ≥7% seen for 27% and 6% of the sample, respectively ($\chi 2$ P = .001). Adjusted for age, enrollees had 4.38 times the odds of showing a clinically significant weight loss compared with non-enrollees (CI, 1.84 to 10.42).	NR	• Limitations include the nonrandomized nature of these data, which may introduce bias. • Furthermore, the cost of participating is likely to have excluded those with lower socioeconomic status. • As another limitation, it was noted that the follow-up rate differed by WiLLoW participation status, which may reflect patient reluctance to enroll if they planned on moving or changing medical practices. • Furthermore, these data lack information on behavioural or cardiovascular risk factor change because of the limited resources and focused evaluation of this quality improvement initiative.
Tsai, A.G., et al. 2010[89] RCT U.S.	At month 6, patients in the Brief Counselling and Control groups lost 5.1 ± 0.7% and 1.0 ± 0.7% of initial weight, respectively (based on losses of 4.4 ± 0.6 kg and 0.9 ± 0.6 kg, respectively). The difference between groups (of 4.1 ± 0.9%) was highly significant (P < 0.0001). Forty-eight percent of patients in Brief Counselling lost ≥5% of initial weight, compared to 0% of the Control group (P = 0.0001). This pilot study found that a series of eight brief (15–20 min) visits with a MA induced a mean loss of 5.1% of initial weight in 6 months, compared to a loss of 1.0% for Control patients. Nearly 50% of Brief Counselling participants lost ≥5% of initial weight, a loss that may be associated with improvements in cardiovascular risk factors, including the prevention of type 2 diabetes (14,16). This is the first study of which we are aware to use auxiliary health professionals to provide weight loss counselling in primary care practice, and the weight losses are among the largest reported in such a setting (excluding the use of weight loss medication) (17). Although no statistically significant differences in cardiovascular risk factors were observed, favorable trends in lipids were observed at month 6 (the time of greatest weight loss) in the Brief Counselling group as compared with the Control group. These differences are of potential clinical importance and likely would have reached statistical significance in a larger study.	NR	• The selection of highly motivated practices (and providers). • The trial's relatively short duration and lack of weight maintenance visits, and the lack of assessment of food and physical activity records as a measure of adherence. • Finally, we did not test other methods of delivering counselling in busy clinical settings.

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Read A, et al. 2004[90] Non-RCT U.K.	3 month changes: Those continuing to attend achieved a weight loss of 2.9% (mean = 3.1 kg, ranging from a loss of 23.6 kg to a gain of 3.8 kg, P<0.001) with a concomitant decrease in BMI (P<0.001). Reductions (P<0.001) were found in waist circumference, percentage body fat, total cholesterol, HbA1c (in those with diabetes), and triglycerides (P = 0.004). 3 to 12 month changes in clinical parameters: There were no significant changes in weight, BMI, waist circumference, percentage body fat, triglycerides, and HbA1c (in those with diabetes), showing that these 3-month improvements had been maintained. HDL and total cholesterol:HDL ratio showed significant improvement (P<0.001) during this sustained phase of lifestyle change. Systolic blood pressure showed a return to baseline (P = 0.006). A 10% weight loss was achieved by 4% of patients who entered the programme, and 13% achieved a weight loss of between 5% and 10%. Psychological Well-being: Seven of the nine parameters (physical function, mental health, energy and vitality, general health perception, change in health [P<0.001 for all of these parameters], social function [P = 0.003], and emotional role [P = 0.007]) assessed showed increases to identify improvements in these aspects of health. The SF-36 parameter scores at 3 months and 12 months did not show any significant deterioration from the gains achieved at 3 months.	Eighty-six (40%) patients did not complete the first 3 months of the programme and received a drop-out questionnaire. The most common responses given on the 27 (31%) questionnaires returned were: work commitments, childcare problems, family commitments, inconvenient timing of sessions, and preferring to lose weight on their own. None of those patients who returned the questionnaire reported that they did not think attending the group sessions would help them to lose weight. A further 55 (25%) patients did not complete the 9-month maintenance phase. Sixteen (29%) drop-out questionnaires were returned, the most common responses being: inconvenient timing of sessions, work commitments and childcare problems. These patients had lost significantly less (P<0.001) weight (mean = 1.7 kg, standard deviation [SD] = 3.0) at 3 months compared with the weight loss (mean = 4.1 kg, SD= 4.2) at 3 months of those who completed the programme. Final evaluation forms were returned by 58 (77%) of the 75 patients who completed the programme. The responses were very favourable to the design and usefulness of the programme (Table 5). More patients rated themselves as being very successful at improving eating habits (70%) compared with those who rated themselves as being very successful at increasing activity levels (50%). The reported usefulness of sessions decreased from 98% when they took place every 2 weeks to 23% when they were 3 months apart. All patients reported that learning about their blood tests and other clinical measurements had been very helpful, and 90% reported that their personal folder was very useful.	• Attrition rates were disappointing.
Bolognesi M, et al. 2006[91] RCT Italy N=96 (experimental group n = 48; usual-care control group n = 48)	The experimental group had significantly better BMI and abdominal girth compared with the control group after a 5- to 6-month follow-up. Furthermore, the experimental group progressed in their stage of physical activity readiness and increased their self-efficacy. Male patients in the control and the intervention groups marginally differed at baseline in BMI, $F(1, 43) = 3.11$, $p = .09$. To control for these differences, an analysis of covariance was conducted, with BMI at baseline as a covariate and group and gender as factors. This analysis of covariance revealed a significant covariate and group effect, $F(1, 95) = 10.60$, $p < .01$, $\eta 2 = .10$. In both sex groups, the control group increased in BMI, and the intervention group decreased in BMI. Although the changes in men were stronger then in women, no	At the end of this project, the majority (6/8) of the participating GPs indicated that they will be more ready to apply the counselling to obese patients and track the objective and subjective parameters regularly. Three of the eight doctors involved also adopted regular activity during the study, indirectly benefiting from the counselling and potentially becoming a role model for patients. The remaining two physicians did not feel that PACE added to what they were already doing.	• No information on the counselling quality (what the physician actually was doing) and how the patients received the counselling was obtained, limiting treatment fidelity discussions. • Because of the select sample (overweight/obese patients of eight GPs), the generalizability of the findings is not clear. • Data collection was not blind, as the GPs delivered the intervention and collected the data. • No information on the intensity, duration, or time and type of physical activity was included for either group (only physical activity stage was assessed in the experimental group),

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	interaction with gender was found ($p = .31$, $\eta 2 = .01$). The same results transpired for abdominal girth (see Table 2). After controlling for the baseline in girth, the groups differed significantly at the follow-up, $F(1, 95) = 10.06$, $p < .01$, $\eta 2 = .10$. The interaction with gender was not substantial ($p = .41$, $\eta 2 = .01$). Both male and female patients in the control group increased their abdominal girth slightly, whereas the individuals in the intervention group decreased their abdominal girth. To examine whether the PACE intervention was effective in moving patients forward in stages, the stages at the baseline and at the follow-up measurement point were compared (see Table 3). The majority of the former inactive patients moved forward, 60% of the patients in Stage 1 (not active and not ready) and 51.4% of the individuals in Stage 2 (not active, but ready). That is, over 50% of patients who either were not ready or who were ready (Stages 1 and 2) progressed, and none of these patients in these two stages of readiness (0%) regressed. Furthermore, 75% of the patients who were physically active at baseline stayed active. Also specific to the experimental group, self-efficacy increased significantly from the first to the second contact (Hodge's $d = 0.72$). The effect was stronger in male participants than in female patients (see Table 4). To investigate whether patients who became or stayed active decreased in BMI and abdominal girth, the intervention group was divided into active (n=24) and the inactive patients (n=24) at follow-up. A repeated measures multivariate analysis of variance was conducted, with BMI and abdominal girth at baseline and follow-up and being active at the follow-up and sex as factors. From the baseline to follow-up, there was a marginal multivariate Time×Group effect,Wilks'sΛ=.88,F(1, 47)=2.93,p=.06,η2=.12. On average, the active patients had a significant decrease in BMI, whereas the inactive patients did not increase their BMI. Independent of exercise behaviour, the intervention group decreased in abdominal girth.		making it impossible to determine what the physical activity characteristics were that influenced the biometric changes.
terBogt, N.C.W. et al. 2009[92] RCT	Changes in main outcome measures for the NP and GP-UC groups after 1 year: After 1 year there were more (successful) weight losers and stabilizers in the NP group than in the GP-UC group (77% vs 65%) ($p< 0.05$). Mean weight change was -1.9% (SD 4.9) in the NP group and -0.9% (SD 5.0) in the		• There were some baseline differences between the NP and GP-UC groups (physical activity and attempts to lose weight), but in stratified analyses these characteristics were not related to weight change after 1 year.

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Netherlands N=457	GP-UC group ($p < 0.05$). Mean waist circumference decreased by 2.4cm (SD 7.1) in the NP group and by 1.2 cm (SD 5.9) in the GP-UC group ($p = 0.07$). No significant differences occurred for changes in serum lipids or blood pressure. Changes in main outcome variables separately for gender: For women, no significant differences were found between the NP and GP-UC groups although the percentage of weight losers and stabilizers tended to be higher in the NP group (73% vs 64%, respectively; $p = 0.17$). For men, changes in body weight (in kilogram and percentage) and waist circumference were significantly more favorable in the NP group compared with those in the GP-UC group. The percentage of weight losers and stabilizers was higher in the NP group than in the GP-UC group (81% vs 65%, respectively; $p < 0.05$). Subgroup analyses were also performed within the NP group (also separately for men and women) for at least three visits versus less than three visits and for obese versus non-obese participants. For women, no significant differences were found. For men, changes in body weight (in kilogram and percentage) and waist circumference were significantly more favorable in obese men in the NP group compared with those in men with a BMI <30 kg/m2 in the NP group. Obese men in the NP group had a greater reduction in systolic blood pressure (-14 mmHg) than did obese men in the GP-UC group (-5 mmHg; $p<0.05$), in addition to lower body weight (in kilogram and percentage) and smaller waist circumference ($p< 0.05$; data not shown).		• Regression to the mean may be involved owing to the fact that both the GP-UC and the NP group patients gained on average 1.0 kg between screening and baseline measurements (a period of 3–12 months). Weight gain during the pre-study period was significantly inversely related with weight change during the first year. However, when also evaluated from the screening on, this intervention succeeds in preventing weight gain. Regression to the mean also cannot account for the gender difference: • The effect of study group was seen in men only (the difference of 2.1 kg is in line with the 2.8 kg as estimated in the power analysis; because of a smaller SD this difference was significant even with fewer than 145 male participants). In general, women might have more knowledge and experience regarding weight maintenance (e.g., dieting is more common in women, (18) and more men than women underestimate their body weight (18,19)), and a low-intensity intervention may have limited additional impact in experienced patients. • Randomization was done at the patient level, allowing contamination of research conditions within the same GP practice.

Pediatric Population

Author	Primary outcome results / Effectiveness	Acceptability / Appropriateness	Limitations
Marild S, et al. 2013[93] RCT Sweden	Between baseline and the follow-up at the end of the intervention, the mean BMISDS changed by -0.36 in the NDPT group and -0.33 in the NDT group. These reductions did not differ significantly, but for each group the reduction was significantly greater than the change of-0.14 observed in the non-intervention group of children with obesity (P<0.0005 for NDPT and P<0.002 for NDT groups). Of the 55 children in the combined NDPT and NDT groups, 13 (24%) changed from obese to overweight, 42 (76%) did not change, and none increased 5 BMI units from baseline BMI. In the non-intervention group of children with obesity, 21 (15%) changed from obese to overweight, 4 (3%) increased 5 BMI units compared with baseline, and 113 were unchanged Mantel -HaenzelP= 0.09). Both treatment options appeared effective, resulting in comparable reductions of BMISDS, both significantly greater than the change seen in an age-, sex- and BMI-matched non-treated group of children. Our attempt to assess the role of physical activity in treatment failed, because monitoring of changes in behaviours at the clinics was incomplete.	About 9 of the 64 children with obesity (14%) dropped out of the study, a fairly low proportion for obesity treatment studies. The primary care setting and the pre-pubertal age of the children may have contributed to good compliance.	• One is that the evaluation of the interventions was done at the end of the intervention year. To report short-term effects may be seen as a first step. If interventions appear effective in short term, a long-term follow-up is motivated. • In addition, the two treatment options were likely to be too similar in design. • Low budget also made it necessary to use the local facilities, e.g. laboratories and equipment. The laboratories were accredited and standard methods were used, but using one laboratory would likely have reduced the relative great variance in laboratory findings.
DeBar LL, et al. 2012[94] RCT U.S.	This medium-intensity, multicomponent behavioural intervention resulted in a modest decrease in weight status among overweight teen-aged girls (20.15 in BMIz score among intervention participants compared with 20.08 among usual care participants). The decrease in BMI z scores over time was significantly greater for intervention participants compared with usual care participants (P= .01); however, the intervention effect size was low-to-moderate (Cohen's d=20.18 for BMIz The decrease in BMIz scores over time was significantly greater for intervention participants compared with usual care participants (P= .01); however, the intervention effect size was low-to-moderate (Cohen's d=20.18 for BMI z score and 20.27 for BMI percentile). The 2 study groups did not differ significantly on change over time on any secondary metabolic outcomes.	Participants attended a mean of 10.3 (5.1) of 16 intervention sessions for teens and 7.9 (3.9) of 12 sessions for parents. Post treatment ratings suggested that most participants rated the intervention services as high quality (4.4(0.8) for teens and 4.4(0.8) for parents on a 1–5 scale [5 being "excellent"]) and reported that the pro-gram met their needs (4.0(1.0) for teens and 3.9(1.1) for parents on a1–5scale ["definitely met needs"]) This finding suggests that an intervention which actively targets parent lifestyle changes (rather than focusing, as this intervention did, primarily on supporting the teen's efforts) may have the benefit of allowing teen autonomy while supporting healthy weight management and lifestyle changes within the broader family.	• Lack of racial/ethnic and socioeconomic diversity among study participants. • Results might not be generalizable to other subpopulations.
Hystad HT, et al. 2013[95] RCT	In both intervention groups, BF, BMI z-scores and energy intake significantly decreased from baseline to 6 months and from baseline to 24 months. In the TLG and SHG, respectively, a reduction in BMI z-	NR	• Did not include a no-treatment control group in the present study and thus the change in BMI z-score may just reflect the natural course of the children's growth. • No information was available regarding the

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Norway	scores of 0.22 and 0.19 units was observed from baseline to 6 months, and a reduction of 0.18 and 0.17 units was seen from baseline to 24 months. Concomitant with this, a 4.7 and 4.4 % reduction in BF was seen from baseline to 6 months, and a 4.8 and 5 % reduction in BF from baseline to 24 months in the TLG and SHG, respectively. Apart from a significant decrease in energy intake/kg in both intervention groups, no significant changes were found from 6 to 24 months for BF, BMI z-scores or dietary intake in either group. The key study findings were that no significant differences were detected for the change in adiposity and dietary intake between children of parents in the TLG and SHG. In both groups, the children achieved a significant reduction in BF and BMI z-scores after 6 months, which persisted throughout 24 months of treatment. Also, both groups achieved a significant reduction in energy intake from baseline to 6 months, which was sustained after 24 months, with an even further reduction in energy intake/kg from 6 to 24 months in both groups.		puberty stage of the children, meaning that we had an unknown ratio of pre-pubertal to pubertal children in the pre-sent study. The puberty stage may have affected the children's level of physical activity.
Arauz Boudreau AD; et al. 2013.[96] RCT U.S.	Health-related quality-of-life measures. There was an overall improvement in the total scale for the control and intervention groups for caregiver proxy and child self-reports. The physical health and psychosocial health subdomains also improved for all participants, with the exception of the control group's child self-report on the psychosocial health subdomain (2.6 points). In the final models, caregiver scores were controlled for maternal BMI and caregiver education, and child scores were controlled for primary household language and child's gender. Nutrition knowledge. Pilot nutritional survey data showed a gap between nutrition knowledge and actual nutrition based on a 24-hour food recall. Anthropomorphic measures. BMI z-scores did not change significantly for the control group (0.05) or the intervention group (0.03). After controlling for care-giver education and maternal BMI, the difference in the change in BMI z-scores between the control and intervention group was not significantly different (p0.31). Overall, the study found no differences among those receiving educational classes and coaching compared to controls. No differences in changes in BMI or metabolic markers were found between intervention and control group. No differences were noted in physical activity levels between the groups, with activity declining among both groups.	In a low-income community, Latino families with obese children are willing to participate in early evening sessions that allow for siblings to participate. They are also willing to work with a health coach. Social factors such as work hours, extracurricular activities, transportation, and child care hindered participation. Many care-givers cited factors that were out of their control as challenges to adopting healthy behaviours. These included the inability to find family encompassing physical activities and to control what their child chooses to eat, emerging independence, and social stressors such as family discord, financial stress, and time pressures.	• The scope of the current results is limited because of power and generalizability. • Sample size was small and fairly homogenous as it was drawn exclusively from a low-income, predominantly Latino community. • Neither participants nor study team members were blinded to group allocation. -Analysis was hindered by loss to follow-up among participants, thereby decreasing statistical power.
Henes ST; et al. 2010[97] Non-RCT	Behavior changes: Vegetable and fruit intake increased from 0.61 to 0.92 and 0.56 to 0.86 servings per day, respectively. The number of times eating out per week decreased from 2.14 to 1.61. Patients reported less TV time, both on weekdays,	As evidenced by their willingness to provide consultation space, schedule appointments and provide reminders and access to patient charts, the KIDPOWER program was well received by these physicians.	• Because the demand for new consultations reduced the capacity to offer all seven visits to most of the patient referred, we were unable to assess the value of the additional four visits

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U.S.	from 3.02 to 2.69 h per day, and weekend days, from 3.56 to 2.92 h per day. Soda and sweetened beverage intake significantly decreased. At baseline, 39.8% were drinking more than 20 ounces per day of soda. By the third visit, only 2.7% were drinking more than 20 ounces per day. At baseline, 65.2%reported drinking more than 20 ounces per day of sweetened beverages. By the third visit, only 23.3% drank more than 20 ounces per day. 3.2. Weight status: Mean BMI z score decreased modestly, but significantly, falling from 2.40 at base line to 2.36 at the third visit. By the third visit, patients reported statistically significant changes in all targeted behaviours in response to the counselling. A modest but significant improvement in weight status (BMI z-score) was achieved by the third visit and may be associated with these improvements in the targeted behaviours.		outlined in KIDPOWER. We were not able to determine if patients would schedule and keep those additional appointments.
Ariza AJ; et al. 2012[98] Observational U.S.	Practice A developed a group strategy to reduce repeating educational messages and for peer support. At Practice B, clinic development occurred through quality improvement efforts, including software for body mass index (BMI) and blood pressure; intake forms and handouts; and motivational inter-viewing training. Obesity clinic staff strived to make addressing childhood obesity a practice-wide mission. At Practice C, a nurse and 3 pediatricians developed their strategy over 6 months.' At Practice D, the lead pediatrician was involved in a preventive cardiology study that increased knowledge about childhood obesity. Subsequently, a nurse practitioner was hired to provide nutritional counselling and lead an obesity clinic effort. Clinic personnel have received training through participation in continuing education sessions. Clinicians often assess family motivation before referring. The clinic ''.is all family focused and individualized,'' ''We are not all about weight loss.'' For some families ''.it is hard to keep interest and enthusiasm up.'' However, in ''families that click,'' the children got excited about the pro-gram. ''Compliance is better with younger children and with girls; adolescents are less likely to comply with a referral appointment.'' Hispanic families were perceived as compliant with appointments but challenged by cultural practices around food. Having the	Practice A: Challenges included maintaining program structure and staff. Program personnel identified ''chaotic situations among most families,'' but perceived that attendees felt empowered due to increases in knowledge. Staff experience was that the family must perceive the child's weight as a problem and be motivated for patient success. The group model had fostered group care strategies on other topics within the practice. Practice B: Obesity clinic providers perceived that patients make progress. For them, motivated families that acknowledged the child's weight as a problem were more likely to attend visits. The staff believed that adolescents were more motivated than younger children in weight control efforts. Practice C: Obesity clinic staff noted that families often agree with the doctor for the referral but ''they aren't re-ally so interested when the nurse calls to follow up and schedule the appointment.'' The clinic aimed to engage parents and families, as their involvement is perceived critical for success. Practice leaders perceived clinic development as their biggest challenge. Patient compliance with visits is an ongoing challenge. Clinic staff perceived that patients usually experience improved self-esteem and willingness to cooperate with treatment goals. ''Adolescents can be difficult, and some practitioners do not refer them.'' ''The clinic is a good	NR

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	obesity clinic reportedly made it easier to bring up weight issues during other visits. Mean BMI z-scores improved (TableIII). Overall, mean BMI rose for ages 2-6 and 7-11 years (0.12 and 0.18 kg/m 2, respectively) and decreased for older children (0.7 kg/m2).	resource for the practice, and has provided some value in marketing the practice in the community."	
Taveras EM; et al. 2011[99] RCT U.S.	At 1 year, BMI had increased by a mean of 0.31 kg/m2 in the intervention group and 0.49 kg/m2 in the usual care group, yielding a crude difference of −0.19. After multivariable adjustment, compared with usual care, intervention participants had a smaller, non-significant increase in mean BMI from baseline to 1 year than usual care participants (−0.21 kg/m 2; 95% CI:−0.50, 0.07; p=0.15).	Based on follow up questions of the 253 intervention participants, 97% reported being "somewhat" or "very satisfied" with the High Five for Kids program and 91% reported they would recommend the program to their family and friends.	• First, unbalanced participant characteristics at baseline occurred. • Second, electronic medical records are not available in all pediatric practices. Thus, our intervention may not generalize to all pediatric settings. • Third we used parental report of behaviours rather than objective measures. Thus, it is possible that parents could exaggerate self-reported improvements in behaviours. • Fourth, because our intervention was not a factorial design, we are not able to specifically say which components were more effective.
Bocca G; et al. 2012[100] RCT Netherlands	In the intervention group, significant decreases were observed for BMI, BMI-z, WC-z, HC, HC-z, upper arm circumference, BF%, and SCF. There was a significant increase in FFM. In the usual-care group during the treatment period, significant decreases were only observed for BMI, BMI-z, and HC-z. A significant increase in FFM was also found. Comparing the effect of the 2 treatment programs between baseline and 16 weeks, significantly greater decreases in BMI (mean [SD], 0.5 [0.3]; 95% CI, 0.01-1.07; P= .05), BMI-z (mean [SD], 0.2 [0.1]; 95% CI, 0.02-0.42; P= .03), and WC- z (mean[SD], 0.3 [0.1]; 95% CI, 0.04-0.60; P= .02) were demonstrated for the intervention group.	The main known reasons for discontinuation of the program were the time-consuming aspect and the stressfulness of the intervention.	NR
Wake M; et al. 2013[101] RCT Australia	The intervention had little discernible effect on any primary or secondary outcome. As expected with age, raw body mass index rose over the 15 month period (mean change: intervention 0.78 (1.79), control 0.96 (1.50)), but body mass index z score fell slightly (mean change: intervention −0.22 (0.25), control −0.18 (0.25)).	The great majority of parents thought that both the specialist clinicians and general practitioners understood their family's challenges, understood how to implement the intervention goals, and felt confident that the intervention would make a difference to the child's weight/lifestyle. Similarly, most general practitioners found the general shared care approach helpful, along with shared care components such as the specialist management plan and ongoing access to specialists.	• The self-selected nature of the general practitioners and families and the non-blinding of families seem unlikely to have affected generalizability given the null outcomes.
Vos RC; et al. 2012[102] RCT Netherlands	The ANCOVA for the effect of the multidisciplinary treatment on BMI-SDS after 3 months treatment and 12 months follow-up, controlling for baseline measures, was statistically significant (P=0.02 and P=0.03,respectively), showing a reduction of BMI-SDS in the intervention group (from 4.2 SDS at baseline to 3.8 SDS at 12 months follow-up) and no change in BMI-SDS (from 4.3 SDS at baseline to 4.2 SDS at 12 months follow-up) in the obese control group.	NR	• Population consisted of treatment-seeking obese children, who may experience more impairment on their HRQOL than their obese peers in the community. • The information collected on the dietary habits was only used for treatment purpose and not included in the analysis. • Third, we did not use an obesity-specific HRQOL questionnaire, used by most previous

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			studies. Using the DISABKIDS questionnaire, however, could also be regarded a strength, since this questionnaire is a European-based and well-validated questionnaire.
Dolinsky DH; et al. 2012[103] Observational U.S.	At follow-up, the mean reduction in BMI SDS was 0.10 (SD = 0.20). The mean reduction in BMI percentile was 0.4% (SD = 1.1%). The distribution of the change in BMI SDS for the 282 patients is shown in Figure 1. Of the 109 patients who were obese at entry to the HLP, 14 (13%) became over -weight and 4 (4%) became severely obese at follow-up with the remainder continuing to be obese. Of the 173 patients who were severely obese at entry, 17 (10%) became obese with the remainder continuing to be severely obese.	NR	• A limitation of our study is that we do not know how the severity of obesity and these obesity-related conditions may have changed without treatment.
Ewing LJ; et al. 2009[104] Non-RCT U.S.	Children who attended at least 6 of 8 intervention sessions and 1 of 3 follow-up sessions (completers) lost an average of 2.84lb; change in BMI z scores was statistically significant at 5 months (P < .001). For children who remained in the program, there was a significant reduction in BMI at 8 weeks and also at 5 months after enrollment; children in the completer group had a lower BMI at 12 months post study enrollment than children in the no completer group (P = .08) but the differences were not significant.	Fifty-one percent (n = 37) of the participants completed the intervention. A subset of those (n = 24) continued to complete weekly self-monitoring homework throughout the 8-week group intervention. Parents completed satisfaction questionnaires anonymously at the session 4 and session 8 group meetings. Three questions related to the perceived helpfulness of the program to their child and their family were asked (What has been the most helpful part of KidsSTRIDE? What has been the least helpful? What suggestions do you have to increase the helpfulness of the program?) Seventy-five percent of parents of completers reported that the Stoplight Food Reference Guide was the most helpful component of the intervention program; 67% of parents reported that their children had taken on more responsibility for making healthier food choices; 50% of parents reported dissatisfaction with the amount of self-monitoring homework required in the program. Many parents requested the inclusion of recipes and wanted to have physical activity as part of the weekly meetings for the children. It is noteworthy that a comparison intervention arm that included a structured diet plan had a dropout rate of 83% at 6 months and was subsequently discontinued. This project represents the only reported attempt to address 3 barriers commonly cited as impediments to the management of obesity reported by pediatric providers: (a) provider knowledge of assessment and treatment strategies for pediatric obesity, (b) provider skills and confidence to address the problem with parents and children, and (c) provision within the pediatric primary care setting of an evidence-informed intervention that is offered broadly with few eligibility restrictions.	• We do not have systematically obtained data on the percentage of parents of children identified by their provider as being overweight or obese who agreed to participate in the intervention. • In addition, we have received verbal and written feedback from parents indicating that the time burden of participation was too great for some, leading to lack of adherence and, for others, treatment withdrawal. • The high dropout rate reflects in part the inability to be highly selective in patient recruitment when studies are conducted in a practice-based network. • Finally, we know that as early as age 8 years, the problem of overweight for many affected children has been present for several years and, thus, unhealthy eating and activity habits are well established. Both prevention and treatment of overweight needs to be addressed in children in the primary care setting across all ages.[17]

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Wald ER; et al. 2011[105] Prospective Cohort Study U.S.	The mean weight loss at 15 weeks among 55 children (71%) who completed the program was 2.4 lbs (SD = 5.24, range of −16.7 to +8.4 lbs) compared with a mean weight gain of 3.45 lbs (SD = 4.31, range of −5.0 to +12.0 lbs) among 23 control children. The mean change in body mass index z score from baseline to month 24 was −0.17 ± 0.32 (P < .001) Children in the intervention group defined as "completers" achieved a significant reduction in BMI z score compared with quasi-control children at 15 weeks. The weight loss at 15 weeks among 55 children who completed this component of the program was 2.40 lbs (±5.24) compared with a weight gain of 3.45 lbs (±4.31) among 23 quasi-control children. A total of 44 children (56% of those who began the program) defined as completers also maintained a significant reduction in BMI z score 12 months after study entry compared with their own baseline as did the 38 children (48%) who remained in the study until 24 months	In the current study, the components of the Stoplight diet were liberalized to some extent to make it less restrictive and follow-up sessions were instituted in an attempt to prevent the rebound of weight loss that many children had successfully achieved. Delivering the intervention within the primary care practice reduces some barriers to participation and the "stigma" attached to referral to an obesity clinic.	• randomization was not possible because of the lower response rate than anticipated, the brief time frame to conduct the project, and the desire to assess children 24 months after study entry, thereby studying children for a longer duration than has usually been reported. • Second, participants were relatively homogeneous in terms of education, race, and economic status, which may limit generalizability. • Last, cost-effectiveness analyses were not included in this study, although the previous program in Pittsburgh continued for several years beyond the study period, at the cost of approximately $150.00 per patient.
Nguyen B; et al. 2012[106] RCT Australia	The Loozit randomized controlled trial produced a significant but modest reduction in body mass index score and improved psychosocial outcomes at 12 months. Supplementary telephone and electronic contact provided no additional benefit at 12 months. The Loozit community-based group lifestyle intervention provides significant, albeit modest, improvements in primary weight outcomes (BMI z score and waist to height ratio) and several psychosocial outcomes at 12- month follow-up.	Of enrolled adolescents, 124 (82.1%) attended 70% or more of phase 1 group sessions (high phase 1 attenders).	• The interpretation of the study's findings may be limited by the absence of a "no treatment" control group. • Another limitation of the study is reliance on self-reported behavioural data. • Potential bias introduced by dropouts and missing data appears minimal.
Wake M, et al. 2009[107] RCT Australia	Tables 3 and 4 show unadjusted and adjusted outcome comparisons between the intervention and control arms at six months and 12 months after randomisation respectively. At six months, the adjusted mean BMI of the intervention group was 0.12 lower than that of the control group (adjusted mean difference −0.12 (95%CI −0.40 to 0.15, P=0.38), and, at 12 months, the adjusted mean BMI was 0.11 lower (adjusted mean difference −0.11 (−0.45 to 0.22, P=0.51). Mean BMI z score (not shown) and waist circumference were similar in the two trial arms.	Fifty-one (37%) of the 139 children in the intervention are attended all four of the intervention consultations, 31 (22%) attended three, 29 (21%) attended two, 16 (12%) attended one, and 12 (9%) attended none. Intervention families had a mean of 2.7 LEAP2 consultations.	• Limitations include the select volunteer nature of the participating GPs. • Only a third of the families with a child identified as eligible chose to take up the intervention. • It was not possible to blind the families to group membership, but this limitation would typically be expected to increase, not reduce, between-group differences on self-reported measures.
McCallum Z, et al. 2007[108] RCT Australia	Table 2 shows unadjusted and adjusted outcome comparisons between the intervention and control arms. At 9 months, the adjusted BMI of the intervention group was 0.2 kg/m2 less than that of the control group (95% CI: -0.6, 0.1; P=0.25), and there was a 0.09 BMI z-score relative decrement from baseline (95% CI: -0.20, 0.02; P=0.12). At 15 months, there was no difference in adjusted BMI of the intervention group compared with the control group (95% CI:-0.5, 0.5; P=1.00), and there	Thirty-four (41%) of the 82 children in the intervention arm attended all four sessions. Seventeen (21%), 14 (17%), 14 (17%) and three (4%) children attended three, two, one and no GP LEAP sessions, respectively.	NR

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	was a -0.03 BMI z-score relative decrement from baseline (95% CI: -0.17, 0.10; P=0.62).		
Schwartz RP, et al. 2007[109] RCT U.S.	At the 6-month follow-up, there were mean decreases in BMI of 0.6, 1.9, and 2.6 percentiles in the control, minimal, and intensive intervention groups, respectively. Adjusting for days from follow-up, the differences between the groups were not statistically significant (P=.85).	In our present study, we used an extensive food and activity questionnaire that required 30 to 40 minutes for completion. Both parents and physicians complained about its length and complexity and a few parents refused to complete the final questionnaire. Prior to the first MI counselling session, parents also filled out a 2-page checklist assessing their child's eating, activity, and television viewing behaviours. This latter form required only 5 minutes to complete. We believe that a brief dietary and activity patterns approach will be more feasible in a general office setting and can effectively identify potential change opportunities for the child and family. Therefore, for a future study, we plan to use an abbreviated 2- to 3-page survey focusing on 5 priority behaviours associated with pediatric obesity (sugar-sweetened drinks, snacks, dining out, fruit and vegetable intake, and television viewing).[11-21]	• A limiting factor in our study was the non-random assignment of clinics to treatment groups.
Korsten-Reck U, et al. 2005[110] Non-RCT Other	After the intensive phase, 72.8% of the children had lower BMI-SDS values (responders) compared to those at the beginning of the program. There was no significant difference in BMI-SDS response between boys and girls (Table 1). During the intensive phase of the program, the average BMI and BMI-SDS of all subjects decreased significantly in the intervention group. Whereas plasma cholesterol and LDL-C decreased, HDL-C tended to increase (MS). Physical performance (W/kg body weight) had improved in the intervention group when post program values were compared with initial measurements (Table 2). In the controls, BMI increased and BMI-SDS remained constant. Plasma cholesterol, LDL-C and HDL-C showed no significant changes. The fitness levels (W/kg body weight) remained unchanged in the controls (Table 2).	NR	NR
Golley RK, et al. 2007[111] RCT Other	After 12 months, the BMI z score was reduced by ~10% with parenting skills training plus intensive lifestyle education versus ~5% with parenting-skills training alone or wait-listing for intervention. Waist-circumference z score fell over 12 months in both intervention groups but not in the control group. There was a significant gender effect, with greater reduction in BMI and waist-circumference z scores in boys compared with girls. Over 12 months, the primary study outcome, BMI z score, reduced by 9% (range: -85% to 18%) in the P DA group, 6% (range: -48% to 49%) in the P group, and 5% (range: -78% to 16%) in the WLC group (linear mixed model, group by time,	Program attendance did not differ between the 2 intervention groups with 18 of 38 and 19 of 37 parents from the P + DA and P groups, respectively, attending more than three quarters of the program sessions. As part of the anonymous satisfaction questionnaire (71% response rate: 26 P + DA, 10 P), parents were asked to circle factors that prevented them attending intervention sessions. Family or work commitments, family illness, and perceived lack of time were more frequently indicated as barriers to intervention attendance (21 of 36), rather than program-related barriers (e.g., session timing or frequency, transport difficulty, program not meeting needs, 9 of 36). Seven parents in both intervention programs sought other assistance elsewhere regarding child weight management	• Future studies should be powered to allow gender sub-analysis.

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	P = .76; Table 2). Forty-five percent of children in the WLC group increased their BMI z score over 12 months, compared with 19% and 24% in the P DA and P groups, respectively (P = .03).	during the study. All 36 respondents in both intervention groups rated the quality of the service provided during the interventions as good to excellent. Thirteen of 26 P+DA parents and 8 of 10 P parents reported they "generally to definitely" received the type of help they wanted in managing their child's weight. All parents in the P group and 22 of 26 in the P+DA group were "satisfied to very satisfied" with the amount of help received during the study. All parents in the P group and 24 of 26 in the P DA group responded that the study had "helped somewhat to helped a great deal" to make changes to family lifestyle. Twenty of 26 P+ DA respondents and 6 of 10 P group respondents said they would repeat the program if they were seeking assistance in managing child overweight again. The parenting-skills training resources (group parenting sessions: 14 P+DA, 7 P; parenting telephone sessions: 12 P+DA, 7 P; parenting manual: 10 P+DA, 6 P) were more commonly reported as being useful than the lifestyle education resources (lifestyle sessions: 5 P+DA, not applicable for P; lifestyle written material: 5 P+DA, 1 P).	
Savoye M, et al. 2007[112] RCT U.S.	Changes in BMI, body weight, and body fat are shown in TABLE 2 and FIGURE 2. Although mean body weight was essentially unchanged from baseline after 12 months in the weight management group (0.3 [95% CI, −1.4 to 2.0] kg), BMI change was −1.7 (95% CI, −2.3 to −1.1] due to continued growth in height. It should be noted there were no differences in changes in height between the control and weight management groups at 6 and 12 months. Percent body fat and total body fat were also reduced in the weight management group. In contrast, BMI, body weight, and percent and total body fat increased in the control group. The difference between the 2 groups in changes in BMI (−3.3), body weight (−7.4 kg), body fat (−9.2 kg), and percent body fat (−6.0%) after 12 months were significantly different (P .001). Six-month improvements were sustained at 12 months in weight management vs control, including changes in the following (mean [95% confidence interval]): weight (0.3 kg [−1.4 to 2.0] vs 7.7 kg [5.3 to 10.0]); BMI (−1.7 [−2.3 to −1.1] vs 1.6 [0.8 to 2.3]); body fat (−3.7 kg [−5.4 to −2.1] vs 5.5 kg [3.2 to 7.8]); and HOMA-IR (−1.52 [−1.93 to −1.01] vs 0.90 [−0.07 to 2.05]).	NR	NR

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