

CHILDHOOD OBESITY SCREENING AND MANAGEMENT FOR PRIMARY CARE

PROVIDERS: A LITERATURE REVIEW

by

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Abstract

Due to an overwhelming rise in childhood obesity (CO), primary care providers (PCPs) need to be cognisant of their pivotal role in assessing, diagnosing, and treating this chronic condition. However, research notes that PCPs face multiple barriers and conflicting recommendations for diagnosing CO resulting in insufficient assessment and management of this condition in children worldwide. The primary objective of this literature review is to evaluate current research and clinical practice guidelines regarding the screening and management of childhood obesity and provide a synthesis of the evidence. A total of 33 primary and secondary sources were reviewed and included in this literature review. Literature and clinical practice guidelines have identified that screening for obesity should begin in all patients two years and older on an annual basis. Screening should include body mass index (BMI), blood pressure (BP), and blood work as necessary. Optimal management of childhood obesity is the 5-2-1-0 program focusing on the education of families and patients about the importance of consuming five or more fruits and vegetables a day, reducing screen time to two hours a day, increasing activity to 60 minutes a day, and restricting all sugary beverage consumption. The aim of this literature review is to reduce obese children from developing diabetes mellitus, hypertension, and hyperlipidemia, in addition to other risk factors pertaining to remaining obese into adulthood and reduced life expectancy.

Keywords: childhood obesity, primary care providers, screening, management

Childhood Obesity Screening and Management for Primary Care Providers: A Literature Review

Childhood obesity (CO) is a prominent and critical health concern of the 21st century (Public Health Agency of Canada [PHAC], 2017). The incidence and prevalence of this chronic disease has increased both in Canada and globally (Childhood Obesity Foundation [COF], 2015). In 2016, over 41 million children worldwide were diagnosed with CO (COF, 2015). In Canada, 25% of children are overweight or obese (PHAC, 2017). CO is of concern to primary care providers (PCPs), including family physicians (FPs) and nurse practitioners (NPs), as it leads to negative health sequela including, type two diabetes, hyperlipidemia, hypertension, obstructive sleep apnea, asthma, and depression (David et al., 2007; Klish, 2017; Robinson, Geier, Rizzolol, & Sedrak, 2011). In addition, obese children are at risk for persisting obesity lasting into adolescence and adulthood.

PCPs are the initial point of health care contact for children and are responsible for the assessment, monitoring, and management of this chronic disease. Due to the increasing prevalence of overweight and obese children, it is important that PCPs are educated on how to diagnose and manage this disease (David et al., 2007). The evidence synthesized in this literature review indicates multiple barriers associated with identifying and treating this chronic disease (Spivack, Swietlik, Alessandrin, & Faith, 2010). Barriers identified include lack of time, resources, assessment skills, insurance reimbursement, and clinical knowledge (David et al., 2007; Barlow, 2007; Spivack et al, 2010). Additionally, poor nutritional habits and an increase in sedentary behaviors has placed children at risk for developing CO (David et al, 2007; Barlow, 2007; Rogers et al, 2013; Spivack et al., 2010). The goal of this literature review is to reduce the declared barriers by synthesizing current assessment tools and management strategies, enabling PCPs to become familiar with the diagnostic criteria, associated risk factors, treatment options, and clinical guidelines for managing CO.

Description of the Problem

In 2007, the American Academy of Pediatrics (AAP) and Canadian Medical Association (CMA) revised the diagnosis of CO to include both overweight and obese children to address and recognize that overweight children were remaining obese into adolescence (Barlow, 2007; David et al., 2007). Children are diagnosed as overweight when their body mass index (BMI) is above the 85th percentile for their gender and age (Center for Disease Control and Prevention [CDC], 2014; David et al., 2007). Obesity is diagnosed when a child's BMI exceeds the 95th percentile for their gender and age (CDC, 2014; David et al., 2007). BMI is calculated by taking the patient's weight in kilograms, divided by their height in meters squared, and is an indication of the patient's total body fat (CDC, 2014; Klein et al., 2017). BMI continues to be the most accurate resource for measuring obesity, versus other methods such as caliper measurements of skin folds, bioelectrical impedance analysis, hydrostatic weighing, and waist, hip, and neck circumference (CDC, 2014; David et al., 2007; Hassick & Hampl, 2016; Hillam, Corathers, & Wilson, 2009).

The CDC (2014) recommends BMI screening annually in all children two years or older during well-child visits. However, the AAP, CMA, and CDC indicates that BMI is underutilized in pediatric care (Hillman et al., 2009; Sesselberg, Klein, O'Connor, & Johnson, 2010). Research estimates that 10% to 30% of PCPs, and less than 19% of pediatrician's measure BMI annually (Sesselberg et al., 2010; Vien, Hargreaves, Briefel, & Orfield, 2013). PCPs attribute difficulty assessing children's weight due to a lack of time, insufficient resources, lack of confidence, and a knowledge deficit of current treatment guidelines (Spivack, Swietlik, Alessandrini, & Faith, 2010; Vien et al., 2013). Spivack et al. (2010) reveal that PCPs have less than four minutes to spend discussing diet, nutrition, and exercise with patients and families during child well-visits. PCPs report that if educational materials and resources were readily available, they would be willing to spend more time with families discussing risk factors and lifestyle interventions to help reduce CO (Spivack et al., 2010). Therefore, this literature review

hopes to provide PCPs with the appropriate education and clinical tools to support PCPs in reducing rates of CO.

Children's sedentary lifestyle habits are also contributing to CO. It is estimated that on average, children spend six hours a day in front of a television, computer, or phone screen (Childhood Obesity Foundation [COF], 2015). Excessive screen time limits participation in physical activities, disrupts the balance in energy intake versus energy expenditure, and leads to weight gain (COF, 2015). Sedentary behaviors are becoming a prominent barrier in promoting physical activity (COF, 2015). However, it is not only screen time, but also the rising popularity of fast food that is impacting the incidence of CO (Rogers et al, 2013; Hassick & Hampl, 2016). Fast food has become a staple of the North American diet given its' convenience, low-cost, and taste (Rogers et al., 2013). Emerging rates of poor nutrition, and inactivity, are significant barriers for PCPs to address in order to help reduce the prevalence of overweight and obese children. To overcome these barriers, it is recommended that PCPs assess screen time and nutritional habits in all children to promote health strategies that reduce inactivity and fast food consumption (Barlow, 2007; David et al., 2007).

The primary objective of this culminating project is to evaluate current research and clinical practice guidelines of CO to provide a synthesis of the evidence for PCPs through a poster presentation. In composing this literature review the following parameters have been considered: all recommendations will be evidence-based; focused on the appropriate age that children's weight status should be assessed; identify current screening tools that best diagnose pediatric obesity; and education with families on primary prevention and management strategies. Secondary objectives include, reducing the prevalence of overweight and obese children by empowering families and children to make healthier lifestyle choices. This literature review aims to support PCPs as they continue to diagnose, monitor, and manage overweight and obese children.

A poster of the information synthesized in this literature review will be presented at the University of British Columbia (UBC) graduate symposium or the British Columbia Nurse Practitioner Association in June 2018. The poster will display current evidence on the age to begin assessing children's weight, frequency of clinical monitoring, obesity screening tools, lifestyle management strategies, and community resources. The goal of this poster is to provide PCPs with the knowledge and resources to help mitigate current barriers to assessing and managing obesity in children.

Methods

In conducting this literature review, research articles were searched over an eleven-year period, from 2006 to 2017. Data bases searched included PubMed, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Web of Science, Medical Literature Online (MEDLINE), Google Scholar, and Cochrane Central Register of Controlled Trials. Peer reviewed journals included; BioMed Central, Pediatric Psychology, Primary Care and Community Health, Public Health Reports, The Clinical Advisor, and The Journal of Obesity. Multiple professional organizations were explored. For example, The Center for Disease Control and Prevention, American Academy of Pediatrics, The Childhood Obesity Foundation, The American Association of Nurse Practitioners, and The Public Health Agency of Canada. The 2006 Canadian Clinical Practice guidelines and The Pediatric Obesity Tool kit from Park Nicollet Institute (2012) on the management and prevention of obesity for adults and children were additionally explored.

Manual searches were performed on the reference list of all reviewed articles to isolate further relevant studies. Non-periodical books, videos and reports were similarly reviewed. Texts on the Clinical Care of the Child with Obesity, Body Mass Index and Health Research, and the Obesity Epidemiology were incorporated. Key terms searched included: Childhood Obesity AND diagnosis AND Primary Care Practitioners, Childhood Obesity AND Screening policies, Childhood Obesity

AND Health Promotion, Childhood Obesity AND Screening Tools, Childhood obesity AND BMI, Childhood Obesity AND Prevention, Childhood Obesity AND Management.

Inclusion and Exclusion Criteria

All the studies included in this literature review were screened independently by the researcher. The original search provided 280,000 studies. Initial studies were chosen based on title. If the title was congruent with the purpose of this culminating project, as stated earlier, abstracts were read. If the abstracts were focused on the age to begin screening children for their weight status, which tool to use, and management strategies, then the full study was read.

Studies were included based on the following criteria: English language; full text; focused on children aged zero to 17; and studies providing evidence for the age to begin screening children for overweight and obesity, the best tool to use to screen, and treatment strategies. Exclusion criteria included: Studies on adult obesity; written before 2006; not relevant to screening or treating overweight and obese children; and studies not linked to primary care settings.

The systematic search process and imposing predefined selection criteria led to identifying a total of 33 studies that met all inclusion criteria and provided evidence based information of how PCP can prevent and treat CO. These studies were a mix of randomized control trials, retrospective studies, cross sectional studies, clinical practice guidelines and non-periodical text. Seven primary studied focused on the age to initiate assessment for obesity, 11 focused on the best tool to measure weight status and 15 focused on the most appropriate intervention and counselling to provide patients and families. Six of the articles were a summary of current recommendations, policy statements by the AAP, and national guidelines and tool kits. All of the non-periodical text included information on the three main themes of this literature review.

Background

CO is a physical diagnosis attributed to individuals who have exceeded the normative BMI recommendation for their gender and age (David et al., 2007). Obesity occurs when excess body fat accumulates due a genetic predisposition, health deficiencies, or an imbalance between caloric intake and physical activity (COF, 2015; Rogers et al., 2013). Certain medical conditions and family habits can precipitate weight gain in children as excess adipose tissue accumulates (COF, 2015). This excess fat storage predisposes children to a variety of co-morbidities, increasing the risk for stroke, heart attack, and diabetes (David et al., 2007; Hillaam, Corathers, & Wilson, 2009).

To support PCPs in caring for overweight and obese children the first step is to educate patients and parents regarding the risk factors that lead to excess weight gain. The second step is to make them aware of the co-morbidities that can develop. The third and final step is to provide PCPs with evidence based treatment recommendations to support knowledge barriers. By focusing on educating PCPs and providing adequate resources to overcome barriers to knowledge, time, and resources it is hope that CO rates will decline (Rogers et al., 2013).

Physiological Risk Factors

Physiological factors that increase the risk for children becoming overweight or obese include: if children are born to mothers with gestational diabetes, have overweight or obese parents, are formula feed, or born large (LGS) or small for gestational age (SGA) (David et al., 2007; Hassink, Hampl, Huang, & Slusser, 2016). These genetic predispositions begin in-utero as the infant's genetic composition alters due to excess maternal glucose or lipids (Hassink et al., 2016). Gestational diabetes is thought to impact infants metabolic programming, due to high glucose levels in the mother's blood causing the infant to be exposed to and retain extra sugar (Hassink et al., 2016). As more glucose is stored in adipose tissue the infants size and BMI increase. Similarly, research shows that infants born to mothers with an increased BMI are found to have two times the risk for pediatric obesity by the age

of two when compared to infants of normal weight mother's due to higher exposure to circulating glucose (Hassink et al., 2016).

LGA and SGA infants have been studied and found to retain more glucose to enhance survival. Growth restrictions or increased demands genetically reprogram the insulin-glucose metabolism to support growth, but also trigger these infants to develop metabolic syndrome (Hassink et al., 2016). Metabolic syndrome is a combination of five medical conditions: elevated systolic blood pressure; high fasting glucose levels; abdominal obesity; and, abnormal cholesterol that increase patients risk for heart disease, stroke, and diabetes (American Heart Association, 2017).

Infants who are predominantly formula feed have been found to gain more weight than breast feed infants due to formulas high caloric index. A study by Horta and Victora (2013) found that infants who were formula fed had a 70% to 85% chance of becoming obese in adolescent (Hassink et al., 2016). Research notes that even infants weaned before four months of age have higher weights compared to infants breastfeed until six months (Shepherd, 2009). Breastfeeding is a sensitive issue for many mother's due to biological difficulties and social pressures however, it is still relevant for PCPs to note to understand since statistical evidence has shown that 70% of obese children become obese adults (Walters, Holloman, Bloomquist, & Bolier, 2003). In summary, parental BMI, gestational diabetes, birth weight, and infant nutrition can all increase the risk for CO (Hassink et al., 2016). Acknowledging and assessing for these risk factors early in care helps PCPs identify mothers at risk as well as provide timely management strategies.

Environmental Risk Factors

Environmental risk factors impacting CO primarily arise primarily from poor nutrition (David et al., 2007). Parents are often unable to afford nutritionally rich foods, provide poor food modeling, or due to children's food preferences (Hassink et al., 2016; Johnson, Montgomery, Ewell, 2015).

Research notes that children's fruit and vegetable consumption is directly linked to their parents (Barlow, 2007). As parents consume more fruit or juice so will their children (Pearson, Biddle, & Gorely, 2008).

A large component in combating CO is through educating and supporting parents in making health lifestyle habits. It is important for PCPs to understand the impact that parents have on their children's genetics and environment (Parrion et al., 2016). A study by Parrion, Vinciguerra, Spina, Romeo, Tumminia, Baratta, et al. (2016) on the influences of parental factors on children's weight, found that having one obese parent increased the child's risk for becoming overweight or obese by two-fold. This study also found that having two obese parents increased the risk by eight-fold (Parrion et al., 2016). It appeared in the study that children's weight status paralleled their parents (Parrion et al., 2016). To impact children's weight, it is important for PCPs to understand the downstream effect of enhancing parental education regarding obesity management strategies and enhancing parental adoption of the interventions to reduce CO.

Obesity Related Co-morbidities

There are multiple co-morbidities linked to CO. The primary conditions explored in this literature review include, depression, type two diabetes, hypertension, hyperlipidemia, obstructive sleep apnea, non-fatty alcoholic liver, early puberty, polycystic ovarian syndrome and asthma (David et al., 2007; Johnson, Montgomery, & Ewell, 2016; Parrino et al., 2016; Zhang, TSE, Deng, & Jiang, 2008; Peek, 2016; Barlow, 2007).

Depression

Depression is defined by feelings of severe sadness, insomnia, changes in appetite, poor concentration, low energy, or thoughts of worthlessness (Klish, 2017). This condition commonly develops in correlation with excess fat storage as children become dissatisfied with their body (Hassick

& Hampl, 2016). Many children are also bullied because of their weight, impacting their feelings of self-worth and perpetuating social phobias (Robinson, Geier, Rizzolo, & Sedrak, 2011). These phobias result in more time spent indoors, negatively impacting their physical activity. Physicians are recommended to assess patients at risk yearly using the self-report patient health questionnaire (PHQ9) depression screening tool (Klish, 2017). If patients are found to be depressed or suicidal they should be referred to a psychiatrist for further assessment.

Type Two Diabetes

Type Two Diabetes occurs when the body is overexposed to glucose resulting in a hyperglycemic state typically due to insulin resistance or impairment of insulin secretion (Klish, 2017). The excess glucose circulates in the child's blood vessels, increasing the risk for glucose plaques to form on blood vessels walls leading to atherosclerotic heart disease (David et al., 2007). These sugar plaques have the risk of breaking off from the blood vessel wall and causing macrovascular or microvascular complications (Klish, 2017). Macrovascular complications include retinopathy (visual impairment or blindness), nephropathy (kidney injury leading to kidney failure), and neuropathy (numbness and tingling to limbs) (Klish, 2017). Microvascular complications include cardiac ischemia, peripheral arterial disease, and cerebrovascular disease. Symptoms of diabetes that parents should monitor for include, polyuria, polydipsia, weight loss, and fatigue (Klish, 2017). Diabetes mellitus is diagnosed when children have a hemoglobin A1c of 6.5, fasting plasma glucose greater than 7.0 or a random plasma glucose greater than 11.1 (Klish, 2017). Metformin can be prescribed to children over age six, and has been shown to decrease BMI by one kilogram for each month that it is consumed (Alizadeh, Khosravi, & Borna, 2013).

Hypertension

Hypertension can be defined as an abnormally high blood pressure (BP) for age and height (Klish, 2017). Hypertension typically develops as the nervous system increase the heart rate and BP, due to increased levels of catecholamine's as a result of hyperlipidemia or diabetes mellitus (Robinson, Geier, Rizzolo, & Sedrak, 2011). According to Zhang, TSE, Deng and Jiang (2008), obese children have three times the risk for developing hypertension than non-obese children. Signs and symptoms of this condition may not be obvious to PCPs in the absence of BP monitoring, but can lead to left ventricular hypertrophy (Klish, 2017). Practice guidelines state that all children over three years of age should have their BP assessed yearly (Barlow, 2007; David et al., 2007). Hypertension is diagnosed when children have a systolic or diastolic BP in the 95th percentile for their sex, age, and height. Children can be referred to pediatric cardiologist for medical management if diagnosed (Barlow, 2007; David et al, 2007).

Hyperlipidemia

Hyperlipidemia occurs because of an abnormal accumulation of lipids in the blood (Klish, 2017). This disease is diagnosed when patients are found to have elevated triglycerides (TG) and low-density (LDL) cholesterol (Zhang, TSE, Deng, & Jiang, 2008). All children two years and older with a family history of hyperlipidemia or cardiovascular disease, with a BMI in the 85th percentile should have a fasting lipid panel ordered (Fennoy, 2010). Hyperlipidemia has the risk of leading to carotid and aortic arterial fatty streaks, arterial stiffness, coronary artery disease, myocardial infarct and stroke (David et al., 2007). If patients initial fasting lipid panel (FLP) is abnormal a second FLP should be obtained in two weeks to three months. If the blood work remains abnormal patients should be referred to pediatric cardiologist (Barlow, 2007; David et al., 2007).

Obstructive Sleep Apnea

Obstructive sleep apnea (OSA) occurs during sleep when there is a partial or complete blockage of the upper airway (Klish, 2017). Verhulst, Van Gaal, De Backer, and Desager (2008) conducted a study on OSA in overweight and obese children and found that 60% of participants had sleep apnea. Apneic episodes occur when the airway is obstructed and lead to hypoventilation, carbon dioxide retention, hypoxia, and potentially pulmonary embolism (Klish, 2017). Diagnosis is confirmed when apneic episodes occur five or more times per hour during sleep (Verhulst, Van Gaal, De Backer, & Desager, 2008). Parents should be educated to monitor their children for symptoms including apneic periods, loud snoring, excessive tiredness, or morning headaches (Fennoy, 2010). If suspected or confirmed, a referral needs to be made to a pulmonologist (Barlow, 2007; David et al., 2007).

Non-alcoholic Fatty Liver Disease

Non-alcoholic fatty liver disease can be diagnosed by monitoring patients Aspartate transaminase (AST), alanine transaminase (ALT) or ordering a liver ultrasound (Hassick & Hampl, 2016). Over nutrition and obesity are thought to cause an inflammatory cycle that leads to hepatic lipid deposits and elevated serum aminotransferase (Klish, 2017). Hassick and Hampl (2016) found that in autopsy on obese children, 38% had a fatty liver. PCP are recommended to order AST and ALT levels every two years in children over two years old (Alizadeh, Khosravi, & Borna, 2013). If these levels are two times the normal values on two different occasions referrals should be made to a pediatric gastroenterologist (Robinson, Geier, Rizzolo, & Sedrak, 2011)

Premature Puberty

Premature puberty in overweight and obese children occurs because these children have more fat cells which release more androgens. Fat cells synthesise androgens including, estrogen and testosterone production, resulting in early physical maturation. Female children that initiate puberty

earlier in age are often at higher risk for premature menses and polycystic ovarian syndrome (Hassick & Hampl, 2016; Klish, 2017; David et al., 2007).

Asthma

Asthma is a respiratory condition caused by bronchial spasms, difficulty breath and increased mucus production (Klish, 2017). This is thought to occur due to adipose tissues producing pro-inflammatory cytokines leading to a chronic inflammatory state in children's lungs (Parsons, Patel, Tran, & Littman, 2012). A case control study by Parsons et al. (2012) noted a correlation between maternal BMI and child respiratory hospitalization. This study found that children born to obese mothers had higher hospital admission for asthma in the first five years of life (Parsons et al., 2012). There was a 3.3% increase risk for wheezing to these children then those born to normal weight mothers (Parsons et al., 2012). Treatment for asthma should follow clinical guidelines for childhood asthma, but not limit physical activity (Robinson, Geier, Rizzolo & Sedrak, 2011; David et al., 2007; Klish, 2017).

It is important to educate PCPs to be aware of these potential complications of CO to effectively identify or monitor children at risk. To support PCPs in assessing and manage overweight and obese children they must understand the risk factors and co-morbidities that arise from this chronic condition. Secondly, they need to have the knowledge and resources to treat these conditions. Further comorbidities and complications of CO not included in this literature review are: slipped capital femoral epiphysis, tibia vara (Blount disease), increased bone fractures, hidradenitis suppurativa, and acanthosis nigricans (David et al., 2007; Klish, 2017).

Literature Review

This literature review will discuss the importance of assessing all children from infancy to 17 years of age, monitoring and tending children's weight status, screening BP and blood work for the

comorbidities associated with obesity, and finally promoting behavioral changes in lifestyle and eating habits. The goal of this review is to provide a clear overview of the research to improve PCPs confidence, knowledge, and resources when caring for overweight and obese children.

Age to Initiate Weight Assessment

It is unclear at what age PCPs should assess pediatric patients weight status. Conflicting recommendations from the United States Prevention Task Force (USPTF), CDC, AAP, Canadian health organization (CHO), Dietitians of Canada, and The College of Family Physicians of Canada, have contributed to the confusion (CDC, 2014; Klien et al., 2017; David et al., 2007; Wein, Yang, & Goldhaber-Fiebert, 2012). Specifically, it is unclear if initiating screening at infancy, two years of age, or six years of age has the greatest impact for reducing rates of pediatric obesity (Barlow, 2007; David, Lau, Douketis, Morrison, Hramiak, & Sharma, 2007; Parkin et al., 2015).

Research in infants aged zero to two is limited. There were no studies found regarding the benefit of initiating lifestyle education at birth. During infancy, the focus for healthy lifestyle education is not on the newborn, but directed at the family. Parents are encouraged to improve their own nutritional knowledge and model healthy exercise and eating habits. During infancy, the home environment and parental behaviors have the largest impact regarding the establishment of feeding, sleep duration, and screen time (Hassink et al., 2016).

The AAP and CMA note in their 2007 expert committee report that a lack of normative BMI values for children less than two years old, energy restrictions to promote weight loss are not recommended (Barlow, 2007; David et al., 2007). Infants require a different evaluation and screening tool for weight status. The AAP and CMA suggests that weight for length be calculated and plotted for all infants at each medical visit to monitor weight and growth status (Barlow, 2007; David et al., 2007). Infancy is a time when PCPs can begin to educate parents about CO signs, risk factors, and the lifestyle

changes to stress the importance of infants obtaining adequate nutrition, activity, and sleep. However, this is not the age PCPs can begin to truly screen children for obesity or restrict their caloric intake.

The USPSTF made a policy statement in 2009 recommending that children six years and older be screened for their weight status annually (Klien et al., 2017). Azarpazhooh, Sekhavat, and Sigal (2017) endorse this recommendation as they note that children at this age are considered more capable of making lifestyle choices and participating in their own care. This age recommendation could also be due to having the majority of specialized counselling programs for overweight and obese children who are six years and older. For example, Shapedown BC, a free multidisciplinary program which provides 10 weeks of lifestyle counseling to reduce pediatric obesity, only accepts patients six years and older (Shapedown BC, 2017).

In reviewing, multiple articles and clinical practice guidelines, a significant amount of the research supports the assessment for weight status to begin in children two years and older (Foster, Farragher, Parker, & Sosa, 2015; Lynch et al., 2017; Wein, Yang, & Goldhaber-Fiebert, 2012; Peek, 2017; Barlow, 2007). Though there is contradiction among recommendations, the CDC, AAP, and COH, all recommend screening for pediatric obesity in children two years and older (Barlow, 2007; Lau, Douketis, Morrison, Hramiak, Sharma, & Ur, 2007). Pediatricians report assessment should begin in all children two years and older as BMI calculations for these age groups have standardized normative values to assist diagnosis (Barlow, 2017; Lau et al., 2007). PCPs can reference the BMI chart and categorize their patients weight for underweight, normal weight, at risk for being overweight, overweight, or obese; helping to trend their patients weight and recognize when to provide intervention and to what degree (CDC, 2014).

Lynch et al. (2017) conducted a retrospective cohort study on BMI trajectories of children aged two and five years old, noting that children with a higher BMI by age five had a higher probability of

being obese into adolescence and adulthood. Secondly, the research discovered that children over five years old who were overweight, had a ten-fold risk of becoming obese in adolescence compared to children aged two who had a two-fold increase of becoming obese in adolescence (Lynch et al., 2017). Ultimately, this research recommends initiating interventions for CO early in life to prevent children from entering into unhealthy BMI trajectories as well as encouraging an upstream health promotion approach.

In further support of initiating obesity screening in children aged two years and older, one study notes that obesity prevention targeting children aged two to six was most beneficial because they had more frequent visits to their PCPs, their behaviors were more malleable, and parents had a larger influence over their children to encourage healthy diets and activity levels (Rifas-Shiman et al., 2017). The researchers found that after the age of 5 years old, it was more difficult for children's lifestyle habits to be impacted (Rifas-Shiman et al., 2017). The evidence indicates that if children at risk for becoming overweight and obese can be identified earlier, then counselling, education, and lifestyle changes have a better opportunity to impact patients and their family's lifestyle choices and ultimately reduce weight (Peek, 2017; Hassink et al., 2016; Barlow, 2017).

The CDC and CMA recommend that PCPs measure and chart children's weight status at each clinical visit (CDC, 2014; David et al., 2007). They also should do a qualitative assessment regarding the dietary patterns of patients and families. This assessment aims to help PCPs understand the diet and exercise choices of patients and families to help them create patient centered management strategies and care plans (Barlow, 2017). A sample of questions to use for this qualitative assessment was created by the Blue Cross Blue Shield of North Carolina, called Behavioral Risk Assessment for Overweight or Obesity, and is included in Appendix A.

The consensus from multiple studies and practice guidelines advocates that to diagnose and monitor pediatric obesity, PCPs should screen all children two years and older for their weight status and plot findings on a standardized growth chart annually (Peek, 2017; Hassink et al., 2016; Barlow, 2007; Rifas-Shiman et al., 2017; Rogers et al., 2013). The first step in reducing weight of children is to provide timely diagnosis in the primary care setting. Peek (2016) notes that weight management is easier to implement than weight loss. If patients can be identified as being overweight or obese at younger ages, hopefully, interventions can be implemented to prevent obesity continuing into adulthood (Peek, 2016). The focus must shift from treating pediatric obesity to preventing it.

Tools to Diagnose Pediatric Obesity

BMI has been adopted by most countries as the most valid and reliable obesity screening tool to identify children with excess adiposity (Hillman, Corathers, & Wilson, 2009). This measure is used for its low cost and ease in determining children and adolescent's total fat mass (Ferrera, 2006). The International Obesity Task Force (IOTF) created a standardized chart for BMI based on age and gender of children aged two to 18 (Klein et al., 2017). BMI is calculated based on the age and sex of the patient. Each gender and age has a different BMI to represent underweight, normal, overweight, and obese categories. To incorporate differences in age, gender, ethnicity, genetic predispositions, and sexual maturation, data was utilized from multiple countries including: Brazil, Britain, Hong Kong, Singapore, the Netherlands, and the United States of America to provide a standardize BMI reference chart (Barlow, 2007; David et al., 2007).

This screening tool is used to help support clinicians to identifying overweight and obese children (David et al., 2007); however, it is not a tool to calculate body fat percentages. For example, some adolescents during puberty with excess muscle development may be inappropriately categorized as overweight or obese. PCPs need to be aware of this misclassification in some adolescent's due to

muscle weighing more than fat. However, the CDC, AAP, COH, and World Health Organization still unanimously support using BMI to diagnose pediatric obesity (Barlow, 2017; Lau et al., 2007).

A systematic review of medical records conducted by Hillman, Corathers, and Wilson, (2009) notes that only 5.5% of pediatric patients in Cincinnati PCP offices had their BMI documented, while only 4.3% plotted them on growth charts. Barriers to time and resources is noted as a leading contributor to reduced rates of BMI screening and charting. The literature suggests that strategies to improve BMI assessment should include using electronic medical records with medical secretaries to chart BMI in PCP offices (Hillman, Corathers, & Wilson, 2009). Authors hypothesize that due to time constraints during clinic visits and high patient volumes, it may be beneficial to conduct BMI screening outside the primary care office (Hillman, Corathers, & Wilson, (2009).

A study by Azarpazhooh, Sekhavat, and Sigal (2017) explored using dental offices to conduct BMI screening. According to the pediatric dental association, children should have biannual dental visits starting at two years of age (Azarpazhooh, Sekhavat, & Sigal, 2017). Therefore, screening BMI in this setting would provide routine opportunities to monitor weight status. This study states that many pediatric dentists already calculate BMI when administering local anesthesia for dental procedures (Azarpazhooh, Sekhavat, & Sigal, 2017). Additionally, Azarpazhooh, Sekhavat, and Sigal (2017) used a qualitative assessment questionnaire to assess sociodemographic, sociodemographic, water and soft drink consumption, school nutrition policy, sedentary and physical activities, and video screen time to help identify children at risk for dental caries. This survey could be easily incorporated into obesity screening and education prevention in the clinical setting. However, for those children unable to afford a dentist it is hoped that they are being followed by their PCP. This study also identified that measuring and charting BMI in dental practices is feasible (Azarpazhooh, Sekhavat, & Sigal, 2017). However, it did not address the sharing of the data with PCPs. Their research notes the possibility of utilizing

alternative settings and disciplines to enhance the triaging of overweight and obese children (Azarpazhooh, Sekhvat, & Sigal, 2017).

Savinon, Smith-Taylor, Canty-Mitchell and Blood-Siegried, (2012) conducted a study analyzed using medical assistance to measure height and weight and plot the information into electronic medical records (EMR) to calculate BMI (Savinon, Smith-Taylor, Canty-Mitchell, & Blood-Siegried, 2012). This was done for pediatric patients at each medical visit to save time for PCPs and to provide an automatic BMI calculation. The EMR BMI plotting was compared to written plotting in 10 different PCP clinics (Savinon et al., 2012). It was noted that EMR improves rates of BMI screening by 62% (Savinon et al., 2012). This intervention improves screening and care of overweight and obese patients as PCP can easily visualize the BMI and trends in weight status. This study has the potential to provide PCPs with the ability to delegate BMI measuring and charting to medical secretaries to overcome barriers to time while improving adherence to screening recommendation (Savinon et al., 2012).

BMI screening is only one measurement used in screening children for CO. Further screening is necessary for overweight or obese children to rule out co-morbidities including cardiovascular disease, diabetes, and nonalcoholic fatty liver (Parkin et al., 2015; David et al., 2007; Zhang, TSE, Deng, & Jiang, 2008). PCPs are recommended to measure blood pressure, fasting glucose, ALT, AST, and a non-fasting lipid panel, including cholesterol, LDL, high density lipoproteins, and TGs in overweight and obese children (Zhang, TSE, Deng, & Jiang, 2008). This assessment is recommended to be conducted every two years, for patients two years and older (Peek, 2016). PCP should also assess behavioral risk leading to CO by using the ten-question assessment created by the Blue Cross Blue Shield of North Carolina included in appendix one (Blue Cross Blue Shield North Carolina [BCBSNC], 2010). This questionnaire helps PCPs further assess the lifestyle risk factors facing overweight and obesity children.

Johnson, Montgomery, and Ewell (2017) conducted a study on the cardiovascular risk in 229 low income preschool aged children, two to five years old, in an urban southeastern city. This study found that 23% of children who were obese had twice the risk of developing dyslipidemia when compared to normal weight children (Johnson, Montgomery, & Ewell, 2016). Authors noted that one in five children had borderline or high-risk cholesterol levels and 21% had elevated systolic blood pressures, classifying them as hypertensive (Johnson, Montgomery, & Ewell, 2016). This study depicts the risk overweight and obese children have for developing hypertension, hyperlipidemia, coronary heart disease, stroke, and end-stage renal disease (Johnson, Montgomery, & Ewell, 2016). It is clear from the literature that CO leads to multiple serious comorbidities and possible mortality. The need exists to evaluate and monitor not only BMI, but also blood pressure, cholesterol, liver enzymes and blood glucose levels as a means of early identification and prevention of CO and its risk factors. (Lynch, Rutten, & Ebbert, 2017).

In summary, BMI is the best clinical tool to assess and diagnose pediatric obesity (CDC, 2014; David et al., 2007; Barlow, 2007). For this tool to be beneficial to PCPs, BMI must be calculated and charted annually to provide trends in patient's weight status (Barlow, 2007; David et al., 2007). Secondary assessment of blood pressure, blood work, and lifestyle and eating habits must also be analyzed (David et al, 2007; Zhang, TSE, Deng, & Jiang, 2008). For PCPs to best support and care for young children and their families the data needs to be available regarding weight status and risk factors for correct clinical diagnose to be made and appropriate management to be provided. Inadequate obesity screening and treatment is leading to missed opportunities to intervene in the disease process and prevent this growing epidemic (Spivack, Swietlik, Alessandrini, & Faith, 2010).

Primary Management and Lifestyle Recommendations

There are several aspects to be considered when developing an approach to support PCPs to intervene in CO. Recent management strategies focus on improving diet, increasing physical activity,

reducing screen time, and limiting sweetened drink consumption (Rogers et al., 2013). These lifestyle interventions are combined into the 5-2-1-0 management program. This program educates pediatric patients and their families about the importance of eating five fruits or vegetables a day, limiting screen time to two hours a day, increasing physical activity to one hour a day, and zero consumption of sugary drinks (Gibson, 2015; Rogers et al., 2013). The purpose of this intervention is not to lose weight, but to promote sustainable lifestyle changes in children (Sesselberg et al., 2010). The 5-2-1-0 intervention has been well established in research, however, many PCPs are unfamiliar with the intervention and lifestyle management strategies (Spivack, Swietlik, Alessandrini, & Faith (2010).

Spivack et al. (2010) reports that 95% of PCPs are willing to spend more time educating patients during well-child visit if educational materials were available. This study states that only 11% of PCPs felt that their current resources for lifestyle management strategies were adequate (Spivack et al., 2010). However, 99% of the PCPs acknowledge that having information to provide patients and families on diet, nutrition, food shopping, portion size, and exercise would be beneficial in reducing the prevalence of CO (Spivack et al., 2010). Additionally, PCPs state that having a website containing information on nutrition, exercise and other health topics would be valuable to provide families and patients (Spivack et al., 2010). This study indicates PCPs are willing to spend more time with patients and families to educate them on the risk factors and management strategies to combat obesity, but need more knowledge and resources (Spivack et al., 2010).

In regard to eating five fruits and vegetables a day it is important to understand what constitutes a serving of a vegetable or fruit. For example, two cups of lettuce equal one serving as one cup of carrots, bell peppers, tomatoes, green beans, potatoes or mixed vegetables is one serving (Government of Canada, 2017). As a rule of thumb fruits and vegetables should cover half of the plate during meals (Rogers et al., 2013). The 5-2-1-0 Let's Go! has an online website with a toolkit to provides strategies

for increasing vegetable and fruit consumption, ideas for healthy snacks for children, and information on how to present fruits and vegetable in a fun and creative way (<http://www.lets-go.org/wp-content/uploads/k-5-final.pdf>). This resource can be provided to both PCPs and families.

In relation to screen time, the AAP and CMA do not recommend children under two years of age to watch TV (Barlow, 2007; David et al., 2007). Research shows that even three-month-old infants are watching TV. Hassink et al. (2016) discovered that 40% of three month olds and 90% of two year olds watch TV. However, in toddlers, younger than 24 months, no screen time is recommended and in children over two years old only one to two hours is acceptable (Hassink et al., 2016). The current increase in screen time across all ages has greatly increased inactivity and sedentary behaviors (Dennison & Jenkins, 2002; Andersen et al., 1998). To combat this rising trend, parents are encouraged to monitor and restrict their children's screen time by removing TVs from bedrooms and encouraging activities outdoors (Hassink et al., 2016).

The 5-2-1-0 management program advocates one hour of physical activity a day, this may be difficult to instigate in some patients. One strategy suggested by Shepherd (2009) was to focus on reducing inactivity not necessarily increasing physical activity. Simple strategies were suggested encouraging parents to walk children to school instead of driving them, for children to skip rope in the driveway each day, dance when indoors or be enrolled in child chosen extracurricular sports (Shepherd, 2009). Shepherd (2009) found that as children got older they became less active and had an increased risk for becoming obese in adolescents and adulthood. To encourage physical activity, it is important that PCPs provide patient centered excises that are realistic and enjoyable (Shepherd, 2009).

A study conducted by Rogers et al. (2013), implemented the 5-2-1-0 Let's Go! program in 12 communities in Maine. The Let's Go! program was implemented to help children and families learn how to make healthy lifestyle choices and increase awareness of the 5-2-1-0 management strategies

(Rogers et al., 2013). After the 5-2-1-0 Let's Go study (2012) had been implemented for three years, from 2007 to 2011, the research indicated that children's consumption of vegetables increased by 18%, sugary drink consumption dropped by 6%, and parents became more aware of the program. Overall 31% of children were following three of the four recommendations by the end of the study (Rogers et al., 2013). Each family was provided a toolkit on how to implement the four strategies. Parents stated that the knowledge of healthy behaviors and supportive environment from other families, the school, and researchers allowed for behavioral change to occur (Rogers et al., 2013).

In addition, the implementation of this study allowed parents to become empowered to recognize and intervene in their child's weight gain and provide healthy lifestyle modeling (Rogers et al., 2013). During the study parents reported positive reactions to the lifestyle changes and the 5-2-1-0 program (Rogers et al., 2013). This study demonstrates the success of utilizing the 5-2-1-0 multifaceted approach in managing overweight and obese children's lifestyle and eating habits. It also illustrates the ease of implementation and sustainability of the program in local communities.

Another study by Gibson (2014), focused on presenting the 5-2-1-0 program in PCPs offices through posters in the waiting room, exam rooms, and bathrooms. Each child and family was given a 5-2-1-0 healthy habits questionnaire from the Let's Go! tool kit to complete in waiting rooms (Gibson, 2014). Medical assistances also measured and charted all patients aged two to 18 years BMI at each visit. The BMI and completed questionnaires were included in all participating children's charts. This study found that the documentation of BMI increased by 71%, education to families and patients increased by 78%, and the accurate diagnosis of overweight and obesity children increased by 32% (Gibson, 2014). Furthermore, this study had a significant impact of reducing children's systolic blood pressure. There was a 12% decrease in hypertension at the end of the study implementation (Gibson, 2014). The implementation of this program in the primary care setting was beneficial in translating

current evidence based recommendations into practice (Gibson, 2014). Both studies by Gibson (2014) and Rogers et al. (2013) show the impact, transferability, and benefit of implementing the 5-2-1-0 program to combat pediatric obesity.

Further lifestyle modifications and recommendations were included in the AAP and CMA 2007 policy statement. The AAP and CMA had evidence supporting the importance of eating breakfast daily, limiting fast food, and eating out (Barlow, 2007; David et al., 2007). Meals were encouraged to be eaten together and at home to increase the health and nutrition of all family members (Barlow, 2007; David et al., 2007). The AAP and CMA also encourages the TV to be turned off during meals and portion sizes to be based on age and nutritional demand. Likewise, high fiber diets with adequate calcium were also recommended. The AAP and CMA found that families play a vital role in modeling eating, exercise, and screen time habits (Barlow, 2007). Due to the impact of a parent's behavior on their children, it is key to design family based prevention strategies ((Barlow, 2007; David et al., 2007).

The AAP and CMA also makes recommendations for breast feeding (Barlow, 2007; David et al., 2007). Having found a correlation between length of breast feeding and BMI. Breastfeeding is recommended until at least six months of age (Barlow, 2007; David et al., 2007; Peek, 2017). Further support for breastfeeding is establish in a study by Thomas and Bishop (2007) who found that infants weaned before four months tended to have rapid weight gain and higher body fat as adolescents. Additionally, a study by Singhal (2007) revealed that babies who were breast feed had lower rates of overweight and obesity. Singhal (2007) believes that breast milk contains fewer calories when compared to formula. Though breast feeding versus bottle feeding is a controversial topic due to its sensitive nature, multiple articles support the evidence for breast feeding. PCPs need to be aware of this knowledge to provide the best patient centered advice to support parents in raising healthy weight children.

Overall, the clinical practice guidelines and primary research studies support the implementation of the 5-2-1-0 management program to overcome the barriers of time, inadequate knowledge of current treatment guidelines, and insufficient resources facing PCPs (Rogers et al., 2013). The 5-2-1-0 program is proven to be effective at promoting healthy lifestyle habits in both patients and their families (Barlow, 2007; David et al., 2007; Gibson, 2014; Rogers et al., 2013). This program is focused on creating self-efficacy and confidence in making food and activity choices. To improve the care for overweight and obese children PCPs must educate patients on the 5-2-1-0 recommendations and provide supplemental resources and referrals to allow patients to become independent in sustaining their own health.

Stages of Management

The AAP has created a staged approach in caring for overweight and obese pediatric which the Canadian task force on preventative health care also supports (Barlow, 2007; Parkin et al, 2015). Treatment strategies are divided into four categories with increasing levels of care and resources. The first stage is focused on prevention. Educating patients and families on the 5-2-1-0 program and teaching them basics healthy lifestyle choices regarding nutrition, exercise, and screen time (Barlow, 2007). The aim of this stage is not to have patients lose weight, but to form healthy lifestyle habits and maintain a healthy BMI. Weight should be maintained with growth to have a BMI that reduces as the patient age increase (Barlow, 2007). Monthly follow-up is to occur to track BMI for improvement, patients are recommended to lose no more than 1kg per week (Barlow, 2007). If after six months there is no improvement in BMI or lifestyle habits, the second stage in care is to occur (Barlow, 2007).

The second stage provides more structure surrounding meals and snacks. A dietitian or clinician confident in creating a healthy meal plan works with the family and patient to create an individualized and realistic strategy (Barlow, 2007). Parents are encouraged to monitor their child's food intake, activity, screen time, and create a restaurant log. The goal is to reduce patients BMI, however weight

loss exceeding one to two pounds per week is to drastic a reduction (Barlow, 2007). Patients are required to have monthly office visits and may be referred to exercise therapist to promote the development of positive physical activity habits (Barlow, 2007). If no improvement in BMI is noted after six months, then the patient progresses to the third stage.

The third stage involves referral to multidisciplinary obesity care programs. Shapedown BC is a multidisciplinary obesity education program that offers intensive counselling sessions to families and patients (Shapedown BC, 2017). Three programs currently exist in British Columbia at Children's Hospital, Abbotsford Hospital, and Nanaimo Hospital. These programs offer a 10-week outpatient counselling program following the 5-2-1-0 multifaceted management approach (Shapedown BC, 2017). The extra structure in diet and exercise is hoped to have patients reduce their BMI until they are no longer above the 85th percentile (Barlow, 2007). After the weekly visits patients are monitored monthly, again if in six month no improvement is made they move to the fourth stage of management (Barlow, 2007).

The fourth stage is for children eleven years and older, with a BMI in the 95th percentile, with significant comorbidities, who have no improvement with stages one to three (Barlow, 2007). This stage includes medical intervention via medications, very low-calorie diets, or hospital admission for bariatric surgeries (Barlow, 2007). In one study, Sibutramine, a serotonin reuptake inhibitor, was prescribed in hospital to helped adolescents lose three kilograms above those in similar diet and exercise programs (Molnar, 2005). Since Molnar's studies publication the Food and Drug Administration has approved the drug's use in patients over 16 years of age with a BMI in the 95th to 99th percentile (Barlow, 2017). Though these recommendations can seem extreme in children, it is necessary that PCPs are aware of the diagnostic criteria of each stage and the level of intervention to support them in caring for overweight and obese patients. Overall, the goal of these four treatment strategies is to help children form healthy

lifestyle and eating habits. Utilizing a multifaceted lifestyle strategies and multidisciplinary network of support to care for different patients at different BMI ranges is recommended.

Description of the Project

This culminating project hopes to transfer the knowledge found in multiple articles and practice guidelines into the clinical setting. This project is a combination of a literature review and a poster presentation at a local conference. The poster is a visual support of this literature review. Strengths of creating a poster include having in person communication with PCPs that allows for individual needs and knowledge gaps to be addressed. It also permits feedback from the audience regarding the poster and information quality. Weakness of using a poster include its limited number of PCPs that the information can reach. Both a strength and weakness is that there is limited space available on the poster so only pertinent knowledge can be included. In developing this poster, I realize that barriers may include getting the poster made and being able to book a space to at the conference to present. The same barriers may also remain as already noted, such as PCPs being unable to have the time to receive the information and intervene in CO.

To assess the impacts of this culminating project, the author will talk with peers and colleagues at local conferences regarding the poster to gain feedback on the information provided. A post presentation survey can be provided to allow for anonymous feedback from colleagues that have reviewed the poster presentation to further explore if there are gaps in the information and if it has been applicable to clinical practice. The author will also provide resources for the algorithm for the assessment and management of CO as well as referral forms for the Shapedown BC program. The layout of the poster will be included in Appendix D upon final approval of this literature review.

Limitations

Limitations of this literature are attributed to a lack of research in children aged zero to two. There were limited studies conducted on the effect of educating families to the risk factors, consequences, and lifestyle habits in this age group. No research studies were found analyzing the effects of the 5-2-1-0 program in infants and toddlers, studies on the 5-2-1-0 program focused only on children two years and older. Further research should be conducted that concentrations on the impacts of education and management for CO during infancy. Secondary limitations include having one author. Publication bias cannot be eliminated as the search and study selection was performed by a single author.

Conclusion

The continued rise in incidence of pediatric obesity despite multiple practice guidelines and research studies indicates the inadequate knowledge translation to PCPs, families, and patients regarding BMI measurement, diet, activity, and screen time recommendations. As PCP continue to diagnose and care for obese children it is vital for them to feel knowledgeable and support with resources to provide families and patients. The goal of this culminating project is to synthesize current research and practice guidelines to help alleviate barriers that are preventing PCPs from assessing, screening, and managing overweight and obese child in the primary care setting. In evaluating the literature and clinical practice guidelines, it was identified that screening for obesity should begin in all patients two years and older on an annual basis. This screening would include BMI, blood pressure, and blood work as necessary. The primary management strategy is the 5-2-1-0 program which focuses on dietary, activity, and screen time education to encourage children and families to make healthier lifestyle choices.

This literature review finds the limitations in treating CO to include a lack of research regarding infants and toddlers. The broader implications are not only to have PCPs understand the impact of CO

on patients, families and the health care system; but also, to identify gaps in the literature and provide research that may further reduce the prevalence of this chronic condition.

The next steps in pediatric care is to have PCPs measure and chart BMI on all patients over two, and to educate families regarding lifestyle modifications and supplemental resources on diet and exercise. The AAP and CMA have created guidelines and tool kits to support PCPs in assessing for CO by overcoming barriers to time, resources and knowledge. Further application of this project would be to have this knowledge filter into schools, communities, and the media. Support from schools regarding having nutritionally rich foods or walking to school initiatives is one more way to encourage activity. Additional support from schools and communities will hopefully encourage patients and family's knowledge regarding lifestyle modifications that will promote healthy weight children. As we continue to discover new assessment tools, resources, and treatment strategies partnering with schools, communities and the media could help further reduce the prevalence of CO.

In regard to CO, PCPs have an opportunity to form long term relationships with pediatric patients and their families to assess and encourage healthy lifestyle behaviors and ultimately reduce the prevalence of this chronic disease. Through evidence based knowledge it is hoped that PCPs will feel empowered to address and treat CO. By focusing on providing education to PCPs, I hope to improve assessment, screening, and management of CO, resulting in earlier and improved identification, treatment, and prevention of this condition.

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Appendix A

Qualitative Childhood Obesity Assessment Questionnaire

1. Does your child eat five or more fruits and vegetables per day? ☐ Yes ☐ No
2. Does your child eat breakfast five times a week or more? ☐ Yes ☐ No
3. Does your child watch TV, videos or play computer games for two hours or less per day?
☐ Yes ☐ No
4. Does your child take gym class or participate in sports or dance in or outside of school three
or more times a week? ☐ Yes ☐ No
5. Does your child have a favorite sport or physical activity that they love to do? ☐ Yes ☐ No
6. Does your child eat dinner at the table with the family at least once a week? ☐ Yes ☐ No
7. Is your child's room a "TV-free zone?" ☐ Yes ☐ No
8. Does your child eat meals at the table with the TV turned off? ☐ Yes ☐ No
9. Does your child drink water instead of soda, juice or other sweetened drinks? ☐ Yes ☐ No
10. Does your child have a favorite fruit or vegetable that they eat every day? ☐ Yes ☐ No

Blue Cross Blue Shield North Carolina [BCBSNC]. (2010). Retrieved from
<http://www.bcbsnc.com/content/providers/toolkit/index.htm>

Appendix B

BMI Standardized Assessment Chart

Age (years)	BMI 25 kg / m ²		BMI 30 kg / m ²	
	Males	Females	Males	Females
2	18.41	18.02	20.09	19.81
2.5	18.13	17.76	19.80	19.55
3	17.89	17.56	19.57	19.36
3.5	17.69	17.40	19.39	19.23
4	17.55	17.28	19.29	19.15
4.5	17.47	17.19	19.26	19.12
5	17.42	17.15	19.30	19.17
5.5	17.45	17.20	19.47	19.34
6	17.55	17.34	19.78	19.65
6.5	17.71	17.53	20.23	20.08
7	17.92	17.75	20.63	20.51
7.5	18.16	18.03	21.09	21.01
8	18.44	18.35	21.60	21.57
8.5	18.76	18.69	22.17	22.18
9	19.10	19.07	22.77	22.81
9.5	19.46	19.45	23.39	23.46
10	19.84	19.86	24.00	24.11
10.5	20.20	20.29	24.57	24.77
11	20.55	20.74	25.10	25.42
11.5	20.89	21.20	25.58	26.05
12	21.22	21.68	26.02	26.67
12.5	21.56	22.14	26.43	27.24
13	21.91	22.58	26.84	27.76
13.5	22.27	22.98	27.25	28.20
14	22.62	23.34	27.63	28.57
14.5	22.96	23.66	27.98	28.87
15	23.29	23.94	28.30	29.11
15.5	23.60	24.17	28.60	29.29
16	23.90	24.37	28.88	29.43
16.5	24.19	24.54	29.14	29.56
17	24.46	24.70	29.41	29.69
17.5	24.73	24.85	29.70	29.84
18	25	25	30	30

David, Lau, Douketis, Morrison, Hramiak, & Sharma, (2007). 2006 Canadian clinical practice guidelines on the management and prevention of obesity in adults and children. *Canadian Medical Association Journal*, 176, 1-117. doi:10.1503/cmaj.061409

Assessment and Management Algorithm

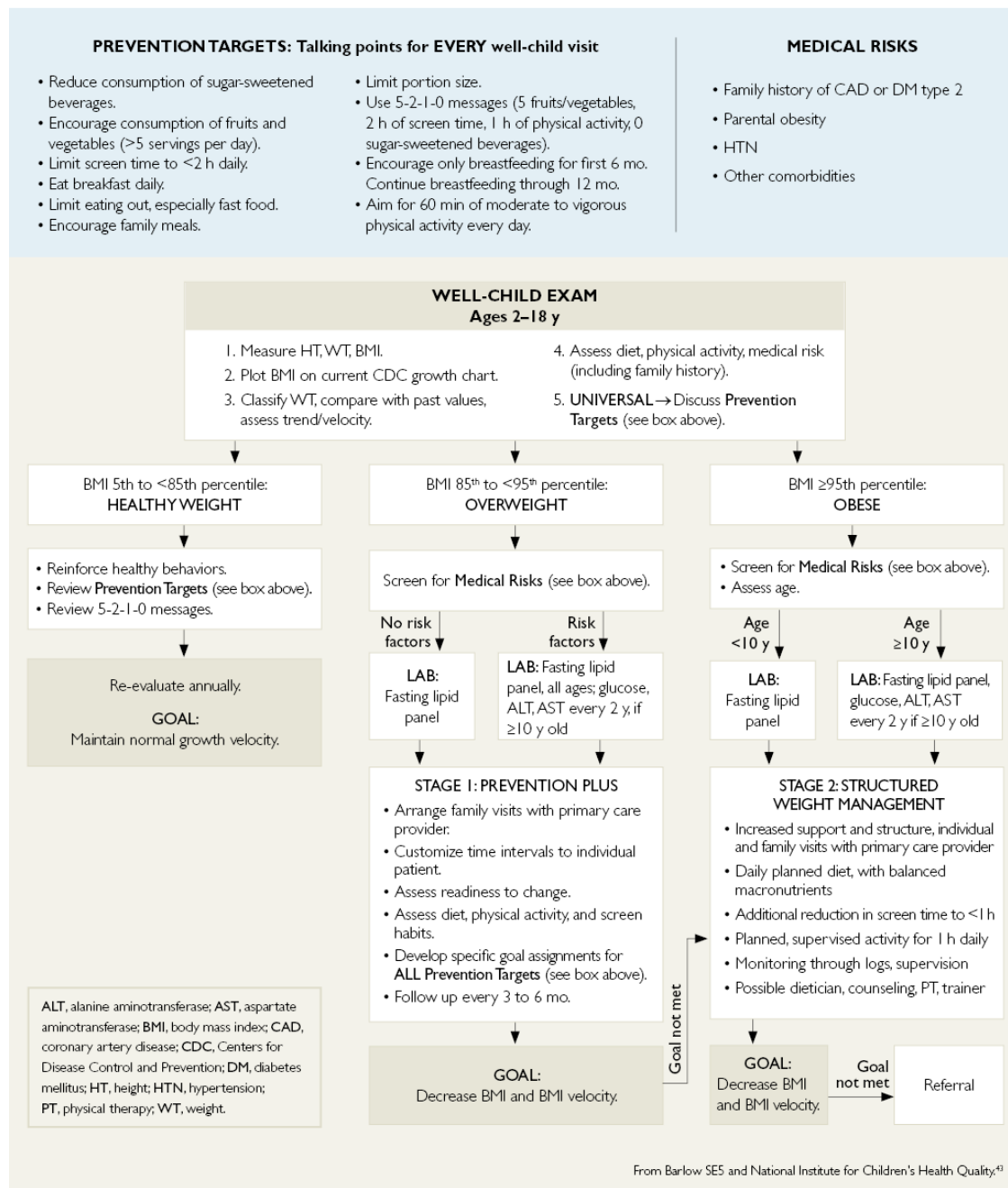


FIGURE 2. Expert Committee recommendations for clinicians for the prevention and treatment of overweight and obesity in children aged 2 to 18 years.

Barlow, S., & The Expert Committee. (2007). Expert committee recommendations regarding the prevention, assessment and treatment of child and adolescent overweight and obesity: summary report. *Journal of Pediatrics*, 120, 164-191. doi:10.1542/peds.2007-2329

Appendix D

Culminating Project: Poster Presentation

