Abstract

Childhood obesity is a leading health problem in Canada and is associated with cardiometabolic disease, reduced quality of life and economic impacts. Obesity prevention is a major imperative in child health. There is an emerging evidence base on obesity-prevention strategies in children. Obesity-prevention strategies need to consider the determinants of obesity, and these determinants should be considered within the context of a child's family, school, neighbourhood, culture and society. This paper reviews approaches to obesity prevention in children, with a focus on the healthcare setting, incorporating both primary and secondary prevention.

Childhood Obesity Prevention

Opportunities in Healthcare

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Childhood Obesity: A Leading Health Problem in Canada Today

Obesity is considered to be the leading public health problem facing children today in Canada and other developed countries. In Canada, the rate of obesity is reported as 8.6% for children and youth aged six to 17 years and as 6.3% for children aged two to five years (Canadian Institute for Health Information [CIHI] and Public Health Agency of Canada [PHAC] 2011; Canning et al. 2004; Shields 2006). Studies examining trends in childhood obesity rates in developed countries worldwide show a consistent increase in the prevalence of overweight and obesity over the past three decades, at a rate of approximately 5% per decade (O'Dea and Eriksen 2010). The rate of overweight and obesity in Canadian children has been increasing at a slightly increased rate per decade (6.6%) over the same time period, even among children as young as preschool age (O'Dea and Eriksen 2010; Tremblay and Willms 2000). Complications of childhood obesity carry significant morbidity and are increasing in prevalence; these include type 2 diabetes mellitus, hypertension, obstructive sleep apnea, non-alcoholic fatty liver disease, orthopedic problems such as slipped capital femoral epiphysis and psychosocial problems including poor self-esteem, depression and reduced quality of life (Freedman et al. 2004; Hannon et al. 2005; Sabin et al. 2006; Sorof and Daniels 2002; Taylor et al. 2005; Taylor et al. 2006; Verhulst et al. 2007; Williams et al. 2005). Children who are obese are at increased risk of becoming obese adults and have increased risks of developing atherosclerotic heart disease, diabetes and certain cancers (Baker et al. 2007; Freedman et al. 1999). Obesity also has important economic impact. A recent systematic review showed that the direct costs of obesity account for between 0.7 and 2.8% of a country's total healthcare expenditures (Withrow and Alter 2011). It has been estimated that obesity in adults and children cost the Canadian economy approximately $4.6 billion in 2008 (CIHI and PHAC 2011).

Challenges with Definitions and Measures of Obesity in Children

Body mass index (BMI), a ratio of weight to height (kilograms/metres squared), is considered the most important and feasible screening measure for obesity in children (Barton, 2010). BMI has been shown to be associated with cardiometabolic risk in both children and adults (de Kroon et al. 2010; Janssen et al. 2005). It can be calculated from either direct measure or a self-/parent report of a child's weight and height. Self-reported measures often underestimate BMI in children and adults and, unfortunately, have been the most common method of reporting BMI in children in Canada until recently (Elgar and Stewart 2008). There still remains a paucity of BMI data in children, especially young children (CIHI and PHAC 2011).

The calculation of BMI is the same as for adults, but the cut-points for weight status (underweight, healthy weight, overweight, obese) vary by age and sex. There are also different systems of BMI cut-points, and obesity estimates can vary among systems. For example, using the International Obesity Task Force system, the rate of obesity among children and youth aged two to 17 years in the 2004 Canadian Community Health

Survey was 8.2%. However, the rate of obesity in this age group was 12.7% based on the World Health Organization (WHO) child growth standards (zero to five years) and growth reference (five to 19 years), and 12.5% based on US Centres for Disease Control and Prevention (CDC) cut-points. The size of the difference between estimates also appears to vary by age group (Shields and Tremblay 2010). A collaborative statement from the Dietitians of Canada, the Canadian Paediatric Society, the College of Family Physicians of Canada and Community Health Nurses of Canada recommends that growth monitoring should be a routine part of healthcare for all Canadian infants, children and adolescents (Dietitians of Canada and Canadian Paediatric Society 2010). It recommends that the growth of all full-term infants and preschoolers should be evaluated using growth charts from the WHO Child Growth Standards (birth to five years of age), and that the growth of all school-aged children and adolescents should be evaluated using growth charts from the WHO Growth Reference 2007 (five to 19 years of age). These are recommended as the charts of choice for use by Canadian family physicians, pediatricians, dietitians, public health or community nutritionists, nurses and other health professionals in the primary care, community and hospital settings (Dietitians of Canada and Canadian Paediatric Society 2010).

Prevention of Obesity in Children: A Major Imperative

There is a substantial and growing base of evidence showing the effectiveness of obesity treatment in childhood, especially in school-aged children. Overall, however, childhood obesity treatment effects are modest and, importantly, require intensive multidisciplinary approaches and sustained contact with the healthcare system over time (Oude Luttikhuis et al. 2009). Treatment programs outside of the research context are often under-resourced and not accessible.

Prevention of obesity in children has become a major imperative. There is an emerging evidence base on obesity-prevention strategies in children. Such strategies need to consider the determinants of obesity (O'Dea and Eriksen 2010). Causes of obesity are often described as simply the imbalance of an individual's energy intake and energy expenditure. However, the "causes of the causes" of obesity – including the determinants of nutrition, feeding behaviours, physical activity and sedentary behaviours of the individual child – need to be taken into account. These determinants should be considered within the context of the child's family, school, neighbourhood, culture and society.

In addition to the determinants of obesity, obesity-prevention strategies need to consider the setting for such interventions, including the healthcare setting, a public health setting, the school, the community and the home. Strategies may need to be tailored for different age groups and for high-risk groups. Aboriginal children in Canada represent a particularly high-risk group. Obesity among Aboriginal children and youth is very high, varying from 16.9% among Metis to 25.6% among the Inuit (ages six to 14 years) (Willows et al. 2012). Unique determinants of obesity in Aboriginal children and families include experiences of colonialism, racism and social exclusion, and inequities in the social determinates of health, and these need to be considered in prevention strategies (Willows et al. 2012).

Finally, obesity-prevention strategies should be guided by health promotion theory (Glanz and Bishop 2010). Important theories relevant to obesity prevention include a focus on individual factors such as beliefs, knowledge and skills. Other theories include ecological perspectives and focus on interpersonal, organizational and environmental factors influencing health behaviours (Kok et al. 2008). Examples of important theories for consideration in the development of obesity-prevention strategies include the theory of planned behaviour, stages of change and the social ecological model.

Evidence for Effective Prevention Interventions

A recent systematic review (updated to September 2010) conducted by the Cochrane Collaboration identified 55 controlled trials designed to prevent obesity in childhood (Waters et al. 2011). A study was included if the intervention had a minimum duration of 12 weeks and was conducted in a broad range of settings (community, school, home, child care, preschool and healthcare settings). Results of the review showed that the studies were predominantly conducted within high-income settings. Eight studies targeted children aged zero to five years, 39 targeted children aged six to 12 years and eight targeted children aged 13–18 years. The most common setting for interventions were schools (43 studies), and most interventions took a combined dietary and physical activity approach to obesity prevention. A meta-analysis of the change in BMI from baseline to post-intervention was conducted of 37 studies with a combined sample of 27,946 children (18 studies could not be included due to a lack of appropriate BMI data reported). The meta-analysis identified a reduction of BMI of 0.15 kg/m^2. The authors noted that the limitations of the included studies may be associated with inflation in their estimate of effect and that their findings should therefore be interpreted with caution.

Emerging Evidence for Obesity Prevention in the Healthcare Setting: Primary Prevention

For healthcare providers, it is notable that there is a paucity of evidence regarding effective obesity-prevention strategies in healthy weight children in the healthcare setting; only two studies were included in the Cochrane review, and the authors of the systematic review concluded that interventions need to be developed that can be embedded into ongoing practice. An example of a primary prevention intervention was conducted in

primary care practices in San Diego County, California (Patrick et al. 2006). This was a one-year randomized trial of an intervention that was initiated in primary care practices and continued in home settings using the computer, mail and telephone for 878 healthy adolescents aged 11–15 years. At the completion of the trial, there were improvements in some diet, physical activity and sedentary behaviours but no between-group differences in BMI.

There is increasing focus on the preschool years for opportunities for obesity prevention since parents have control over feeding and activity when their children are young. The Institute of Medicine recently published policy recommendations for the prevention of obesity in infancy and early childhood in the following domains: growth monitoring, physical activity, healthy eating (and breastfeeding), screen time and exposure to food and beverage marketing, and sleep (Institute of Medicine 2011). A recent review of 38 studies in preschoolers identified several modifiable behaviours that appear to be associated with obesity. These include the intake of sugar-sweetened beverages, television use and inadequate sleep (Kuhl et al. 2012). Of the 13 studies of obesity prevention in preschoolers that were included in this review, seven were conducted in daycare/preschool settings; none were conducted in healthcare settings (Kuhl et al. 2012). Emerging evidence suggests that pregnancy may be an important time to consider obesity-prevention interventions. Key factors that may be associated with infant weight gain include in utero glucose exposure (Catalano et al. 2009), maternal pre-pregnancy BMI (Whitaker 2004), maternal diet (Moses et al. 2006), physical activity during pregnancy (Hopkins et al. 2010) and smoking (Mizutani et al. 2007).

Secondary Prevention: Screening Followed by Treatment

Screening may be intended to occur in the primary care practice setting; however, the subsequent treatment may be undertaken either in the primary care practice setting or in another healthcare centre. The screening test most often recommended is the calculation of the BMI percentile score based on age- and sex-specific norms since it is feasible and reliable in primary care practice settings. The Live, Eat, Play 2 (LEAP2) trial was conducted in 45 family practices in Melbourne, Australia, in children aged five to 10 years (Wake et al. 2009). Almost 4,000 children were screened, and those identified as overweight or obese were randomized to a brief, physician-led counselling intervention. At 12 months following the intervention, there was no improvement in the children's BMI, physical activity or nutrition. The authors concluded that the findings of the trial cast doubt on current policies that support universal surveillance. Another interpretation is that the BMI screening was effective in identifying children at risk, yet the brief physician-led intervention was not effective in reducing BMI.

The United States Preventive Services Task Force recommends that "clinicians screen children aged 6 years and older for obesity and offer them or refer them to intensive counselling and behavioural interventions to promote improvements in weight status" (Barton 2010). This recommendation was based on a systematic review of medium- to high-intensity behavioural interventions that were found to result in improvements in weight status up to 12 months later (Whitlock et al. 2010). It was noted that such interventions would not be feasible to implement in primary care practice settings but could be conducted in facilities such as pediatric obesity referral clinics. The Canadian Task Force on Preventive Health Care is currently developing a recommendation for screening in Canadian primary care practice settings (Birtwhistle et al. 2012).

Recognition of the Importance of Optimal Health Systems to Support Obesity-prevention Efforts

The Kaiser Permanente Southern California Pediatric Weight Management Initiative included the development of clinical practice guidelines for the management of pediatric weight and enhancements to patients' electronic medical records to provide computer-assisted decision tools (Coleman et al. 2012). This initiative led to a substantial increase in the proportion of children and adolescents with height and weight measured, the proportion of those who were overweight or obese receiving this diagnosis, and the documented counselling rates for exercise and nutrition.

"Do No Harm": Integrating Obesity and Eating Disorder Preventions

There are potential adverse effects of activities aimed at obesity prevention in children, and few obesity-prevention activities have been examined for unintended negative outcomes (Waters et al. 2011). For example, there is controversy regarding some obesity-prevention strategies, such as BMI screening in schools, that may put children at risk for stigmatization if not addressed appropriately (Ikeda et al. 2006). Training of school professionals to use behaviour change techniques as well as dealing with weight bias are some approaches to address these issues (Yager and O'Dea 2009). There is some important work in Canada to develop integrated and sensitive approaches to the prevention of weight-related disorders, including obesity and eating disorders, and to develop common priorities in research, advocacy and policy (Adair et al. 2008).

Addressing the Evidence Gap for Obesity Prevention in Primary Care

To address the limited capacity in preventive research in early childhood in Canada, our group at The Hospital for Sick Children, in Toronto, Ontario, developed a primary care–based research network called Toronto Applied Research Group for Kids! (TARGet Kids!). This research network represents

the development of a novel platform for obesity-prevention research embedded in primary care practice to advance evidence using surveillance, cross-sectional, longitudinal and pragmatic randomized controlled trial methods. As of February 2012, we have recruited over 4,000 children under six years of age to TARGet Kids! and are collecting survey data on behavioural determinants of obesity (nutrition, sedentary lifestyle, sleep, child temperament, parent stress), anthropometrics (BMI and waist circumference) and cardiometabolic risk measures (blood pressure, laboratory measures including insulin, glucose). We hope to fill the research gaps identified in the Cochrane review and to develop, test and implement effective prevention strategies embedded in practice.

Summary

In summary, research is now emerging regarding effective prevention of obesity in children. Strategies have largely been focused on school-aged children and in the school setting. Despite the acknowledged importance of focus on early childhood, there are large gaps in knowledge regarding effective prevention interventions in this age group. Young children and families access the primary healthcare system frequently, yet the opportunity for obesity prevention in this setting is unrealized. There are no studies reporting research integrating prevention interventions in multiple settings. The complex problem of childhood obesity likely requires the development, evaluation and implementation of complex prevention strategies and policies that are multi-level, across age groups and integrated within multiple settings such as homes, schools, the community, public health and healthcare. HQ

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