


Summary of highly processed evidence
on components of effective weight
management interventions for children
and young people

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About this briefing

This briefing is a summary of highly processed evidence* that reviews the effectiveness of child healthy weight interventions since the publication of the National Institute for Health and Care Excellence (NICE) guidance in 2013. The findings from this report will inform the development of minimum standards for child and young people's weight management services.

Key points

- Owing to the heterogeneity of the primary studies included in the reviews drawing firm conclusions on the individual components of effective interventions is difficult.
- Interventions with more frequent contacts tended to be more efficacious.^{1, 2, 3, 4}
- Providing a practical component appears to be a common factor in effective interventions across all age groups including for parents.^{3, 5, 6, 7}
- Engagement of parents may have a positive impact on weight outcomes, especially for younger children.^{5, 7, 8, 9, 10, 11, 12}

Background

The prevalence of the risk of overweight and obesity in children in Scotland has remained relatively stable since 1998. In 2017, 72% of children aged between 2 and 16 years were within a healthy weight range.¹³ However, this masks trends across different populations, as for girls the percentage of the population which is of a healthy weight drops to 69%.¹³ There is also evidence

* Evidence of effectiveness from research studies helps us to identify areas for effective action. While the outcomes of individual primary outcome studies are important, these may be atypical, and potentially biased. Such issues may only become apparent when studies are repeated or interventions rolled out on a wider scale. Evidence and evidence-informed recommendations from systematic reviews and reviews of reviews seek to reduce bias by providing an overview of the findings of a number of studies. These form the basis of 'highly processed evidence'. While we acknowledge that other sources of evidence may be available, because of time constraints and in the interests of quality assurance, the evidence presented here is from these 'highly processed evidence' sources as opposed to primary outcome studies.

of socio-economic inequalities in obesity rates, with a higher prevalence in those living in the most deprived areas, particularly for children.¹⁴

During childhood, those who are overweight or obese have an increased risk of developing conditions such as hypertension, type 2 diabetes and asthma.^{15, 16} If their weight continues to be unhealthy into adulthood, there is an increased risk of developing numerous conditions associated with adult obesity, such as type 2 diabetes, cardiovascular disease, osteoarthritis and some cancers.^{8, 17, 18}

Long-term monitoring of the diet in Scotland has shown that we are consistently eating too much fat and sugar in our daily diets and this is contributing to the obesity epidemic in Scotland.¹⁹

Addressing obesity requires a sustained and integrated portfolio of preventative measures to address the obesogenic environment and social norms so that healthy behaviours become easier for all, alongside interventions that provide services for obese individuals wanting to lose weight. Weight management interventions cannot deliver population-level reductions in overweight and obesity but it is necessary to offer effective evidence-based treatment services to people who are overweight or obese and request support.

Weight maintenance is considered to be an acceptable goal of weight management interventions in children and adolescents as their body mass index (BMI) will improve as they grow taller.²⁰ However, once growth stops, weight loss may be needed to achieve a healthier BMI.

Weight management services for children and adolescents in Scotland are informed by the NICE guidance 'Weight management: lifestyle services for overweight or obese children and young people'²⁰ which was published in 2013. The guidelines cover lifestyle weight management services for children and young people aged under 18 years old who are overweight or obese.

In addition to this, Scottish Intercollegiate Guidelines Network (SIGN) 115 'Management of obesity'²¹ guidelines published in 2010 provide guidance for practitioners working in Scotland. The guidance includes a section on the treatment of obesity in children and young people.

To ensure that the development of the new 'Minimum standards for weight management services for children and adolescents' are informed by the best available evidence, NHS Health Scotland conducted this summary of highly processed evidence since the publication of the NICE guidance.

Methodology

The review aims to answer the following research question: What does the high-level evidence tell us about the components of effective weight management interventions for children and young people?

Searches of 10 databases were conducted in December 2018. The search terms were 'child', 'young people', 'adolescent', 'pre-school', 'school', 'family', 'community' and 'weight management'. A full description of the methodology is given in Appendix A.

The search generated 1,212 articles and an additional 155 articles were identified through a manual search. These articles were screened using agreed inclusion and exclusion criteria. After full-text screening, 31 articles were found to be relevant to the research question. The details of the screening are given in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) diagram in Appendix B.

The findings represent a summary of these relevant articles.

Findings

Overview of studies

The majority of the studies included in the systematic reviews used BMI[†], adjusted for age and sex, or BMI z-scores[‡] as an outcome measure for the interventions.

There is consistent evidence from 11 reviews that interventions that adopt a multi-component approach which includes dietary and physical activity elements along with behavioural strategies and parent or family involvement can be effective in improving weight outcomes (such as changes in or maintenance of BMI, or reductions in percentage overweight) of overweight and/or obese children and adolescents.^{2, 5, 7, 8, 9, 15, 17, 22, 23, 24, 25}

Only one review examined the effectiveness of brief interventions in primary care²⁶ for children and adolescents. The review found that compared to no treatment or usual care these interventions were associated with a marginal effect on z-BMI of -0.04 (95% CI -0.08 to -0.01). However, the researchers recognised that this effect size is ineffective to get the required weight reduction to gain health benefits in the population.

The primary studies included in the systematic reviews identified for this paper looked at a range of dietary strategies, physical activities and behavioural approaches in different combinations. Dietary strategies included the traffic light diet (encourages the uptake of foods that are low in fat and sugar, and have high nutritional value, i.e. 'green' foods, and the decreased intake of foods that are high in fat and sugar, and have low nutritional value, i.e. 'red' foods), calorie intake restrictions and general healthy eating advice.^{7, 27, 28} Physical activity elements varied from advice about general physical activity

[†] If the BMI of a child or adolescent is found to be above the 98th centile for their age and sex, on UK standard growth charts, they are classified as obese; between the 91st and 98th centile they are considered to be overweight.

[‡] BMI z-scores are also used as a measure of how many standard deviations a child or young person's BMI is above or below the average BMI for their age and sex.

recommendations to supervised sessions lasting two hours or more per week.²⁸ Behavioural approaches included motivational interviewing, goal setting and problem solving.¹⁷

Components of effective interventions

In each of the included reviews, there was considerable heterogeneity between the primary studies. This, along with a lack of detailed information reported about the components of each intervention, makes drawing conclusions about the scale to which aspects contribute to the most effective interventions difficult.

Findings from a large-scale review⁴ which included studies with children under 20 years, suggest the following components may enhance the efficacy of an intervention:

- Monitoring of dietary intake at an individual level by the child, adolescent or parent appeared to be an effective approach. This effect was enhanced when guidance was provided on appropriate dietary intake.
- Targeting specific dietary components, e.g. decreasing consumption of sugar-sweetened beverages had a greater impact than general healthy eating advice.
- Strategies that prioritise personalised behaviour change based on individual health education or behaviour needs.
- Use of health-coaching techniques by health professionals to assist individuals to identify, prioritise, implement and evaluate agreed, prioritised health behaviour changes.

Components of effective interventions for preschool children

The evidence in this section draws on one systematic review and one meta-analysis which include populations of children under six years.

For this age group, evidence from one review suggests that practical experience may affect the effectiveness of an intervention for both the child and the parent. The review that examined interventions for preschool children⁵ reported effective intervention strategies used among parents included interactive education on health, physical activity and nutrition, practical experience of physical activity and behavioural therapy. The review also reported that effective child intervention strategies used among preschool children included interactive education on physical activity and nutrition, and practical experience of physical activity.

A meta-analysis reported the more effective interventions for preschool children were likely to include a general parenting skills and behaviours component.²⁹

The timing of the initiation of the intervention may also be an important factor within this age group. The meta-analysis²⁹ found the small number of studies which showed a continued effect at long-term follow-up were all initiated during preschool age rather than in infancy.

However, owing to the small effect sizes found and the heterogeneous nature of the studies it is difficult to draw firm conclusions.

Components of effective interventions for primary school-age children

The evidence in this section draws on one systematic review and one meta-analysis which include studies with populations of children predominately aged five to 12 years.

As with preschool children, for this age group the evidence suggests that practical experience may affect the effectiveness of an intervention for both the child and parent.

One review⁶ which examined features of effective interventions (i.e. those achieving clinically significant improvements in BMI z-scores) found the

mechanisms, which were common to the five most effective interventions and absent from the 15 least effective interventions, were:

- Providing three or more sessions which offered the families the opportunity to take part in a practical component such as physical activity and/or behaviour change techniques.
- Delivering three or more sessions to both the parents and children, aiming to change behaviours across the family.
- Delivering three or more child group sessions and parent group sessions, to establish social support for parents and children.

Practical components were characterised by sessions which demonstrated and gave experience of behaviour changes rather than simply telling people what to change.⁶ Although it should be noted that these findings were drawn from a small number of studies reporting clinically significant results.

A meta-analysis⁷ also suggested the importance of practical sessions in the efficacy of interventions. It reported that the greatest post-intervention effect in an intervention targeting children was a community-based intervention (mean BMI difference = 2.10 kg/m²) where the parents and children attended 18 two-hour group education and exercise sessions twice weekly over nine weeks and then received a 12-week free family swimming pass.

Components of effective interventions for adolescents

The evidence in this section draws on one systematic review and one meta-analysis which include populations of children aged 10–19 years.

As with the younger age groups, the evidence for adolescents suggests that practical experience, particularly for physical activity, may affect the effectiveness of an intervention.

A meta-analysis⁷ reported that the greatest post-intervention effect was found in interventions which included a two-month community-based intensive

exercise training intervention four times per week, for 90 minutes each, combined with dietary restrictions (500 calorie deficit).

A review found that clinical trials that included regular exercise (at least 40 minutes three times a week) as a component of the intervention were effective,³ although this was based on findings from heterogeneous studies so should be interpreted with caution.

Intervention intensity and duration

There is evidence from four reviews to suggest that better weight outcomes were associated with greater intervention intensity.^{1, 2, 3, 4} Although there is inconsistent evidence about the optimum number and frequency of contacts, interventions with more frequent contact tended to be more efficacious.

One large-scale review concluded that effective interventions were often delivered through frequent face-to-face contacts, with a duration of three months or more. This was followed up by a less intensive phase often delivered via less frequent face-to-face contact or text messaging for up to 18 months.⁴

There were mixed findings reported on the effect of the duration of the intervention on efficacy. Two reviews reported that interventions that lasted six months or more were found to be more effective than those of a shorter duration.^{7, 8} However, one review reported the efficacy of the intervention did not appear to be associated with the length of time children received the intervention,³⁰ and another that longer interventions were less effective.¹ These mixed findings may be attributable to the heterogeneous nature of the primary studies in the reviews.

Group and one-to-one sessions

There was no evidence found for this review examining the efficacy of one-to-one sessions over group sessions. However, the findings from one review⁶ suggest the inclusion within an intervention of three or more child group

sessions and parent group sessions to establish social support for parents and children, may be associated with an intervention's effectiveness.

Maintenance of BMI

Evidence about which interventions help children to maintain their BMI or, in older adolescents, maintain reductions in BMI is currently limited, in part because few studies follow participants in the longer term. One review, which looked at multi-component interventions for under-six-year-olds, found that outcomes were maintained to at least two years post intervention.¹⁶ However, this should be interpreted with a degree of caution as the attrition rates were relatively high (more than 50%).

The age of participants may be a factor in maintenance of outcomes. While weight management interventions seemed to be more effective in younger age groups (< 12 years) in the short term, in the longer term, older age groups (> 12 years) were more likely to maintain improvements.⁹

Parent or family involvement

There is consistent evidence from seven reviews that interventions that target parents and children or whole families are more effective in improving BMI than child-only interventions, particularly in younger children (under 12 years).^{5, 7, 8, 9, 10, 11, 12}

One review also suggested family involvement may also help maintain improvements.⁸ However, a review that examined UK interventions found insufficient evidence to suggest how the inclusion of parents and the wider family impacted on effectiveness. The review found evidence to suggest a change in short-term outcomes, but insufficient robust evidence to indicate benefit is long lasting at 12 month or more follow-up.³¹

A review found parental involvement in weight management interventions targeting children may have a positive impact on the parents' BMI as well as supporting greater improvements in their children.³¹

Furthermore, for children aged between two and 12 years, parent-only interventions may be as effective as parent-child interventions^{32, 33} and significantly more effective than child-only interventions.^{10, 22, 33} However, compared to interventions that involved children as well, there was a tendency for parent-only groups to have higher attrition rates^{10, 32} and they reported lower satisfaction with the interventions.²²

Delivery professionals

Only one review reported evidence on the contribution of the delivery professionals to the efficacy of the intervention. The review reported that interventions that were delivered by professional staff, for example dietitians and exercise trainers, tended to be more efficacious than those delivered by paraprofessional or community-based staff,¹ although this was based on findings from a small number of heterogeneous studies so should be interpreted with caution.

Use of technology

Across the reviews that examined the use of technology, for example smart phones, text messaging and apps, no statistically significant difference in weight outcomes between the intervention and control groups were found.^{4, 34, 35, 36} The overall quality of studies included was not high, therefore these findings should be interpreted with caution.

One review, which included only two studies involving children aged seven to 17 years, reported electronic contact appeared unsuccessful in achieving weight loss. However, smartphone usage was linked to improved engagement and reduced dropout rates during the maintenance phases of interventions.³⁵ One review found statistically significant differences in physical activity levels and fruit and vegetable consumption in a small number of included studies. This suggests that technology-based interventions may have a positive effect on encouraging a healthier lifestyle in obese and overweight children and adolescents. Although, owing to the heterogeneity of the studies it is unclear

whether the effect was due to the technology component of the intervention or not.³⁴

Socio-economic inequalities

One review analysed the differential outcomes for children and adolescents participating in a weight management intervention across socio-economic groups. Family-based interventions seemed to be equally effective across the social gradient.³⁷ However, individual studies suggested that children in the lowest socio-economic groups benefited more from participating in one-to-one counselling interventions and from an intervention that aimed to reduce screen time in children aged four to seven years.³⁷

An evidence briefing from NHS Health Scotland looked at the effectiveness evidence for interventions that had the potential to narrow the difference in childhood obesity prevalence across different socio-economic groups. This briefing concluded that there was limited evidence of effectiveness for interventions with the potential to reduce inequalities in childhood obesity.³⁸

Limitations

This review was limited to highly processed evidence such as systematic reviews and meta-analysis from a limited number of databases. It is possible that a more comprehensive search might identify additional useful information, particularly in the areas where evidence is limited. The majority of the studies included in the identified reviews and meta-analyses were from countries outside the United Kingdom, so the transferability of the findings to a Scottish context may be difficult. The ages and gender of participants were not necessarily representative of the general population.

Conclusions

Overall, there was evidence of effectiveness of multi-component weight management interventions involving families or parent–child units. However, effects tended to be relatively small and there was limited evidence of this being maintained in the longer term (follow-up at 12 months or more). This

suggests that weight management interventions are only one small part of the effort needed to tackle overweight and obesity in children and adolescents.

Across the body of evidence there appears to be some common themes. However, owing to the heterogeneity of the primary studies, drawing firm conclusions on the impact of individual components may be difficult,

For all age groups, practical hands-on experience appears to be effective in generating positive weight outcomes. This experience was characterised by sessions which demonstrated and gave experience of behaviour changes rather than simply telling people what to change.

Interventions with more frequent contacts tend to be more effective. Effective interventions were often delivered through frequent face-to-face contacts, which was followed up by a less intensive phase.

Engagement of parents may have a positive impact on weight outcomes, especially for younger children. Parental involvement may also have a positive impact on the parents' BMI as well as supporting greater improvements in their children. For younger children parent-only interventions may be as effective as parent-child interventions, however, these can have higher attrition rates and lower reported satisfaction with the intervention.

Appendix A

Evidence review methodology

Search strategy

The search centred on highly processed evidence (systematic reviews and meta-analysis) which summarised high-quality international research (including Scotland and the rest of the UK where this is available) that had been quality assured.

No further critical appraisal was undertaken by NHS Health Scotland. The focus was evidence of effectiveness of interventions that aimed to reduce or maintain the weight of overweight or obese children. Searches of the following databases were conducted in December 2018: CINAHL, MEDLINE, ProQuest Public Health, Applied Social Sciences Index and Abstracts (ASSIA), International Bibliography of the Social Sciences (IBSS) & Sociological abstracts, NES Knowledge Network, The National Institute for Health and Care Excellence (NICE), National Institute for Health Research (NIHR), World Health Organization (WHO) and The Cochrane Library.

These databases were searched using 'child', 'young people', 'adolescent', 'pre-school', 'school', 'family', 'community', 'weight management' as search terms. After de-duplication 1,212 were identified for potential inclusion. A further 155 articles were identified through manual searching.

After a review of the title, abstract and, in some cases, full text, 31 were relevant to the research question and met the following criteria:

Inclusion criteria

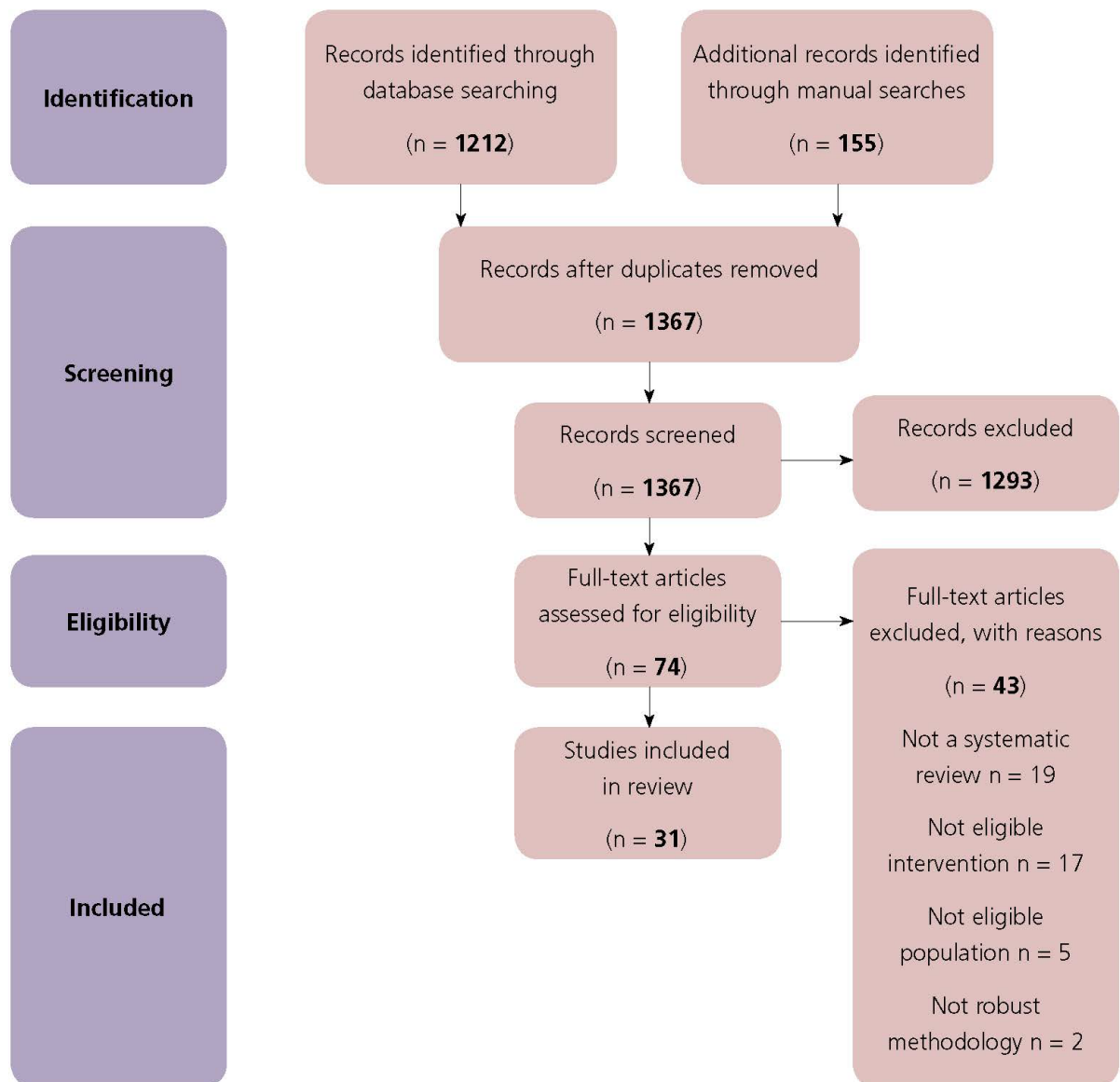
- Systematic reviews of interventions that aimed to reduce weight in children and/or young people (0–18 years) who were obese or overweight (including parent-only interventions).

- Systematic reviews of interventions that aimed to maintain weight in children who were obese or overweight (including parent-only interventions).
- Interventions that focused on non-pharmacological and non-surgical management of obesity in children and young people.
- Reviews that reported a weight-related measure, e.g. weight, BMI as a primary outcome measure.
- Reviews of interventions from any of the following settings: school, community, home.
- Reviews that were published in English from 2012 onwards.

Exclusion criteria

- Reviews that focused specifically on populations living outside the UK, e.g. African–American, Latino–American.
- Reviews that included populations of ‘normal’ weight.
- Interventions that focused on food or vitamin supplements, e.g. green tea or chromium.
- Reviews of pharmacological or surgical treatments.
- Reports of primary research.
- Systematic reviews of interventions that aimed to prevent excessive weight gain in pregnancy of overweight or obese women.
- Interventions that focused on eating and weight disorders.
- Reviews with predominately poor-quality studies.

Appendix B



References

- ¹ Appelhans BM, Moss OA, Cerwinske LA. Systematic review of paediatric weight management interventions delivered in the home setting. *Obesity Reviews* 2016;17(10):977–988.
- ² van Hoek E, Feskens EJ, Bouwman LI, Janse AJ. Effective interventions in overweight or obese young children: Systematic review and meta-analysis. *Childhood Obesity* 2014;10(6):448–60.
- ³ Boff RM, Liboni RPA, Batista IPA, de Souza LH, Oliveira MS. Weight loss interventions for overweight and obese adolescents: a systematic review. *Eating & Weight Disorders* 2017;22(2):211–229.
- ⁴ Duncanson K, Shrewsbury VA, Collins C. Interim Report on the Effectiveness of Dietary Interventions for Children and Adolescents with Overweight and Obesity. Geneva: WHO; 2015.
- ⁵ Ling J, Robbins L, Wen F. Interventions to prevent and manage overweight or obesity in preschool children: A systematic review. *International journal of nursing studies* 2016;53:270–289.
- ⁶ Burchett HED, Sutcliffe K, Melendez-Torres GJ, Rees R, Thomas J. Lifestyle weight management programmes for children: A systematic review using qualitative comparative analysis to identify critical pathways to effectiveness. *Preventive Medicine* 2018;106:1–12.
- ⁷ Ho M, Garnett SP, Baur L, et al. Effectiveness of lifestyle interventions in child obesity: systematic review with meta-analysis. *Pediatrics* 2012;130(6):e1647–71.
- ⁸ Kothandan SK. School based interventions versus family based interventions in the treatment of childhood obesity - a systematic review. *Archives of Public Health* 2014;72(1):1–17.

⁹ Morgan F, Weightman A, Whitehead S, et al. Review 1: Effectiveness and cost-effectiveness of lifestyle weight management services for children and young people. Cardiff: Support Unit for Research Evidence, Cardiff University; 2013.

¹⁰ Ewald H, Kirby J, Rees K, Robertson W. Parent-only interventions in the treatment of childhood obesity: A systematic review of randomized controlled trials. *Journal of Public Health* 2014;36(3):476–89.

¹¹ Sung-Chan P, Sung YW, Zhao X, Brownson RC. Family-based models for childhood-obesity intervention: A systematic review of randomized controlled trials. *Obesity Reviews*. 2013;14(4):265–78.

¹² van der Kruk JJ, Kortekaas F, Lucas C, Jager-Wittenaar H. Obesity: A systematic review on parental involvement in long-term European childhood weight control interventions with a nutritional focus. *Obesity Reviews* 2013; 14(9):745–60.

¹³ Scottish Government. The Scottish Health Survey: 2017 edition volume 1 main report. Edinburgh: Scottish Government; 2018.

¹⁴ Bromley C, Tod E, McCartney G. Obesity and health inequalities in Scotland. Edinburgh: NHS Health Scotland; 2017. URL: www.scotpho.org.uk/publications/reports-and-papers/obesity-and-health-inequalities-in-scotland

¹⁵ Bhuyan SS, Chandak A, Smith P, Carlton EL, Duncan K, Gentry D. Integration of public health and primary care: A systematic review of the current literature in primary care physician mediated childhood obesity interventions. *Obesity Research & Clinical Practice* 2015;9(6):539–52.

¹⁶ 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 of Systematic Reviews 2016; Issue 3.

¹⁷ Janicke DM, Steele RG, Gayes LA, et al. Systematic review and meta-analysis of comprehensive behavioral family lifestyle interventions addressing pediatric obesity. *Journal of Pediatric Psychology* 2014;39(8): 809–25.

¹⁸ Khambalia AZ, Dickinson S, Hardy LL, Gill T, Baur LA. A synthesis of existing systematic reviews and meta-analyses of school-based behavioural interventions for controlling and preventing obesity. *Obesity Reviews* 2012; 13(3):214–33.

¹⁹ Food Standards Scotland Situation Report: The Scottish Diet: It needs to change 2018 update. Aberdeen: Food Standards Scotland; 2018.

²⁰ NICE. Weight management: Lifestyle services for overweight or obese children and young people. PH47. London: NICE; 2013. URL: www.nice.org.uk/guidance/ph47/resources/weight-management-lifestyle-services-for-overweight-or-obese-children-and-young-people-pdf-1996362978757

²¹ Scottish Intercollegiate Guidelines Network (SIGN). SIGN 115 Management of obesity. Edinburgh: SIGN; 2010. URL: www.sign.ac.uk/sign-115-management-of-obesity.html

²² Loveman E, Al-Khudairy L, Johnson Rebecca, et al. Parent-only interventions for childhood overweight or obesity in children aged 5 to 11 years. *Cochrane Database of Systematic Reviews*. 2015; Issue 12.

²³ Mühlig Y, Wabitsch M, Moss A, Hebebrand J. Weight loss in children and adolescents - a systematic review and evaluation of conservative, non-pharmacological obesity treatment programs. *Deutsches Ärzteblatt International* 2014;111:818–24.

-
- ²⁴ 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 of Systematic Reviews* 2017;6:012651.
- ²⁵ Ling J, Robbins LB, Wen F, Zhang N. Lifestyle interventions in preschool children: A meta-analysis of effectiveness. *American Journal of Preventive Medicine* 2017;53(1):102–112.
- ²⁶ Sim LA, Lebow J, Wang Z, Koball A, Murad MH. Brief primary care obesity interventions: A meta-analysis. *Pediatrics* 2016;138(4):e20160149.
- ²⁷ Staniford LJ, Breckon JD, Copeland RJ. Treatment of childhood obesity: A systematic review. *Journal of Child and Family Studies* 2011;21(4):545–64.
- ²⁸ Ho M, Garnett SP, Baur LA et al. Impact of dietary and exercise interventions on weight change and metabolic outcomes in obese children and adolescents: a systematic review and meta-analysis of randomized trials. *JAMA Pediatrics* 2013;167(8):759–768
- ²⁹ Yavuz HM, van Ijzendoorn MH, Mesman J, van der Veek S. Interventions aimed at reducing obesity in early childhood: a meta-analysis of programs that involve parents. *Journal of Child Psychology and Psychiatry* 2015;56;6:677–692.
- ³⁰ Snethen JA, Broome ME, Treisman P, Castro E, Kelber ST. Effective weight loss for children: A meta-analysis of intervention studies 2002–2015. *Worldviews on Evidence-Based Nursing* 2016;13(4):294–302.
- ³¹ Upton P, Taylor C, Erol R, Upton D. Family-based childhood obesity interventions in the UK: a systematic review of published studies. *Community Practitioner* 2014;87(5):25–29.

³² Jull A, Chen R. Parent-only vs. parent-child (family-focused) approaches for weight loss in obese and overweight children: a systematic review and meta-analysis. *Obesity Reviews* 2013;14(9):761–768.

³³ Knowlden AP, Sharma M. Systematic review of family and home-based interventions targeting paediatric overweight and obesity. *Obesity Reviews* 2012;13(6):499–508.

³⁴ Kaakinen P, Kyngas H, Kaariainen M. Technology-based counseling in the management of weight and lifestyles of obese or overweight children and adolescents: A descriptive systematic literature review. *Informatics for Health & Social Care* 2018;43(2):126–141.

³⁵ Chaplais E, Naughton G, Thivel D, Courteix D, Greene D. Smartphone interventions for weight treatment and behavioral change in pediatric obesity: A systematic review. *Telemedicine Journal & E-Health* 2015;21(10):822–830.

³⁶ Hammersley ML, Jones RA, Okely AD. Parent-focused childhood and adolescent overweight and obesity e-health interventions: a systematic review and meta-analysis. *Journal of Medical Internet Research* 2016;18(7):e203.

³⁷ Hillier-Brown FC, Bambra CL, Cairns J, Kasim A, Moore HJ, Summerbell CD. A systematic review of the effectiveness of individual, community and societal level interventions at reducing socioeconomic inequalities in obesity among children. *BMC Public Health* 2014;14:834.

³⁸ Mackison D. Evidence briefing: Evidence for interventions that reduce socio-economic inequalities in childhood obesity. Edinburgh: NHS Health Scotland; 2015.

