Evaluating routine pediatric growth measurement as a screening tool for overweight and obese status

Ilona Hale MD CCFP FCFP Emma Jackson MD

Routine growth measurement (RGM) is a widely accepted practice considered to be an integral part of routine pediatric health care. Traditionally, it has been used to detect faltering growth, but more recently it has been recommended as a screening tool for overweight and obese status.[1-4] The Canadian Task Force on Preventive Health Care guideline on pediatric obesity recommends "growth monitoring at all appropriate primary care visits ... (strong recommendation; very low-quality evidence)"[1] based on a long history of use, recommendations from other organizations, and presumed lack of harm; however, no studies were identified to support the practice. A comprehensive systematic review by Westwood et al found inadequate evidence to support RGM for obesity screening and concluded that "it is difficult to see how screening to identify individual children can be justified without effective interventions."[5] Routine growth measurement might also not be as benign as has been assumed.[6]

Wilson and Jungner's criteria

Population screening tests are increasingly being scrutinized using criteria such as those originally developed by Wilson and Jungner for the World Health Organization (WHO) (**Box 1**).[7] Many previously well-established practices, including components of the "annual physical," are no longer being recommended, having failed to meet these criteria.[8] The objective of this article is to evaluate RGM as a screening tool for obesity among pediatric patients in a primary care practice, using Wilson and Jungner's criteria.[7]

The condition should be an important health problem (criterion 1). Overweight and obese status are undoubtedly important health problems. They affect two-thirds of Canadian adults and one-third of children, with an economic cost of between $4.6 and $7.1 billion annually, and contribute to 48 000 to 66 000 deaths every year in Canada.[9]

There should be an accepted treatment for patients with recognized disease, and facilities for diagnosis and treatment should be available (criteria 2 and 3). Although many treatment options have been proposed, there is little evidence that weight management interventions lead to successful long-term weight reduction for most children. A meta-analysis of brief interventions suitable for pediatric patients in a primary care setting found only a marginal reduction of 0.04 on body mass index (BMI) *z* scores,[10] whereas the minimum decrease in the BMI *z* score necessary to ensure fat loss is postulated to be 0.6.[11] A 2015 Canadian study estimated the probability of an overweight child achieving clinically significant weight reduction through secondary prevention in primary care at 0.6% per year.[12] This disappointing trend appears to be generalized over multiple settings.[13,14] A 2017 Cochrane review found only small reductions in childhood BMI as a result of such interventions, reductions that were generally not sustained.[15]

Many studies report that parents and clinicians are often unaware of a child's overweight or obese status, and it follows that BMI screening could present an opportunity for education and intervention.[16] However, a positive screening result might not translate to improvement in weight or health status, because providers often fail to follow an abnormal screening result with the appropriate investigation, counseling, or referral. Weight management programs are often unavailable, and many

Box 1. Wilson and Jungner's criteria for evaluating screening tests

The following are principles of early disease detection to guide planning of case finding:

1. The condition sought should be an important health problem
2. There should be an accepted treatment for patients with recognized disease
3. Facilities for diagnosis and treatment should be available
4. There should be a recognizable latent or early symptomatic stage
5. There should be a suitable test or examination
6. The test should be acceptable to the population
7. The natural history of the condition, including the development from latent to declared disease, should be adequately understood
8. There should be an agreed policy on whom to treat as patients
9. The cost of case finding (including diagnosis and treatment of patients diagnosed) should be economically balanced in relation to possible expenditure on medical care as a whole
10. Case finding should be a continuing process and not a "once and for all" project

Adapted from Wilson and Jungner.[7]

clinicians feel ill-equipped to manage childhood obesity. Parents might not accept the diagnosis or might fail to remember or understand the advice given.[17]

The natural history of the condition, including the development from latent to declared disease, should be adequately understood and there should be a recognizable latent or early symptomatic stage (criteria 7 and 4). The natural history of obesity is not predictable, and growth trajectories are highly variable, particularly during infancy. Although children who are overweight or obese have an increased risk of comorbidities and later obesity,[18-20] a recent longitudinal multicohort study demonstrated that more than half of the children who were overweight as infants had a normal BMI by age 8, and most overweight children were found to have been normal-weight infants,[21] indicating that it is difficult to use early weight measurements to predict future obesity. During infancy, growth rates vary substantially over time and among individuals, and it is common for infants to "surf" over percentile lines.[22] These normal fluctuations of BMI through the first few years can cause confusing shifts in percentiles and false-positive results if infants peak or rebound slightly earlier or later than average.

The variable trajectory of obesity from infancy to childhood to adulthood leads to controversy about the age at which screening and intervention have the highest yield for reduction of future cardiovascular risk. In a 2011 study of Finnish children and adolescents, the positive predictive value of BMI for predicting high adult BMI was found to be 50% for girls and 65% for boys. The ability of elevated childhood BMI to predict later cardiometabolic risk was slightly higher for adolescents when their data were analyzed separately from those of school-age children.[23] This finding is supported by a recent modeling study, which determined that age 16 was the most beneficial age for most children to be referred to treatment for obesity.[24]

A study of 37 672 Swedish men found that boys who were overweight as children but whose weight normalized through puberty were not at higher cardiovascular risk compared with normal-weight children, and that an increase in BMI through adolescence is a more useful predictor of future cardiovascular risk than childhood BMI.[25] The finding that childhood obesity cannot independently predict downstream risk is supported by a meta-analysis published in 2011,[26] which showed that the relationship between childhood obesity and downstream cardiometabolic consequences is dependent on adult weight status, with increased risk only being conferred to those who remain obese as adults. The only exception noted in this study was hypertension, which continued to be affected by childhood weight status regardless of adult weight. Childhood obesity has been found to be a poor predictor of adult morbidity because most disease in adulthood occurs in people who were a healthy weight in childhood.[27]

There should be a suitable test or examination and an agreed policy on whom to treat as patients (criteria 5 and 8). Body mass index, a surrogate measure for adiposity, is the most commonly recommended anthropometric measure for detecting obesity; however, it does not account for variance in body composition among children of the same weight,[28] especially for those individuals with weights at the extremes of upper and lower percentiles, at different ages and stages of sexual maturity, and for different ethnic groups.[29,30]

Use of growth charts has been shown to improve clinicians' ability to identify overweight and obese status in children,[31] but there remains little agreement on which charts to use. Despite the introduction of the international WHO growth charts in 2006, a survey of pediatricians in Europe found that only 29% of them use the WHO growth charts and that 69% use national growth charts.[32] The choice of growth chart has a significant effect on the classification of children's weight and the resulting decision to refer for treatment. The rate of obesity diagnosis is statistically significantly higher when clinicians use the WHO reference compared with the US Centers for Disease Control and Prevention reference (which reflects a heavier, shorter sample).[33] In one Canadian study, the rate of obesity among the children was determined to be twice as high when their weight was evaluated using the WHO charts.[34]

Regardless of which tools are used, accuracy in measurement is required for effective screening. Even very small inaccuracies can lead to substantial differences in classification, particularly in young children and infants. Yet inconsistencies in methodology have been widely reported, and few practitioners consistently adhere to the recommended techniques for measurements.[29]

Appropriate interpretation of growth charts requires a complex and subjective evaluation of a variety of factors, including birth weight, breastfeeding status, parental height, socioeconomic context, ethnicity, and growth trends over time. Guidelines for exactly how and when practitioners should respond are often vague and inconsistently applied.[4]

The test should be acceptable to the population (criterion 6). Several studies reported that while parents often report that growth monitoring helps them understand their child's growth[12] and provides reassurance when their child is growing well, there is a tendency for parents to disregard growth chart information when it signals overweight or obesity.[35] Some parents believe that measurement of children's BMI is distressing and fear it could lead to harm, including the development of eating disorders, stigmatization, and poor self-esteem.[6,36] Many studies report parents' low understanding of growth charts,[17,35,37] which can lead to their worrying about their child's growth, becoming anxious about minor fluctuations in their child's BMI,[38] and

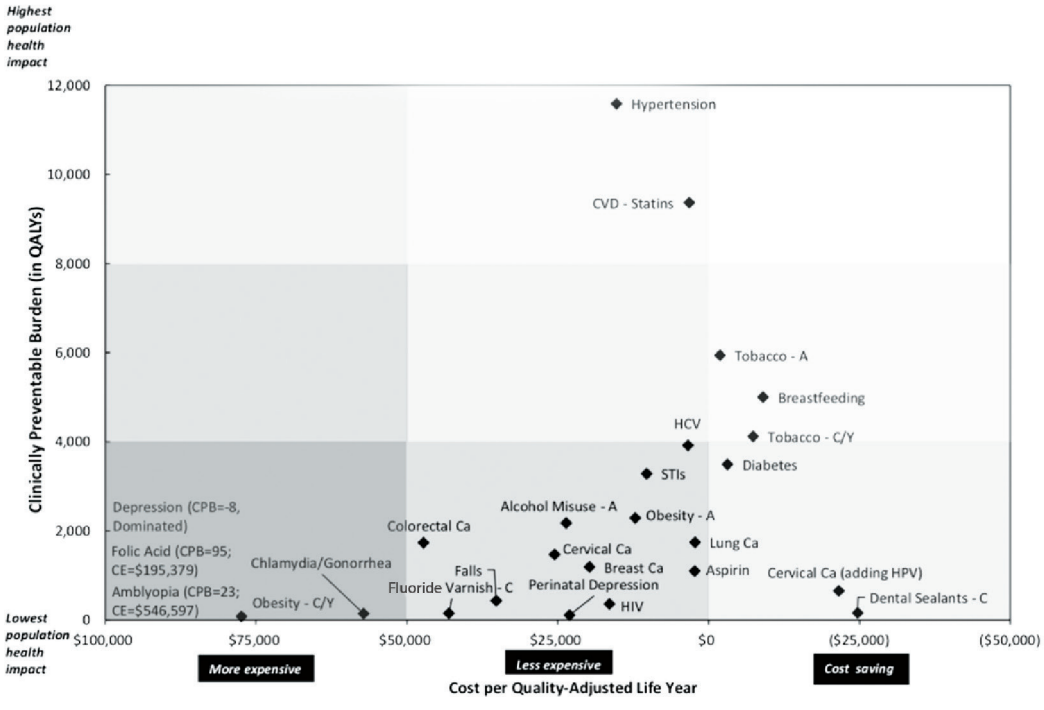
disordered feeding behaviour. Many parents perceive a higher percentile on a growth chart to be healthier and report supplementing feeding or switching from breastfeeding to formula feeding if they believe their baby's weight gain to be inadequate.[39,40]

The cost of case finding should be known and economically balanced in relation to possible expenditure on medical care as a whole (criterion 9). One Australian trial calculated that the economic cost associated with obesity screening that is followed by a brief intervention in a primary care setting would be financially unrealistic if the practice were widely implemented.[41] The British Columbia Ministry of Health's Lifetime Prevention Schedule analysis found that the average net cost of offering RGM for obesity would be $77 441 to $283 574 per quality-adjusted life-year (QALY) gained, in contrast to breastfeeding promotion (saves $9021) or obesity screening and management in adults, which has an estimated cost of $12 160 per QALY (**Figure 1**).[42] The analysis also found that the population benefit of RGM was low compared with most other strategies, resulting in an increase of only 80 QALYs, compared to 5002 QALYs for promotion of breastfeeding, or to 2287 QALYs for adult obesity screening and management.[42] Two recent reviews reported that most studies measuring the cost of childhood obesity interventions have found them to be cost-effective or even cost-saving[43,44]; however, a systematic review concluded that studies evaluating the cost-effectiveness of interventions to tackle childhood obesity have been limited by insufficient consideration of the complexity of child obesity, poor measurement of intervention effectiveness, and a lack of tools to measure child-related quality of life.[45]

Conclusion

Pediatric RGM fails to satisfy most of the WHO's criteria for an appropriate screening test. While obesity is an important health concern, it does not follow a predictable path from onset to overt disease. There are no universally accepted metrics or diagnostic cutoffs for diagnosis that can consistently predict important health outcomes, and there is no evidence of long-term effectiveness of treatment for established obesity. Although RGM has been assumed to be harmless and inexpensive, a closer look reveals potential harms and insufficient evidence on its costs. Despite its widespread use, there is no clear evidence that using RGM to assess overweight and obese status in a pediatric population has any effect on these patients' long-term metabolic health; indeed, relying on RGM might also displace other health promotion activities that have proven benefits.

Figure 1. Effectiveness and cost-effectiveness of clinical prevention services



A—adults, C—children, Ca—cancer, CE—cost-effectiveness, CPB—clinically preventable burden, CVD—cardiovascular disease, C/Y—children/youth, HCV—hepatitis C virus, HPV—human papillomavirus, QALY—quality-adjusted life-years, STI—sexually transmitted infection.

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Of note is a similar, and somewhat surprising, paucity of evidence to support RGM for other indications.[46-50]

Several alternatives to routine screening for obesity using BMI exist. Opportunistic clinical diagnosis of obesity that is followed by interventions targeting comorbidities such as hypertension and hypercholesterolemia could identify those at highest risk (BMI above the 95th percentile).[51] Tools such as the validated Infant Risk of Overweight Checklist[52] or healthy habit questionnaires might be more effective for predicting future morbidity than BMI; there are normal-weight children who are at risk, just as there are overweight individuals who are metabolically healthy, eating well, and exercising regularly.[53] These screening strategies also provide opportunities for primary prevention and healthy behaviour counseling, which might be more effective than weight management interventions that start only after weight problems are already established.

More research is needed to better understand how RGM for obesity in childhood affects long-term health outcomes. In the absence of clear evidence of benefits, practitioners must be mindful of the limitations, costs, and potential risks associated with RGM for obesity in childhood and work to mitigate these.

Dr Hale is a family physician and Clinical Assistant Professor in the Department of Family Practice at the University of British Columbia. **Dr Jackson** is a family medicine resident at the University of British Columbia.

Competing interests
None declared

Correspondence
Dr Ilona Hale; e-mail **ilona.hale@ubc.ca**

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