

Diet, physical activity, and behavioural interventions for the treatment of overweight or obesity in children and adolescents

Laura N. Anderson PhD¹, Geoff D. C. Ball PhD, RD²

¹Department of Health Research Methods, Evidence, and Impact, McMaster University, Hamilton, Ontario; ²Department of Pediatrics, University of Alberta, Edmonton, Alberta

Correspondence: Geoff D. C. Ball, Department of Pediatrics, University of Alberta, 8B, PCWH, Edmonton General Continuing Care Centre, 11111 Jasper Ave, Edmonton, Alberta T5K0L4. Telephone 780-342-8465, e-mail gdball@ualberta.ca

For the current issue of the *Journal*, we asked Drs. Laura Anderson and Geoff Ball to comment on and put into context three recent Cochrane Reviews on interventions for managing overweight and obese in children.

Background

Child overweight and obesity has increased globally, and can be associated with short- and long-term health consequences.

Objectives

The objective was to assess the effects of diet, physical activity, and behavioural interventions for the treatment of overweight or obesity in preschool children up to the age of 6 years.

Data collection and analysis

Search methods

We performed a systematic literature search in the databases Cochrane Library, MEDLINE, EMBASE, PsycINFO, CINAHL, and LILACS, as well as in the trial registers ClinicalTrials.gov and ICTRP Search Portal. We also checked references of identified trials and systematic reviews. We applied no language restrictions. The date of the last search was March 2015 for all databases.

Selection criteria

We selected randomized controlled trials (RCTs) of diet, physical activity, and behavioural interventions for treating overweight or obesity in preschool children aged 0 to 6 years.

Two review authors independently assessed risk of bias, evaluated the overall quality of the evidence using the GRADE instrument, and extracted data following the *Cochrane Handbook*

for *Systematic Reviews of Interventions*. We contacted trial authors for additional information.

Main results

We included seven RCTs with a total of 923 participants: 529 randomized to an intervention and 394 to a comparator. The number of participants per trial ranged from 18 to 475. Six trials were parallel RCTs, and one was a cluster RCT. Two trials were three-arm trials, each comparing two interventions with a control group. The interventions and comparators in the trials varied. We categorized the comparisons into two groups: multicomponent interventions and dietary interventions. The overall quality of the evidence was low or very low, and six trials had a high risk of bias on individual 'risk of bias' criteria. The children in the included trials were followed up for between 6 months and 3 years.

In trials comparing a multicomponent intervention with usual care, enhanced usual care, or information control, we found a greater reduction in body mass index (BMI) z score in the intervention groups at the end of the intervention (6 to 12 months): mean difference (MD) -0.3 units (95% confidence interval [CI] -0.4 to -0.2); $P < 0.00001$; 210 participants; 4 trials; low-quality evidence, at 12 to 18 months' follow-up: MD -0.4 units (95% CI -0.6 to -0.2); $P = 0.0001$; 202 participants; 4 trials; low-quality evidence, and at 2 years' follow-up: MD -0.3 units (95% CI -0.4 to -0.1); 96 participants; 1 trial; low-quality evidence. One trial stated that no adverse events were reported; the other trials did not report on adverse events. Three trials reported health-related quality of life and found improvements in some, but not all, aspects. Other outcomes, such as behaviour change and parent-child relationship, were inconsistently measured.

Received: June 28, 2018; Accepted: November 2, 2018

One three-arm trial of very low-quality evidence comparing two types of diet with control found that both the dairy-rich diet (BMI z score change MD -0.1 units (95% CI -0.11 to -0.09); $P < 0.0001$; 59 participants) and energy-restricted diet (BMI z score change MD -0.1 units (95% CI -0.11 to -0.09); $P < 0.0001$; 57 participants) resulted in greater reduction in BMI than the comparator at the end of the intervention period, but only the dairy-rich diet maintained this at 36 months' follow-up (BMI z score change in MD -0.7 units (95% CI -0.71 to -0.69); $P < 0.0001$; 52 participants). The energy-restricted diet had a worse BMI outcome than control at this follow-up (BMI z score change MD 0.1 units (95% CI 0.09 to 0.11); $P < 0.0001$; 47 participants). There was no substantial difference in mean daily energy expenditure between groups. Health-related quality of life, adverse effects, participant views, and parenting were not measured. No trial reported on all-cause mortality, morbidity, or socioeconomic effects. All results should be interpreted cautiously due to their low quality and heterogeneous interventions and comparators.

Authors' conclusions

Multicomponent interventions appear to be an effective treatment option for overweight or obese preschool children up to the age of 6 years. However, the current evidence is limited, and most trials had a high risk of bias. Most trials did not measure adverse events. We have identified four ongoing trials that we will include in future updates of this review. The role of dietary interventions is more equivocal, with one trial suggesting that dairy interventions may be effective in the longer term, but not energy-restricted diets. This trial also had a high risk of bias.

DIET, PHYSICAL ACTIVITY, AND BEHAVIOURAL INTERVENTIONS FOR THE TREATMENT OF OVERWEIGHT OR OBESE CHILDREN FROM THE AGE OF 6 TO 11 YEARS

Background

Child and adolescent overweight and obesity have increased globally, and can be associated with significant short- and long-term health consequences. This is an update of a Cochrane review published first in 2003, and updated previously in 2009. However, the update has now been split into six reviews addressing different childhood obesity treatments at different ages.

Objectives

The objective was to assess the effects of diet, physical activity, and behavioural interventions (behaviour-changing interventions) for the treatment of overweight or obese children aged 6 to 11 years.

Data collection and analysis

Search methods

We searched CENTRAL, MEDLINE, Embase, PsycINFO, CINAHL, LILACS as well as trial registers ClinicalTrials.gov and ICTRP Search Portal. We checked references of studies and systematic reviews. We did not apply any language restrictions. The date of the last search was July 2016 for all databases. Selection criteria: We selected RCTs of diet, physical activity, and behavioural interventions (behaviour-changing interventions) for treating overweight or obese children aged 6 to 11 years, with a minimum of 6 months' follow-up. We excluded interventions that specifically dealt with the treatment of eating disorders or type 2 diabetes, or included participants with a secondary or syndromic cause of obesity.

Two review authors independently screened references, extracted data, assessed risk of bias, and evaluated the quality of the evidence using the GRADE instrument. We contacted study authors for additional information. We carried out meta-analyses according to the statistical guidelines in the *Cochrane Handbook for Systematic Reviews of Interventions*.

Main results

We included 70 RCTs with a total of 8,461 participants randomized to either the intervention or control groups. The number of participants per trial ranged from 16 to 686. Fifty-five trials compared a behaviour-changing intervention with no treatment/usual care control and 15 evaluated the effectiveness of adding an additional component to a behaviour-changing intervention. Sixty-four trials were parallel RCTs, and four were cluster RCTs. Sixty-four trials were multicomponent, two were diet only, and four were physical activity only interventions. Ten trials had more than two arms. The overall quality of the evidence was low or very low and 62 trials had a high risk of bias for at least one criterion. Total duration of trials ranged from 6 months to 3 years. The median age of participants was 10 years old and the median BMI z score was 2.2.

Primary analyses demonstrated that behaviour-changing interventions compared to no treatment/usual care control at longest follow-up reduced BMI, BMI z score, and weight. MD in BMI was -0.53 kg/m² (95% CI -0.82 to -0.24); $P < 0.00001$; 24 trials; 2,785 participants; low-quality evidence. MD in BMI z score was -0.06 units (95% CI -0.10 to -0.02); $P = 0.001$; 37 trials; 4,019 participants; low-quality evidence and MD in weight was -1.45 kg (95% CI -1.88 to -1.02); $P < 0.00001$; 17 trials; 1,774 participants; low-quality evidence.

Thirty-one trials reported on serious adverse events, with 29 trials reporting zero occurrences RR 0.57 (95% CI 0.17 to 1.93); $P = 0.37$; 4/2,105 participants in the behaviour-changing intervention groups compared with 7/1,991 participants in the comparator groups). Few trials reported health-related quality of life or behaviour change outcomes, and none of the analyses

demonstrated a substantial difference in these outcomes between intervention and control. In two trials reporting on minutes per day of TV viewing, a small reduction of 6.6 minutes per day (95% CI -12.88 to -0.31), $P=0.04$; 2 trials; 55 participants) was found in favour of the intervention. No trials reported on all-cause mortality, morbidity, or socioeconomic effects, and few trials reported on participant views; none of which could be meta-analyzed.

As the meta-analyses revealed substantial heterogeneity, we conducted subgroup analyses to examine the impact of type of comparator, type of intervention, risk of attrition bias, setting, duration of postintervention follow-up period, parental involvement, and baseline BMI z score. No subgroup effects were shown for any of the subgroups on any of the outcomes. Some data indicated that a reduction in BMI immediately postintervention was no longer evident at follow-up at less than 6 months, which has to be investigated in further trials.

Authors' conclusions

Multicomponent behaviour-changing interventions that incorporate diet, physical activity, and behaviour change may be beneficial in achieving small, short-term reductions in BMI, BMI z score, and weight in children aged 6 to 11 years. The evidence suggests a very low occurrence of adverse events. The quality of the evidence was low or very low. The heterogeneity observed across all outcomes was not explained by subgrouping. Further research is required of behaviour-changing interventions in lower income countries and in children from different ethnic groups; also on the impact of behaviour-changing interventions on health-related quality of life and comorbidities. The sustainability of reduction in BMI/BMI z score and weight is a key consideration and there is a need for longer-term follow-up and further research on the most appropriate forms of postintervention maintenance in order to ensure intervention benefits are sustained over the longer term.

DIET, PHYSICAL ACTIVITY, AND BEHAVIOURAL INTERVENTIONS FOR THE TREATMENT OF OVERWEIGHT OR OBESE ADOLESCENTS AGED 12 TO 17 YEARS

Background

Adolescent overweight and obesity has increased globally, and can be associated with short- and long-term health consequences. Modifying known dietary and behavioural risk factors through behaviour-changing interventions (BCI) may help to reduce childhood overweight and obesity. This is an update of a review published in 2009.

Objectives

The objective was to assess the effects of diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years.

Data collection and analysis

Search methods

We performed a systematic literature search in: CENTRAL, MEDLINE, Embase, PsycINFO, CINAHL, LILACS, and the trial registers ClinicalTrials.gov and ICTRP Search Portal. We checked references of identified studies and systematic reviews. There were no language restrictions. The date of the last search was July 2016 for all databases.

Selection criteria

We selected RCTs of diet, physical activity, and behavioural interventions for treating overweight or obesity in adolescents aged 12 to 17 years.

Two review authors independently assessed risk of bias, evaluated the overall quality of the evidence using the GRADE instrument, and extracted data following the guidelines of the Cochrane Handbook for Systematic Reviews of Interventions. We contacted trial authors for additional information.

Main results

We included 44 completed RCTs (4,781 participants) and 50 ongoing studies. The number of participants in each trial varied (10 to 521) as did the length of follow-up (6 to 24 months). Participants' ages ranged from 12 to 17.5 years in all trials that reported mean age at baseline. Most of the trials used a multidisciplinary intervention with a combination of diet, physical activity, and behavioural components. The content and duration of the intervention, its delivery, and the comparators varied across trials. The studies contributing most information to outcomes of weight and BMI were from studies at a low risk of bias, but studies with a high risk of bias provided data on adverse events and quality of life. The MD of the change in BMI at the longest follow-up period in favour of BCI was -1.18 kg/m² (95% CI -1.67 to -0.69); 2,774 participants; 28 trials; low-quality evidence. BCI lowered the change in BMI z score by -0.13 units (95% CI -0.21 to -0.05); 2,399 participants; 20 trials; low-quality evidence. BCI lowered body weight by -3.67 kg (95% CI -5.21 to -2.13); 1,993 participants; 20 trials; moderate-quality evidence. The effect on weight measures persisted in trials with 18 to 24 months' follow-up for both BMI (MD -1.49 kg/m² (95% CI -2.56 to -0.41); 760 participants; 6 trials) and BMI z score MD -0.34 (95% CI -0.66 to -0.02); 602 participants; 5 trials).

There were subgroup differences showing larger effects for both BMI and BMI z score in studies comparing interventions with no intervention/wait list control or usual care, compared with those testing concomitant interventions delivered to both the intervention and control group. There were no subgroup differences between interventions with and without parental involvement or by intervention type or setting (health care, community, school) or mode of delivery (individual versus group). The rate of adverse

events in intervention and control groups was unclear with only five trials reporting harms, and of these, details were provided in only one (low-quality evidence). None of the included studies reported on all-cause mortality, morbidity or socioeconomic effects. BCIs at the longest follow-up moderately improved adolescent health-related quality of life (standardized mean difference 0.44 [95% CI 0.09 to 0.79]; $P=0.01$; 972 participants; 7 trials; 8 comparisons; low quality of evidence) but not self-esteem. Trials were inconsistent in how they measured dietary intake, dietary behaviours, physical activity, and behaviour.

Authors' conclusions

We found low-quality evidence that multidisciplinary interventions involving a combination of diet, physical activity, and behavioural components reduce measures of BMI and moderate-quality evidence that they reduce weight in overweight or obese adolescents, mainly when compared with no treatment or waiting list controls. Inconsistent results, risk of bias, or indirectness of outcome measures used mean that the evidence should be interpreted with caution. We have identified a large number of ongoing trials (50) which we will include in future updates of this review.

The full text of these Cochrane Reviews is available in *The Cochrane Library*:

- 1) Colquitt JL, Loveman E, O'Malley C, Azevedo LB, Mead E, Al-Khudairy L, Ells LJ, Metzendorf M, Rees K. Diet, physical activity, and behavioural interventions for the treatment of overweight or obesity in preschool children up to the age of 6 years. *Cochrane Database of Systematic Reviews* 2016, Issue 3. Art. No.: CD012105. DOI: 10.1002/14651858.CD012105
- 2) Mead E, Brown T, Rees K, Azevedo LB, Whittaker V, Jones D, Olajide J, Mainardi GM, Corpeleijn E, O'Malley C, Beardsmore E, Al-Khudairy L, Baur L, Metzendorf M, Demaio A, Ells LJ. Diet, physical activity and behavioural interventions for the treatment of overweight or obese children from the age of 6 to 11 years. *Cochrane Database of Systematic Reviews* 2017, Issue 6. Art. No.: CD012651. DOI: 10.1002/14651858.CD012651.
- 3) Al-Khudairy L, Loveman E, Colquitt JL, Mead E, Johnson RE, Fraser H, Olajide J, Murphy M, Velho R, O'Malley C, Azevedo LB, Ells LJ, Metzendorf M, Rees K. Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years. *Cochrane Database of Systematic Reviews* 2017, Issue 6. Art. No.: CD012691. DOI: 10.1002/14651858.CD012691

EXPERT COMMENTARY

As part of a recent series of Cochrane systematic reviews that also focused on surgery (1), pharmacotherapy (2), and

parent-only interventions (3), three reviews evaluated and graded the evidence for diet, physical activity, and behavioural interventions for treating overweight and obesity in 0 to 6 (4), 6 to 11 (5), and 12 to 18 (6) year olds. The purpose of this commentary is to highlight key findings from these reviews and describe how results may be applicable to paediatricians in their clinical practices.

The overall impact of the interventions on change in weight status was modest. The mean decrease in the intervention groups ranged from -0.06 to -0.30 for BMI z score, -0.53 to -1.18 kg/m² for absolute BMI, and -1.45 to -3.67 kg for body weight. Most of the trials were multicomponent interventions, including dietary, physical activity, and behavioural components. The majority of studies included active parental involvement in the interventions. Despite the complex nature of many of these interventions, the overall impact remained small and might reflect the degree of change that should be expected in clinical practice. Perceived lack of progress and unmet expectations are common reasons why families discontinue paediatric weight management (7). Paediatricians, parents, and children may be advised to set modest treatment goals that are consistent with observed impacts for BMI and weight change and to focus on health outcomes beyond weight, which may be more amenable to change.

The impact of behavioural interventions on weight status, although modest, varied between the three age categories. The review that included 0 to 6-year olds found the greatest reduction in mean BMI from diet, physical activity, and behavioural interventions (4), although there was a smaller evidence base to draw from in this age group. Notwithstanding, this suggests that the early years, when the role of parenting attitudes and behaviours may be more influential and before excess weight becomes more entrenched, is an opportune time for paediatric weight management. Within this youngest age group, improvements in parents' weight status (~ 5.0 kg) were also reported, highlighting intervention impacts beyond the child. The mean decrease in BMI was greater in 12 to 17-year olds (6) than in 6 to 11-year olds (5); however, most of the studies included in the review of age 6 to 11-year olds review were ≥ 9 years old, so it is possible that interventions in that period of pre-/peri-puberty may be less successful for a range of biologic and social factors. Families and health care professionals may not perceive a child's excess weight to be of concern until later in childhood or adolescence, until weight gain is substantial, or until the consequences of children's excess weight become overt (8). Since excess weight tracks over time (9), paediatricians and families should be discouraged from taking a wait-and-see approach, which can delay the initiation of a therapeutic intervention to later childhood or adolescence when weight management success is less likely.

Most studies included in these reviews focused on changes in weight status; however, the health and well-being of children and adolescents extend beyond weight and BMI. For instance, few studies reported on adverse events, but the overall evidence did not support any harms associated with the interventions. Further, only a small proportion of studies included patient reported outcomes such as quality of life and self-esteem and the meta-analyses suggested small-to-moderate improvements in quality of life among 6 to 11 (5) and 12 to 17 (6) year old groups. Other secondary health outcomes, such as cardiometabolic risk factors and changes in lifestyle habits, were also reported infrequently. Future studies should include primary outcomes other than BMI or weight, which are also predictive of long-term health and may be more meaningful for paediatricians and families. None of the reviews included socioeconomic variables in meta-analyses, such as educational attainment or parental income, factors that may influence families' adherence to care and health equity.

Only two studies were identified that explicitly evaluated weight loss maintenance. In all three reviews, the follow-up period ranged from 6 months to 3 years (the majority of interventions ranged from 6 to 12 months only), suggesting a lack of long-term data on weight maintenance. Maintaining a stable weight or slowing the rate of weight gain may be an important goal in managing overweight and obesity; given the degree of difficulty in successfully losing and maintaining weight loss, stabilizing body weight may indeed be a more realistic and appropriate goal. Emerging data suggest that while overweight and obesity have remained relatively stable over recent decades (10), there has been an increase in the proportion of children with severe obesity, a degree of excess weight that is associated with greater health risks (11). While there are no national estimates of severe paediatric obesity in Canada, we are part of an ongoing, national team grant designed to improve our understanding and management of paediatric severe obesity (12); data that are relevant to Canadian paediatricians and other stakeholders are forthcoming from this research.

Two of the most substantial challenges to successfully managing paediatric obesity are low treatment initiation and high attrition, both of which limit the potential benefits children and adolescents can derive from care. While relatively few children and adolescents with overweight and obesity are ever referred for weight management in Canada, for those who are referred, less than one-half ever initiate treatment (13). Further, discontinuing care prematurely is commonplace; it is not unusual for interventions to report 30 to 40% drop-out, which minimizes intervention impact for families and compromises the generalizability of research (14). Many of the reviewed trials were at high risk of attrition bias due to incomplete outcome data; for example, in the review of 6 to 11-year olds, only 27 of the 70 trials reported drop-out <15% (5).

The three reviews included interventions that took place in a range of environments, including healthcare (primary, secondary, and tertiary care settings), home, community, and school settings; despite this heterogeneity, subgroup analyses did not reveal differential responses to treatment in any age group. Further, there were no differences between one-on-one and group-based interventions, suggesting that effective interventions may be delivered in a variety of different contexts. While the success of interventions can occur in different settings and modalities, the intervention structure and dose appear to be important. For instance, a specialized, well-trained team of clinicians that includes medical oversight and ≥ 25 hours of clinical contact are features that can optimize the likelihood of weight management success for children and adolescents (15); however, given the level of family commitment and motivation, combined with the limited availability and accessibility of these specialized health services, only a minority of children and adolescents with overweight and obesity will benefit, a reality that underscores the imperative to prevent unhealthy weight gain early in life and identify intervention features that are effective and scalable in order to have the greatest impact and reach.

Overall, the findings from these three reviews were consistent with the current Canadian clinical practice guidelines for the management of obesity in children, which recommend assessing barriers and readiness to change, implementing goal-setting, and encouraging lifestyle changes that include modifications to nutrition, physical activity, and sedentary activities (16). These reviews support a role of behavioural interventions as a foundational part of managing paediatric obesity; however, given the magnitude of the issue, modest treatment outcomes, and limitations of the original data and study quality included in the reviews, more wide-ranging initiatives are clearly needed to prevent unhealthy weight gain and enable successful weight management once overweight and obesity are established. Consistent with a socioecological perspective (17) and systems-level thinking (18), the range of interconnected factors that influence energy balance at the individual level must be addressed. While it is logical for paediatricians in the medical field to play a leadership role in this area, the engagement of all stakeholders from government, industry, and nongovernmental organizations who have a vested interest in the health and well-being of our children is necessary. Multilevel, systematic changes are needed, including policies to create healthy environments as well as enhance access to healthy nutrition and physical activity throughout the paediatric years. Targeted interventions for paediatric weight management represent only a small part of what is needed to address overweight and obesity in Canadian children and adolescents. For paediatricians who choose to include evidence-based tools in their practices to help address overweight and obesity, the following may be useful resources: Fostering positive weight-related conversations:

Evidence and real-life learnings from the heart of care (<https://hollandbloorview.ca/newsarticle/Interactive-Casebook-sets-stage-for-positive-weight-related-conversations>); Changing the conversation about childhood obesity (<https://go.kognito.com/changetalk>); CONversation Cards[®] and other information and resources related to obesity (<http://www.obesitynetwork.ca/CONversation>).

Funding Information: There are no funders to report for this submission.

Potential Conflicts of Interest: All authors: No reported conflicts of interest. All authors have submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest. Conflicts that the editors consider relevant to the content of the manuscript have been disclosed.

References

1. Eells LJ, Mead E, Atkinson G, et al. Surgery for the treatment of obesity in children and adolescents. *Cochrane Database Syst Rev* 2015;CD011740.
2. Mead E, Atkinson G, Richter B, et al. Drug interventions for the treatment of obesity in children and adolescents. *Cochrane Database Syst Rev* 2016;11:CD012436.
3. Loveman E, Al-Khudairy L, Johnson RE, et al. Parent-only interventions for childhood overweight or obesity in children aged 5 to 11 years. *Cochrane Database Syst Rev* 2015;CD012008.
4. Colquitt JL, Loveman E, O'Malley C, et al. Diet, physical activity, and behavioural interventions for the treatment of overweight or obesity in preschool children up to the age of 6 years. *Cochrane Database Syst Rev* 2016;3:CD012105.
5. Mead E, Brown T, Rees K, et al. Diet, physical activity and behavioural interventions for the treatment of overweight or obese children from the age of 6 to 11 years. *Cochrane Database Syst Rev* 2017;6:CD012651.
6. Al-Khudairy L, Loveman E, Colquitt JL, et al. Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years. *Cochrane Database Syst Rev* 2017;6:CD012691.
7. Dhaliwal J, Perez AJ, Holt NL, et al. Why do parents discontinue health services for managing paediatric obesity? A multi-centre, qualitative study. *Obes Res Clin Pract* 2017;11(3):335–43.
8. Black JA, Park M, Gregson J, et al. Child obesity cut-offs as derived from parental perceptions: Cross-sectional questionnaire. *Br J Gen Pract* 2015;65(633):e234–9.
9. Cunningham SA, Kramer MR, Narayan KM. Incidence of childhood obesity in the United States. *N Engl J Med* 2014;370(5):403–11.
10. Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of obesity and trends in body mass index among US children and adolescents, 1999–2010. *JAMA* 2012;307(5):483–90.
11. Skelton JA, Cook SR, Auinger P, Klein JD, Barlow SE. Prevalence and trends of severe obesity among US children and adolescents. *Acad Pediatr* 2009;9(5):322–9.
12. Team ABC. The team to address bariatric care in Canadian children (Team ABC3): Team grant research proposal. *BMC Res Notes* 2017;10:301.
13. Perez AJ, Yaskina M, Maximova K, et al. Predicting enrollment in multidisciplinary clinical care for pediatric weight management. *J Pediatr* 2018;202:129–35.
14. Dhaliwal J, Nosworthy NM, Holt NL, et al. Attrition and the management of pediatric obesity: An integrative review. *Child Obes* 2014;10(6):461–73.
15. Wilfley DE, Staiano AE, Altman M, et al. Improving access and systems of care for evidence-based childhood obesity treatment: Conference key findings and next steps. *Obesity (Silver Spring)* 2017; 25:16–29.
16. Lau DC, Douketis JD, Morrison KM, Hramiak IM, Sharma AM, Ur E; Obesity Canada Clinical Practice Guidelines Expert Panel. 2006 Canadian clinical practice guidelines on the management and prevention of obesity in adults and children [summary]. *CMAJ* 2007;176(8):S1–13.
17. Kellou N, Sandalinas F, Copin N, Simon C. Prevention of unhealthy weight in children by promoting physical activity using a socio-ecological approach: What can we learn from intervention studies? *Diabetes Metab* 2014;40(4):258–71.
18. Lee BY, Bartsch SM, Mui Y, Haidari LA, Spiker ML, Gittelsohn J. A systems approach to obesity. *Nutr Rev* 2017;75(suppl 1):94–106.