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Behaviour change techniques and theory use in healthcare professional-delivered infant feeding interventions to prevent childhood obesity: a systematic review

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ABSTRACT

The conceptual basis of early childhood feeding interventions for obesity prevention is poorly understood. The aim of this systematic review is to characterise these interventions' use of behaviour change techniques (BCTs) and psychological theory, focusing on interventions delivered by healthcare professionals for children ≤ 2 years. We searched seven electronic databases from inception to January 2019 and identified 12 trials. BCTs and theory use were identified using the Behaviour Change Technique Taxonomy v1 and the Theory Coding Scheme respectively. Interventions used 19 BCTs, most commonly 'Instruction on how to perform the behaviour' (12 of 12 studies) and 'Social support (unspecified)' (8 of 12 studies). The mean number of BCTs used was 5.1. Six trials explicitly stated basing interventions on theory, most commonly social cognitive theory and responsive feeding (4 of 6 studies each). Links between theory use and BCTs were poor. Early childhood feeding interventions have insufficiently integrated psychological theories into their development and evaluation. We recommend greater consideration of psychological theory incorporating family and systems approaches and responsive feeding in future intervention development. Moreover, these theories should explicitly link with BCTs. These theories and BCTs should also be included in the evaluation phase.

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'Childhood obesity'; intervention; 'Behaviour change techniques'; theory

Introduction

Childhood obesity is associated with reduced quality of life and increased risk of morbidity in childhood and later life (Reilly & Kelly, 2011). Obesity in childhood tracks into adulthood and increases the risk of diabetes, hypertension, coronary heart disease, and stroke (Maffeis & Tato, 2001; Reilly & Kelly, 2011). Despite some stabilisation in childhood obesity rates, the prevalence of overweight and obesity remains high (N. C. D. R. F. Collaboration, 2017; Ogden et al., 2016). Increasing evidence identifies the period from conception to 2 years of age as a critical window for obesity prevention (Andersen, Holst, Michaelsen, Baker, & Sorensen, 2012; Blake-Lamb et al., 2016; Woo Baidal et al., 2016). This is because during the first 2 years, children's feeding behaviours and preferences are shaped and influenced by modifiable parental child-feeding behaviours that lead to childhood obesity (Birch & Ventura, 2009; Clark, Goyder, Bissell, Blank, & Peters, 2007; Woo Baidal et al., 2016). Initiation and

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duration of breastfeeding (Yan, Liu, Zhu, Huang, & Wang, 2014), timing of introduction to solids (Wang et al., 2016), the type and quantity of foods consumed (Johnson, van Jaarsveld, Llewellyn, Cole, & Wardle, 2014; Pearce & Langley-Evans, 2013), and parent–child interactions during feeding, such as responsive or controlling feeding (Birch & Doub, 2014; Pérez-Escamilla, Segura-Pérez, & Lott, 2017), are all implicated in child weight outcomes.

Given the modifiable nature of these child feeding behaviours, there is an increasing focus on interventions targeting early child feeding to prevent childhood obesity (Redsell et al., 2016). Healthcare professionals are in a unique position to deliver early child feeding interventions as they engage frequently with parents during the child's first two years. A number of trials have examined the effects of such interventions delivered by healthcare professionals in early childhood (Hesketh & Campbell, 2010; Laws et al., 2014). Despite the large potential for benefits (Gorin et al., 2014), to date healthcare professional interventions demonstrate inconsistent or minimal effects on weight outcomes for children up to 5 years old (Hesketh & Campbell, 2010; Laws et al., 2014; Redsell et al., 2016). However, a recent review incorporating a range of different early child feeding interventions, such as responsive feeding, breastfeeding promotion and family lifestyle interventions, have highlighted improvements in modifiable parental feeding behaviours for children up to 2 years (Redsell et al., 2016). In light of increasing research in this area, and the variability across trial outcomes, there is a need to identify and synthesise the components and theoretical bases of early child feeding interventions, as these are posited to contribute to intervention effectiveness.

Behaviour change techniques (BCTs) are irreducible components of interventions that are observable, replicable and designed to influence behaviour (Michie et al., 2013a; Michie et al., 2013b). Identifying BCTs in early feeding and childhood obesity prevention interventions facilitates replication of positive effects (Martin, Chater, & Lorencatto, 2013) and informs the development of more effective interventions for the prevention of childhood obesity (Michie et al., 2013a). To date, only a limited number of studies have examined BCTs in childhood obesity treatment or prevention. One review examining BCTs in the prevention and management of childhood obesity, found little evidence supporting the use of specific BCTs for improving weight outcomes (Martin et al., 2013). Only one BCT, related to generalising the target behaviour to multiple settings such that it becomes part of daily life, had an effect on reducing weight outcomes (Martin et al., 2013). A second review of weight control interventions for the prevention and treatment of childhood obesity identified a number of BCTs included in effective interventions (van der Kruk, Kortekaas, Lucas, & Jager-Wittenaar, 2013). These included: providing information on links between diet, physical activity and health; information on consequences of improved diet and physical activity; providing instruction on how to perform behaviours; and planning changes in social support (van der Kruk et al., 2013). These two reviews did not look specifically at interventions in children up to 2 years, however. The first examined interventions in children aged 2–18 years (Martin et al., 2013), the second examined the 0–12 year age range without differentiation between age groups (van der Kruk et al., 2013). The findings of these reviews therefore lack comprehensive assessment of components in obesity prevention interventions specific to the critical window of the first 2 years (Blake-Lamb et al., 2016; Woo Baidal et al., 2016).

Martin et al. (2013) suggest that examining theoretically based BCT use in the area of childhood obesity prevention is also warranted. Using theory to develop and evaluate behaviour change interventions establishes clear links between determinants or predictors of targeted behaviours and appropriate BCTs (Bartholomew & Mullen, 2011; French et al., 2012b; Michie & Prestwich, 2010). A number of theories have been examined in the literature in relation to early child feeding to date. The Theory of Planned Behaviour (TPB) is one such theory that can provide insight into feeding behaviours such as the early introduction of solids (Heinig et al., 2006; Swanson et al., 2012; Zhang, Shi, Chen, Wang, & Wang, 2009). For instance, it may be that although the early solid introduction is against feeding guidelines parents may still do so due to their attitudes, norms and perceived behavioural control about the introduction of solids. These may include not perceiving negative effects of early solid introduction (attitude), living in an environment where early introduction is common or at

least not unusual (subjective norm), and feeling that their infant is a 'hungry baby' or will be given solids by other family members (perceived behavioural control). A recent Australian study observed that maternal attitude, subjective norm and group norm predicted intentions to introduce solids at 6 months (Hamilton, Daniels, White, Murray, & Walsh, 2011).

Responsive feeding is a broader approach identified as particularly important for understanding infant feeding as it relates to child weight outcomes (Hodges, Wasser, Colgan, & Bentley, 2016; Pérez-Escamilla et al., 2017; Shloim, Vereijken, Blundell, & Hetherington, 2017). Responsive feeding emerges from responsive parenting and is characterised as consistent, appropriate and prompt feeding interactions and responses to child hunger and satiety cues (DiSantis, Hodges, Johnson, & Fisher, 2011; Hodges et al., 2013; Hodges et al., 2016). Nonresponsive feeding on the other hand lacks reciprocity between the parent and the child and involves maladaptive feeding behaviours including feeding the child in the absence of hunger and/or beyond their point of satiety (DiSantis et al., 2011). Non-responsive feeding is posited to contribute to childhood risk of overweight and obesity by overriding children's self-regulation of energy intake, leading to increased risk of overweight (Birch & Doub, 2014). Family Systems Theory (FST), or Family Process Theory, adopts a broader systems approach, incorporating interactions of individuals with their environments. While not intended to represent a single defined theory of behaviour, the FST provides a useful framework for understanding infant feeding behaviours and has been used in paediatric weight management interventions (Skelton, Buehler, Irby, & Grzywacz, 2012). According to FST, the family is a complex, interacting system, with higher and lower order levels, that must be viewed as a whole. This system is in constant interaction with the environment and operates via positive and negative feedback loops with the ultimate goal of maintaining stability and equilibrium within the family system and between the system and the environment. To this end, infant feeding behaviour changes, such as waiting until six months to introduce solids, must be acceptable to the existing rules and structures within the system such that they do not sufficiently upset the stability of the system. Targeting higher order levels of the system, for instance targeting parents and grandparents in the context of infant feeding, could therefore be successful because FST views the family as a system in which parenting practices occur that can impact all family function, including child behavioural and health outcomes (Ball, Mushquash, Keaschuk, Ambler, & Newton, 2017).

Incorporating and reporting theoretical underpinnings in paediatric obesity prevention is therefore essential to understanding behaviours and behaviour change, and designing effective interventions (Skelton et al., 2012). However, reviews of obesity prevention and management interventions with children from 2 years old up to school-aged demonstrated that less than half of studies reported a theoretical basis (Amini, Djazayery, Majdzadeh, Taghdisi, & Jazayeri, 2015; Knowlden & Sharma, 2012; Ling, Robbins, & Wen, 2016; Skelton et al., 2012; Thomas, 2006). The majority of studies in reviews that examine theory reported using social cognitive theory (Amini et al., 2015; Knowlden & Sharma, 2012; Ling et al., 2016; Thomas, 2006), suggesting that a limited number of theories are applied to intervention development in this area. Two reviews of younger children, including one review specifically examining weight reduction interventions in children aged 0–2years (Redsell et al., 2016), also noted poor theory reporting and a focus on social cognitive theories where theories are reported (Hesketh & Campbell, 2010; Redsell et al., 2016). These reviews did not systematically examine the use of theory in intervention development, however, and did not examine potential links between theory use and BCTs.

The aim of this study is to identify BCTs and theory use in healthcare professional-delivered early child feeding interventions to prevent obesity for children ≤ 2 years.

Methods

This review is reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (See Supplementary File 1). The current review was conducted as part of a complementary review of the effectiveness of healthcare professional delivered early

feeding interventions to prevent childhood obesity (Matvienko-Sikar, Toomey et al., 2017) (PROSPERO registration number: CRD42016033492). The same systematic literature search was conducted for both reviews, with the exception of the inclusion of the methodological term 'time series' in the current review; data extraction and synthesis was conducted separately for each review.

Systematic literature search

The following databases were searched from inception to January 2019: CINAHL, the Cochrane Library, EMBASE, Medline and PubMed, PsycINFO, and Maternity and Infant Care. Searches also included additional sources, such as trial registries including clinicaltrials.gov, contact with authors of relevant publications, and reference list searching by one researcher (LD). Search terms used are presented in Supplementary File 2. Eligibility criteria were: (1) interventions promoting healthy feeding practices and behaviours to prevent overweight and obesity delivered by a healthcare professional (defined as someone who has undergone professional training to provide any form of health care); (2) children, born at >38 weeks gestation, and ≤ 2 years at intervention commencement; (3) examination of at least one feeding outcome; (4) inclusion of an active or 'normal care' comparator. Studies were excluded if they only included breastfeeding outcomes as the focus of this review is on broader infant feeding practices, including complementary feeding, up to two years of age. Randomised controlled trials (including cluster randomised controlled trials), case–control, and quasi-experimental studies were included. There were no restrictions on country or date of publication. Titles, abstracts, and full texts of studies were independently screened by at least two researchers (KMS, LD, CF); any disagreements were resolved by consensus.

Data extraction

A standardised form was used by two researchers (KMS, LD) to extract relevant study characteristics (see Supplementary File 3). Where more than one study is published from the same trial, results are presented for the overall trial, including all relevant individual papers.

Behaviour Change Technique (BCT) coding. Only BCTs related specifically to child feeding behaviours were coded. BCTs were coded from intervention descriptions using the Behaviour Change Technique Taxonomy version 1 (BCTTv1) (Michie et al., 2013b). The BCTTv1 includes 93 distinct BCTs, grouped into 16 clusters that are used to specify detailed content of behaviour change interventions (Michie et al., 2013a). Intervention content was coded for presence (+) or absence (-) of the BCTs. As per guidance on the use of the BCTTv1, where it was unclear whether a BCT was present or absent, it was coded as absent (Michie et al., 2013a). Active control conditions were also coded for BCTs; usual care conditions were not coded as components of these conditions are not developed to modify the target behaviour. Published manuscripts of trial outcomes and, where available, intervention protocols were examined for intervention details. All intervention content was independently assessed by at least two reviewers, who have training and experience in BCT coding (KMS, ET, CF). Any disagreements were discussed and resolved by consensus, and through consultation with an expert in behaviour change techniques (FL) where necessary.

Theory coding. The Theory Coding Scheme (Michie & Prestwich, 2010) was used to describe the theoretical basis of the reviewed interventions. This coding scheme is comprised of 19 items that describe, for instance, whether a theory or model is mentioned, and how theories are incorporated into intervention design and evaluations. The definition of a theory or model used by this scheme is that it represents an interrelated set of propositions or constructs that specify relationships among variables to explain events in a systematic way (Prestwich et al., 2014). Items 1–12 were coded for in the current review to examine the extent to which the development and evaluation of the intervention was theoretically based. Items 13–19 assess methodological issues related to measurement, testing and refinement of theory. Due to the focus of this review on the use of theory in intervention

development, these items were not coded (MacDonald, Lorimer, Knussen, & Flowers, 2016). Theoretical components were independently coded from intervention descriptions in published manuscripts and protocols by one reviewer (KMS), with a random third of all interventions coded by a second reviewer (ET or CF). Any disagreements were discussed and resolved by consensus. Theoretical components were coded for presence (+) or absence (-). Three composite scores were calculated to evaluate overall theory use and also relationships between theory and BCTs. The first assessed the extent that each BCT reported was linked to a theory-relevant construct by the authors ('BCT → theory-relevant construct score'). The second composite score assessed the extent that theoretical constructs were described by authors as specifically targeted by BCTs ('theory-relevant constructs → BCTs'). An overall theory score was calculated by summing individual items related to the use of theory to develop the intervention (items 3–6) and the two previous composite scores; this results in a score ranging from 0 (no theory use) to 8 (most extensive theory use). Calculation of composite scores was done following guidelines from Michie and Prestwich (2010).

Data synthesis

To examine the use of BCTs in interventions, the percentage of individual BCTs across all trials and the total number of BCTs per intervention were calculated. To examine the extent of theory use in intervention development and evaluation, the percentage of individual theory components across all trials and percentage of theory components included per intervention were also calculated. As intervention effectiveness is not the main focus of this review, effects of interventions are presented in table format and briefly narratively summarised for parent feeding outcomes (including for example, parent feeding styles and behaviours), dietary intake outcomes (including for example, introduction of solids and frequency of food consumption), and child weight outcomes. Intervention effects are presented in terms of effect sizes where reported and/or as calculated from data presented within the reviewed papers. A meta-analysis was not conducted for intervention effectiveness within this or the complementary effectiveness review (Matvienko-Sikar, Toomey et al., 2017), due to the considerable heterogeneity in outcomes examined and interventions used. Attempting to collapse multiple irreconcilable behaviours and constructs, from a small number of trials, into categories for inclusion in a meta-analysis would also not provide robust, reliable or useful insight into intervention effects or add value to knowledge in this area.

Quality assessment was independently conducted for each study by at least two researchers (KMS, LD) using the Cochrane Effective Practice and Organization of Care (EPOC) risk of bias criteria (Higgins & Green, 2011). Risk of bias is presented by a trial where appropriate and in instances where multiple studies are published from a trial, or no protocol is available for a trial, selective reporting rating is based on an agreement between methods and results sections of included papers (see Supplementary File 4).

Results

The systematic literature search identified 165 potentially eligible studies. Of these, 21 studies (representing 12 trials) met inclusion criteria (see Supplementary File 5 for search results). With the exception of one non-randomised controlled trial (Adam, Stern, & Stein, 1985; Wen et al., 2012; Wen et al., 2015; Wen, Baur, Rissel, & Simpson, 2011) all studies were randomised controlled trials (RCT); study and intervention characteristics are presented in Table 1. Overall, studies demonstrate low to moderate risk of bias (Supplementary File 4). Inter-rater reliability for BCT coding, using percent agreement, was high (80.49%). Inter-rater reliability using percent agreement was also high (93.93%) for coding of theoretical underpinnings of interventions. Full consensus on BCT and Theory coding was reached following discussion between the coders (KMS, ET, CF) and so consultation with a third party was not necessary.

Table 1. Study and intervention characteristics.

Study (Country)	Population	Design	Intervention	Control
Adam et al. (1985) (America)	Mothers of new-born infants 44.7% on welfare Hispanic (55.3%), African-American (37.9%)	Controlled trial	$n = 49$ Group and individual sessions, and at-home materials. Focus on appropriate introduction of solids. 4 month duration: 1 meeting during postpartum stay & 1 meeting at 1st well baby visit. Delivered by paediatrician in hospital.	$n = 54$ Usual care
BLISS Taylor et al. (2018) (New Zealand)	Women in late pregnancy and followed through to 2 years 86.1% European ancestry	RCT	$n = 105$ Standard Well Child care in addition to individual group session, home visits and telephone contacts, and at home resources including recipe books. Focus on prolonging milk feeding, in keeping with BLW, delaying introduction of solids, responsive feeding. 10 month duration: antenatally, 1 and 3–4 weeks, 3-4, 5, 5.5, 7 and 9 months. Delivered by lactation consultant and trained researcher.	$n = 101$ Standard Well Child care including home and clinic visits providing information on aspects of child health and growth, feeding, and sleep and safety. Visits occur at birth, 1, 2–4, 4–6, and 8–10 weeks, and 3–4, 5–7, 9–12, and 15–18 months, and 2–3 years. Delivered by a lead maternity carer and Well Child nurse.
French et al. (2012a) (America)	Mothers of infants younger than 2 months Majority overweight or obese low-income mothers More African American participants than white or other ethnicities	Cluster RCT	$n = 101$ Two intervention arms including group and individual sessions and at-home materials. Focused on infant feeding (arm 1, $n = 101$) and maternal eating habits (arm 2, $n = 101$). 10 month duration: 5 well child visits at 2, 4, 6, 9 & 12 months. Delivered by clinic physicians, nurses & medical assistants in pediatric primary care clinics.	$n = 104$ Usual care including existing hand-outs on breastfeeding and infant feeding.
HBT Wen et al. (2011, 2012, 2015) (Australia)	Socially & economically disadvantaged pregnant women Majority of participants were Australian (65%)	RCT	$n = 337$ (2011,2012) $n = 236$ (2015) Individual and group sessions, and at-home material. Focused on infant feeding, physical activity and social support. 24 month duration: 7 × 1-2hr visits at 3–36 weeks gestation, and 1, 3, 5, 9, 12, 18 & 24 months. Delivered by community nurses in home visit.	$n = 330$ (2011, 2012) $n = 239$ (2015) Usual care
INFANT Campbell & Hesketh (2007) Cameron et al. (2014) (Australia)	1st time parents participating in MCH nurse-initiated groups Broad representation across socioeconomic groups Majority (79.1%) Australian	Cluster RCT	$n = 271$ (2013); $n = 191$ (2014) Group sessions, peer support and at-home materials. Focus knowledge and skills around on infant feeding, physical activity, and sedentary behaviours. 15 month duration: 6 × 2 hr meetings delivered quarterly. Delivered by dietician in MCH centre.	$n = 271$ (2013); $n = 198$ (2014) Usual care from MCH nurse. 6 general health newsletters, birthday & Christmas cards, and gifts also provided.
INSIGHT Hohman et al. (2017) Adams et al. (2018) Savage et al. (2018) (America)	First time mothers Predominantly higher income Predominantly white (90.73%)	RCT	$n = 140$ Individual sessions and at-home materials. Focused on infant feeding, sleep, emotional regulation, and active social play. 36–37 weeks duration: 5 visits: 3–4, 16, 28 and 40 weeks. Delivered by research nurses in home visits.	$n = 139$ Age appropriate home safety information.
Lakshman et al. (2018) (UK)	Parents of infants less than 14 weeks old 92% Caucasian	RCT	$n = 340$ Individual face-to-face sessions and telephone contact, additional leaflets and stickers for formula-milk containers with guideline daily requirements.	$n = 329$ Attention control condition. Focus on general topics including other aspects of formula milk and weaning.

			Focus on reducing formula milk intake, promote responsive feeding, and monitor growth. Involved developing and reviewing personal feeding plan. 4 month duration: 3 × 30–45 min face-to-face sessions (at 2, 4, 6 months), 2 15–20 min telephone contacts (at 3 and 5 months). Delivered by research nurses.	4 month duration: 3 × 30–45 min face-to-face sessions (at 2, 4, 6 months), 2 15–20 min telephone contacts (at 3 and 5 months). Delivered by research nurses.
NOURISH Daniels et al. (2012, 2013, 2014, 2015) (Australia)	1st time mothers 33% met criteria for relative disadvantage 78% born in Australia	RCT	$n = 346$ Interactive group sessions and at-home materials. Focus on appropriate and responsive infant feeding. 12 month duration: 2 modules of 6 fortnightly sessions of 1/1.5 hrs duration. Delivered by dieticians and psychologists in child health clinics.	$n = 352$ Usual care
Paul et al. (2011) (America)	First time mothers 83% had private insurance 91% Caucasian	RCT	$n = 38$ Three intervention arms including iindividual sessions and at-home materials. Focused on introduction of solids (arm 1, $n = 38$), sleep and soothing (arm 2, $n = 39$) and both (arm 3, $n = 42$). Approx. 4–6 month duration: 1st visit at 2–3 weeks after birth. 2nd visit within 2 weeks of introduction of solids. Delivered by community nurses in home visit.	$n = 41$ Provided with parenting book and standard AAP hand-out on introduction of solids.
POI Fangupo et al. (2015) Taylor et al. (2018) (New Zealand)	Families with healthy infants 37% had low levels of deprivation Majority were New Zealand European (79%)	RCT	$n = 205$ Three intervention arms including interactive family and individual sessions on: infant feeding and sleep (arm 1, $n = 205$), sleep (arm 2, $n = 192$) and both (arm 3, $n = 196$) 1 month duration: 4 visits at 4, 7, 13 & 18 months. Delivered by nutritionists, paediatricians, research staff in health centre and home visits.	$n = 209$ Usual care
Schroeder et al. (2015) (America)	Parents of new born infants Largest proportion were African American (48%)	Cluster RCT	$n = 134$ Individual sessions and at-home materials. Focused on infant feeding practices, self-efficacy, and physical activity. 24 month duration: 9 visits at 1, 2, 4, 6, 9, 12, 15, 18 & 24 months. Delivered by paediatricians in JHCP health centre.	$n = 144$ Usual care
Starting Early Gross, Mendelsohn, Gross, Scheinmann, and Messito (2016) (America)	Low-income pregnant women with uncomplicated Pregnancies Hispanic/Latina, 79.92% not US born	RCT	$n = 266$ Individual and group sessions, and at-home materials. Focused on infant feeding and sleep. 33 months duration: Prenatal visit after 32 weeks; postnatal ward visit; 1, 2, 4, 6, 9, 12, 15, 18, 21, 24, 27, 30, 33 months. Delivered by dieticians certified as lactation counsellors in prenatal and pediatric primary care centres.	$n = 267$ Usual care

Note: AD = Adjusted Difference; CI: Confidence Interval: INFANT: Infant Feeding Activity and Nutrition Trial; INSIGHT: Intervention Nurses Start Infants Growing on Healthy Trajectories; JHCP: Johns Hopkins Community Physicians; MCH: Maternal and Child Health; N/A: Non applicable; POI: Prevention of Overweight in Infancy; RCT: Randomized Controlled Trial; SDS: Crossing upward centile bands on growth charts > ±67 SD score

Behaviour change techniques in early child feeding interventions

In total, 19 BCTs were identified across the 12 interventions reviewed (Table 2). Descriptions of the interventions in the reviewed papers and related protocols provided insufficient evidence for the presence of the remaining 80 BCTs in the BCTTv1. (Michie et al., 2013a). The number of BCTs in individual interventions ranged from 1 (Adam et al., 1985; Wen et al., 2011; Wen et al., 2012; Wen et al., 2015) to 11 (Lakshman et al., 2018). The mean number of BCTs used across interventions was 5.1. The most commonly reported BCT was 'Instruction on how to perform the behaviour', in this case child feeding; this was coded in all interventions. 'Social support (unspecified)' was the second most commonly identified BCT; occurring in eight interventions. 'Demonstration of the behaviour', 'adding objects to the environment', and 'identification of self as a role model' were each used in five interventions. As noted in Table 2, nine BCTs were only used in one intervention each.

Four trials included active control conditions (Adams et al., 2018; Fangupo et al., 2015; French et al., 2012a; Hohman, Paul, Birch, & Savage, 2017; Paul et al., 2011; Savage et al., 2018; Taylor et al., 2018). Two of these trials included stand-alone active control conditions only (Adams et al., 2018; Hohman et al., 2017; French et al., 2012a; Savage et al., 2018). Two trials included both stand-alone control conditions and combination control conditions that included components of the intervention and active control conditions (Fangupo et al., 2015; Paul et al., 2011; Taylor et al., 2018). The number of BCTs coded in each stand-alone active control condition were 1 (Fangupo et al., 2015; Hohman et al., 2017; Taylor et al., 2018), 2 (French et al., 2012a) and 3 BCTs (Paul et al., 2011). The combination control conditions included 4 (Fangupo et al., 2015; Taylor et al., 2018) and 8 (Paul et al., 2011) BCTs. All BCTs identified in the active control conditions were also included in the corresponding intervention conditions (See Supplementary File 6).

Theoretical underpinnings of early child feeding interventions

Half of all trials explicitly stated that the intervention was based on theory. The most commonly reported theories were social cognitive theory (SCT; the number of studies including this theory: $n = 4$) and responsive feeding ($n = 4$). Responsive feeding is proposed to be embedded in the theoretical framework of responsive parenting (Black & Aboud, 2011). As currently understood in the literature it can be conceptualised as representing set of propositions that are interrelated and specify relationships among variables to explain events in a systematic way, thus meeting criteria for theory categorisation in the Theory Coding Scheme (Michie & Prestwich, 2010). Three trials that did not explicitly state being based on theory were described as being anticipatory guidance based (Adam et al., 1985; Fangupo et al., 2015; French et al., 2012a; Taylor et al., 2018), or reported intervention aspects that were informed by theory (Paul et al., 2011). Eight trials reported that theory, or predictors which are not explicitly linked to theory, were used to select or develop intervention techniques. Seven trials also reported that at least one intervention technique was explicitly linked to at least one theory-relevant construct or predictor; and at least one theory-relevant construct or predictor was explicitly linked to at least one intervention technique across all trials. Fifty percent of studies mentioned a targeted construct as a predictor of behaviour. Constructs differ from predictors in the Theory Coding Scheme, in that the latter are not explicitly linked to theory. No studies reported using theory to recruit participants or using theory to tailor BCTs to recipients. The overall theory score, based on previous guidelines (Prestwich et al., 2014), ranged from 0 (Adam et al., 1985; Fangupo et al., 2015; French et al., 2012a; Taylor et al., 2018) to 8 (Adams et al., 2018; Hohman et al., 2017; Lakshman et al., 2018; Savage et al., 2018). Eight trials reported some link between theory and BCTs; this was not restricted to the use of theory to select or develop BCTs. However, the majority of these trials reported sub-optimal links between the two, as indicated by low scores on the composite measures; see Table 3. Only one trial included a combined control condition described as having some theoretical underpinnings (Paul et al., 2011); the active control condition in this trial was not described as having a theoretical basis (Paul et al., 2011). More information is provided in Supplementary File 6.

Table 2. Presence of BCTs (from BCT taxonomy version 1) in interventions in trials included in systematic review.

BCT	BCT definition	Adam et al. (1985)	BLISS	French et al. (2012a)	HBT	INFANT	INSIGHT	Lakshman et al. (2018)	NOURISH Trial	Paul et al. (2011)	POI	Schroeder et al. (2015)	Starting Early 2016	%
1.1	Goal setting	-	-	-	-	-	-	+	-	-	-	-	-	8
1.2	Problem solving	-	-	-	-	-	+	+	-	-	-	-	+	25
1.4	Action planning	-	-	-	-	-	-	+	-	-	-	-	-	8
2.1	Monitoring of behaviour by others without feedback	-	-	-	-	-	-	-	-	+	-	-	-	8
2.3	Self-monitoring of behaviour	-	-	-	-	-	-	+	+	-	-	-	-	17
2.4	Self-monitoring of outcomes	-	-	-	-	-	-	+	-	-	-	-	-	8
2.7	Feedback on outcomes of behaviour	-	-	-	-	-	-	+	-	-	-	-	-	8
3.1	Social support (unspecified)	-	-	+	-	+	-	+	+	+	+	+	+	67
3.2	Social Support (practical)	-	-	-	-	-	-	-	-	-	-	-	+	8
4.1	Instruction on how to perform the behaviour	+	+	+	+	+	+	+	+	+	+	+	+	100
5.1	Information about health consequences	-	-	-	-	+	-	+	+	-	-	-	+	33
5.3	Information about social and environmental consequences	-	-	-	-	-	-	-	-	+	-	-	-	8
6.1	Demonstration of the behaviour	-	-	-	-	-	+	+	+	+	+	-	+	50
7.1	Prompts/cues	-	-	-	-	-	-	+	-	-	-	-	-	8
8.1	Behavioural practice/ rehearsal	-	-	-	-	-	-	-	+	+	+	-	+	33
8.3	Habit Formation	-	-	-	-	-	-	-	-	+	+	-	-	17
9.1	Credible source	-	+	-	-	-	-	-	-	-	-	-	-	8
12.5	Adding objects to the environment	-	-	-	-	-	+	-	+	+	-	+	+	42
13.1	Identification of self as role model	-	-	-	-	+	+	-	+	-	+	-	+	42
	Total no. BCTs used	1	3	2	1	4	5	11	8	8	6	3	9	

Note: %= Percentage of identified BCTs included in each trial.

Table 3. Use of theory from the theory coding scheme in interventions in trials included in systematic review.

	Adam et al. (1985)	BLISS	French et al. (2012a)	HBT	INFANT	INSIGHT	Lakshman et al. (2018)	NOURISH	Paul et al. (2011)	POI	Schroeder et al. (2015)	Starting Early	% all Studies
1. Theory/model of behaviour mentioned	-	-	-	+	+	+	+	+	-	-	-	+	50
2. Targeted construct mentioned as a predictor of behaviour	-	-	-	-	+	+	+	+	+	-	-	+	50
3. Intervention based on a single theory (Not a combination of theories or theory and predictors)	-	+	-	+	-	-	-	-	+	-	-	-	17
4. Theory/predictors used to select recipients for the intervention	-	-	-	-	-	-	-	-	-	-	-	-	0
5. Theory/predictors used to select/develop intervention techniques	-	RF	-	(HBM)	(SCT, PST)	(RF, RP)	SCT; II	(CBT; AT; RF; SCT)	(RF)	-	-	(HBM, SCT)	67
6. Theory/predictors used to tailor intervention techniques to – recipients=	-	-	-	-	-	-	-	-	-	-	-	-	0
7. All intervention techniques are explicitly linked to at least one theory – relevant construct	-	-	-	-	-	+	-		-	-	-	-	8
8. At least one, but not all, intervention techniques are explicitly linked to at least one theory-relevant construct/predictor	-	-	-	+	+	+	+		+	-	+	+	67
9. A group of techniques are linked to a group of constructs/predictors	-	-	-	-	+	-	+		-	-	-	-	25
10. All theory-relevant constructs/predictors are explicitly linked to at least one intervention technique	-	-	-	-	-	+	+		+	-	-	-	25
11. At least one, but not all, theory-relevant constructs/ predictors are explicitly linked to at least one intervention technique	-	-	-	-	+	+	+	+	+	-	+	+	58
12. Theory-relevant constructs/predictors are measured	-	-	-	-	-	-	+	+	-	-	-	+	25
Total (n)	0	3	0	4	6	8	8	7	5	0	2	6	
BCTs→ theory relevant constructs score*	0	0	0	1	1	1	2	1	1	0	1	1	
Theory-relevant constructs → BCTs score**	0	0	0	0	1	2	4	1	2	0	1	1	
Overall theory score***	0	2	0	2	3	5	7	3	5	0	2	3	

AG: Anticipatory Guidance; AT: Attachment Theory; CBT: Cognitive Behaviour Theory; HBM: Health Belief Model; HBT; Healthy Beginnings Trial; II: Implementation intentions; INFANT: Infant Feeding Activity and Nutrition Trial; POI: Preventing Obesity in Infancy; PST: Parenting Support Theory; RF: Responsive Feeding; SCT: Social Cognitive Theory

*Composite score of items 7, 8, and 9; item 7 given a weighting of + 2 for presence and 0 for absence, items 8 and/or 9 given a weighting of + 1 for presence and 0 for absence

**Composite score of items 9, 10, and 11; item 10 given a weighting of + 2 for presence and 0 for absence, items 9 and/or 11 given a weighting of + 1 for presence and 0 for absence

***The overall theory score was calculated by summing items 3, 4, 5, and 6, with each item weighted as + 1. This score was then added to the BCT → theory-relevant construct score and the theory-relevant constructs → BCTs score.

Intervention effects

Individual parental feeding, dietary intake and weight outcomes examined across trials vary considerably. Further, results reported for feeding, dietary intake and weight outcomes, are inconsistent between trials, within trials over time, and between different outcomes within the same trial. As such, and because effectiveness is not the primary focus of this review, a summary of intervention effects for parent feeding outcomes, dietary intake outcomes, and weight outcomes is presented here. Results of intervention effects for individual outcomes are presented in Supplementary file 7 and a more detailed discussion of intervention effects is presented in the complementary review of effectiveness (Matvienko-Sikar, Toomey et al., 2017).

Parental feeding. Seven trials reported parental feeding outcomes (Adams et al., 2018; Daniels et al., 2012; Daniels, Mallan, Nicholson, Meedeniya, & Magarey, 2013; Daniels, Mallan, Nicholson, Thorpe, & Magarey, 2014; Daniels et al., 2015; Fangupo et al., 2015; French et al., 2012a; Hohman et al., 2017; Savage et al., 2018; Schroeder et al., 2015; Taylor et al., 2017; Wen et al., 2011; Wen et al., 2012; Wen et al., 2015). French et al. (2012a) found little to no effect of their intervention on the likelihood of the child eating in the kitchen, self-feeding, or drinking from a cup at 1 year of age, though a small-sized effect was observed for eating meals with the family. Taylor et al. (2018) reported medium-sized effects including increased likelihood of child self-feeding, and reduced likelihood of food fussiness and picky eating at 12 and 24 months; however, no effect was observed for responsive feeding. The Healthy Beginnings Trial (HBT) reported some medium-sized effects of the intervention for reducing the likelihood of using food as a reward at 1 and 2 years of age but not at 3.5 or 5 years of age; medium-sized effects were also observed for reducing television use during meals at 2 years (Wen et al., 2011; Wen et al., 2012; Wen et al., 2015). The Intervention Nurses Start Infants Growing on Healthy Trajectories (INSIGHT) trial reported mostly medium-sized effects for a range of parental feeding behaviours across the time points examined (Adams et al., 2018; Hohman et al., 2017; Savage et al., 2018). Due to the number of variables examined in this trial not all outcomes are reported here (please refer to Supplementary file 7); however examples of beneficial effects include medium-sized effects on reduced feeding to soothe at 8, 16, 28, 32 and 44 weeks; no effects were observed for appropriate use of bottles or sippy cups at 32 weeks but effects were small-to-medium in size at 52 weeks, with children less likely to use a bottle and more likely to use a sippy cup (Adams et al., 2018; Hohman et al., 2017; Savage et al., 2018). Similarly, the NOURISH trial reported small-sized effects at 13–15 months, and 2, 2-5, and 5 years, for a range of responsive and non-responsive feeding behaviours, including instrumental feeding and restriction (see Supplementary file 7 for all outcomes) (Daniels et al., 2012; Daniels et al., 2013; Daniels et al., 2014; Daniels et al., 2015). In the Prevention of Overweight in Infancy (POI) study, the intervention demonstrated little to no effect for most outcomes at 18 months and 2 years; those outcomes that demonstrated improvements, including less pressurised feeding, had medium-sized effects (Fangupo et al., 2015; Taylor et al., 2018). Schroeder et al. (2015) reported effects that were small-to-medium sized for restriction and monitoring at 2 years of age but no effect for pressure to eat.

Dietary intake. Eleven trials reported on child dietary intake (Adam et al., 1985; Adams et al., 2018; Cameron et al., 2014; Campbell & Hesketh, 2007; Daniels et al., 2012; Daniels et al., 2013; Daniels et al., 2014; Daniels et al., 2015; French et al., 2012a; Gross et al., 2016; Hohman et al., 2017; Lakshman et al., 2018; Paul et al., 2011; Savage et al., 2018; Schroeder et al., 2015; Taylor et al., 2018; Taylor et al., 2017; Wen et al., 2011; Wen et al., 2012; Wen et al., 2015). Four trials reported beneficial effects for all dietary intake outcome(s) examined, including reducing likelihood of introducing foods or drinks other than breast or formula milk at 4 months (Adam et al., 1985); small-sized effects were observed for reducing the likelihood of adding tea, water, juice or cereal to the infants bottle; (Gross et al., 2016); reduced likelihood of early solid introduction or giving non-core drinks, stage 1 foods, cereals as first food, or cow's milk at 1 year of age (Schroeder et al., 2015); and medium-sized effects for reduced milk consumption at 3, 4, 5 and 6 months of age (Lakshman et al., 2018). Findings were inconclusive for the remaining trials. For instance, Taylor et al. (2018) reported beneficial effects for delaying the

introduction of solids but no effects for energy intake at 7, 12 or 24 months. French et al. (2012a) reported a small-sized effect for increased fruit consumption at 1 year of age but no effect for vegetable consumption. The HBT reported the decreased likelihood of early introduction of solids and small-sized effects for the increased likelihood of consuming more than one portion of vegetables per day at 6 months of age (Wen et al., 2011; Wen et al., 2012; Wen et al., 2015). No effects were observed for vegetable consumption at any time or for fruit, drinks or snack consumption at 2, 3.5 and 5 years (Wen et al., 2011; Wen et al., 2012; Wen et al., 2015). In the INSIGHT trial, there was an increased likelihood of delaying introduction of solids and less likelihood of being fed low or higher energy density formula than being in the formula, fruit and vegetables grouping at 9 months (Adams et al., 2018; Hohman et al., 2017; Savage et al., 2018). Some improvements were observed for salty snack and vegetable consumption at 1 year of age but no effects were reported for exposure to non-core drinks, sweets or fruit (Adams et al., 2018; Hohman et al., 2017; Savage et al., 2018). The NOURISH trial reported no effect for the timing of introduction of solids or a range of dietary intake outcomes at 2 years of age (see Supplementary file 7), except whether the infant ever tried vegetables, consumed fried potatoes, or ever tried non-core drinks (Daniels et al., 2012; Daniels et al., 2013; Daniels et al., 2014; Daniels et al., 2015). Finally, Paul et al. (2011) reported better acceptance of specific vegetables (see Supplementary file 7) but no effect for the timing of introduction of solids.

Child weight outcomes. Nine trials reported on child weight outcomes; five of these trials reported inconsistent results across the outcomes examined (Daniels et al., 2012; Daniels et al., 2013; Daniels et al., 2014; Daniels et al., 2015; Fangupo et al., 2015; Lakshman et al., 2018; Schroeder et al., 2015; Taylor et al., 2018; Wen et al., 2011; Wen et al., 2012; Wen et al., 2015). Three reported no effects of the interventions for all weight outcome(s) examined, including BMI z-score at 9 or 20 months (Campbell & Hesketh, 2007; Cameron et al., 2014), 12 months (French et al., 2012a; Taylor et al., 2018), 24 months (Taylor et al., 2018), or 1, 3.5 or 5 years (French et al., 2012a). Paul et al. (2011) reported reduced mean weight-for-length and slower weight gain at 1 year. Lakshman et al. (2018) reported small changes in weight from baseline at 6 months, with no effects reported for any other weight outcome at 6 or 12 months of age (see Supplementary file 7). The NOURISH trial reported small-sized effects for BMI and less rapid weight gain at 13–15 months but no effects for any other weight outcomes at 13–15 months, 2 years or 2–5 years of age (see Supplementary file 7) (Daniels et al., 2012; Daniels et al., 2013; Daniels et al., 2014; Daniels et al., 2015). The POI study reported no effect for BMI zscore at 3.5 years of age but a medium-sized effect at 5 years of age (Fangupo et al., 2015; Taylor et al., 2018). Finally, Schroeder et al. (2015) reported no effect for weight, BMI or BMI zscore at 1 or 2 years of age, a small-sized effect for triceps and subscapular skinfold at 1 and 2 years, and a small-sized effect for triceps skinfold at 1 year but not 2 years of age.

Discussion

This is the first review to systematically examine BCTs and the use of theory in healthcare professional-delivered early child feeding interventions to prevent childhood obesity in children up to 2 years. The findings highlight a greater need for consideration and incorporation of BCTs and theoretical components in early child feeding interventions.

Overall, a small number and range of BCTs were used in healthcare professional-delivered early child feeding interventions. The majority of interventions included the BCT 'instruction on how to perform the behaviour', which is to be expected given the importance of information provision for parents of young children, particularly around early feeding and weaning (Arden, 2010; Matvienko-Sikar, Kelly et al., 2017; Synnott et al., 2007; Walsh, Kearney, & Dennis, 2015). Such instruction can be provided as anticipatory guidance and/or can include responsive feeding instruction. Responsive feeding instruction involves teaching parents how to respond to their child's hunger and satiety cues in a prompt and developmentally appropriate manner (Pérez-Escamilla et al., 2017). Recent reviews have identified that responsive feeding-based interventions demonstrate greater benefits

for some feeding and weight outcomes (Matvienko-Sikar, Toomey et al., 2017; Redsell et al., 2016), thus indicating the potential for targeting instruction in this area. A review of interventions in children aged 0–12 years identified potential links between aspects of behaviour instruction and social support, and child weight outcomes (van der Kruk et al., 2013). While this paper cannot provide evidence of similar associations, the prevalence of these BCTs in the reviewed studies suggests a need for further research on the use of these BCTs in future early child feeding interventions. It is important to note that the definition of 'social support (unspecified)', which was the second most commonly described BCT in reviewed trials, is relatively broad. This potentially increases how frequently it is coded and limiting interpretations that can be made in the current review. However, social support has been consistently identified as important by parents of young children (Green, Furrer, & McAllister, 2007; Taraban et al., 2017). A number of social support-based feeding interventions have also demonstrated improvements in child feeding outcomes in the extant literature (Mukuria, Martin, Egondi, Bingham, & Thuita, 2016; Scheiwe, Hardy, & Watt, 2010; Watt et al., 2009). Further investigation of how best to establish and implement sustainable social support components in early child feeding interventions is therefore warranted to elucidate potential mechanisms of intervention effects. Differences between the identified BCTs in this and previous reviews (Martin et al., 2013; van der Kruk et al., 2013) may be due to the different age groups examined. Previous reviews have included children up to 12 years (van der Kruk et al., 2013) and 18 years (Martin et al., 2013) and so may include BCTs targeting children's own eating behaviours rather than the focus on parental feeding behaviours in the current review.

Observed links between theory and selection of BCTs in the reviewed studies were infrequently and often insufficiently reported. This suggests inadequate consideration of theory during intervention design and development (Prestwich et al., 2014). Only half of the interventions reported a theoretical basis, with few incorporating theory into the development of the intervention or evaluation of outcomes. This is in keeping with previous findings of paediatric obesity prevention interventions (Amini et al., 2015; Ling et al., 2016; Skelton et al., 2012; Thomas, 2006), and health behaviour interventions more generally (Michie & Prestwich, 2010; Prestwich et al., 2014). As noted in previous reviews (Amini et al., 2015; Ling et al., 2016), one of the most commonly used theories across studies in this review was SCT. SCT-based interventions that incorporate components to increase mastery, self-efficacy and opportunities for learning have demonstrated effective weight reduction in older children (Ling et al., 2016). For parents of children up to 2 years, increasing mastery and self-efficacy around early child feeding could be particularly useful based on previous qualitative findings regarding parents' feeding self-confidence (Matvienko-Sikar, Kelly et al., 2017) and the influence of beliefs about one's capabilities on subsequent behaviour (Michie, van Stralen, & West, 2011). As such, the inclusion of SCT in early feeding interventions is warranted, as is inclusion of a responsive feeding approach. As previously noted, responsive feeding can help to ensure appropriate child self-regulation of hunger and satiety through appropriate parental responses, and potentially prevent the risk of childhood overweight (Birch & Doub, 2014; Matvienko-Sikar, Toomey et al., 2017; Redsell et al., 2016). It is important to note, however, that while some reviewed interventions are based on responsive feeding and social cognitive theory, the current review does not have sufficient evidence to posit that either/both of these theoretical bases offers a more robust explanation of how parental behaviours reduce the risk of childhood overweight. Furthermore, while interventions may include educational or informative components to increase self-efficacy and responsive feeding, it is important that parents be provided opportunities to develop, enhance and maintain these skills in practical ways; behavioural practice was a less common BCT in the reviewed studies and warrants further examination in conjunction with psychological aspects such as self-efficacy. The absence of broader ecological approaches and theoretical underpinnings such as Family Systems Theory, in the reviewed studies is a limitation of the area. This is particularly true in terms of understanding the immediate familial environment and the broader social norms in which early child feeding occurs, and identifying which are important sources of influence for parents in their early feeding practices (Matvienko-Sikar, Toomey et al., 2017). In addition, the behavioural domain

and population targeted in behaviour change interventions can influence the effectiveness of applying different theoretical processes (Peters, de Bruin, & Crutzen, 2015). As such, limitations in how more general theories are applied in specific contexts, such as paediatric obesity prevention, may limit inferences that can be drawn about associations between these theories and intervention effectiveness. There is therefore a need for evaluation of the usefulness of parenting theories or theories that map onto family processes in healthcare professional delivered interventions with children up to 2 years; such theories are lacking in the current review. These findings highlight the need for healthcare professional-delivered early child feeding interventions to incorporate and report theory in a more rigorous way throughout intervention development.

Strengths and limitations

This paper provides a timely and systematic examination of BCTs and theory in healthcare professional delivered early-feeding interventions to prevent childhood obesity. The use of an established taxonomy and coding scheme for identification of BCTs and theoretical components is an important strength of this study. It enables a robust and comprehensive approach to systematically identify unique and potentially useful intervention components. However, it is important to note that BCTs used to target constructs in such interventions may not be the best fit and the use of a more formal approach to linking BCTs and mechanisms of action is needed (Michie et al., 2016). Furthermore, in the reviewed studies all BCTs that were identified in active control conditions were also included in the corresponding interventions. This similarity between the intervention and control conditions significantly limits the ability to determine if any observed intervention effects are due to specific intervention components. Well-designed trials utilising appropriate intervention and control conditions are therefore essential. The heterogeneity in constructs and behaviours examined in the reviewed trials limited synthesis of intervention effects in this review, impacting on our ability to examine the role of BCTs and/or theory on intervention outcomes. Use of more standardised approaches to evaluating outcomes of infant feeding interventions to prevent childhood obesity (e.g., Matvienko-Sikar, Byrne et al., 2017) may help overcome such issues in the future. It is important to consider the fidelity of intervention delivery and receipt in terms of BCT use and theoretical underpinnings due to moderate levels of intervention fidelity within the reviewed studies, reported elsewhere (Toomey et al., 2017). Intervention fidelity relates to the extent that an intervention is implemented as intended (Carroll et al., 2007). Full reporting and understanding of what actually occurred in the intervention and control conditions during trials is essential to draw accurate conclusions about the role of BCTs and theoretical components (JaKa et al., 2016; Toomey et al., 2017). Thus, the methodological limitations of the reviewed studies must be taken into account when examining the role of theory and BCTs in early child feeding interventions.

Conclusion

This is the first systematic examination of BCTs and theoretical components in healthcare professional-delivered early child feeding interventions for childhood obesity prevention for children up to 2 years. The findings indicate that, across the reviewed studies, theory is not adequately reported, with poor evidence of integration of theory in intervention development. Future early child feeding interventions must be more robustly theoretically based with full consideration given to BCT and theoretical components. Future work teasing out associations between BCTs, theory and specific outcomes is also a critical next step in developing and evaluating healthcare professional-delivered early child feeding interventions.

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References

Adam, H. M., Stern, E. K., & Stein, R. E. (1985). Anticipatory guidance: A modest intervention in the nursery. *Pediatrics*, *76*(5), 781–786.

Adams, E. L., Marini, M. E., Stokes, J., Birch, L. L., Paul, I. M., & Savage, J. S. (2018). INSIGHT responsive parenting intervention reduces infant's screen time and television exposure. *International Journal of Behavioral Nutrition and Physical Activity*, *15*. doi:10.1186/s12966-018-0657-5

Amini, M., Djazayery, A., Majdzadeh, R., Taghdisi, M. H., & Jazayeri, S. (2015). Effect of school-based interventions to control childhood obesity: A review of reviews. *International Journal Of Preventive Medicine*, *6*), doi:10.4103/2008-7802.162059

Andersen, L. G., Holst, C., Michaelsen, K. F., Baker, J. L., & Sorensen, T. I. (2012). Weight and weight gain during early infancy predict childhood obesity: A case-cohort study. *International Journal of Obesity*, *36*(10), 1306–1311. doi:10.1038/ijo.2012.134

Arden, M. A. (2010). Conflicting influences on UK mothers' decisions to introduce solid foods to their infants. *Maternal & Child Nutrition*, *6*(2), 159–173.

Ball, G. D., Mushquash, A. R., Keaschuk, R. A., Ambler, K. A., & Newton, A. S. (2017). Using intervention mapping to develop the parents as agents of change (PAC©) intervention for managing pediatric obesity. *BMC Research Notes*, *10*(1), 43. doi:10.1186/s13104-016-2361-3

Bartholomew, L. K., & Mullen, P. D. (2011). Five roles for using theory and evidence in the design and testing of behavior change interventions. *Journal of Public Health Dentistry*, *71*, S20–S33. doi:10.1111/j.1752-7325.2011.00223.x

Birch, L. L., & Doub, A. E. (2014). Learning to eat: Birth to age 2 y. *The American Journal of Clinical Nutrition*, *99*(3), 723S-728S. doi:10.3945/ajcn.113.069047

Birch, L. L., & Ventura, A. K. (2009). Preventing childhood obesity: What works? *International Journal of Obesity*, *33*(Suppl 1), S74–S81. doi:10.1038/ijo.2009.22

Black, M. M., & Aboud, F. E. (2011). Responsive feeding is embedded in a theoretical framework of responsive parenting. *The Journal of Nutrition*, *141*(3), 490–494. doi:10.3945/jn.110.129973

Blake-Lamb, T. L., Locks, L. M., Perkins, M. E., Woo Baidal, J. A., Cheng, E. R., & Taveras, E. M. (2016). Interventions for childhood obesity in the first 1,000 Days a systematic review. *American Journal of Preventive Medicine*, *50*(6), 780–789. doi:10.1016/j.amepre.2015.11.010

Cameron, A. J., Ball, K., Hesketh, K. D., McNaughton, S. A., Salmon, J., Crawford, D. A., … Campbell, K. J. (2014). Variation in outcomes of the Melbourne infant, feeding, activity and nutrition trial (InFANT) program according to maternal education and age. *Preventive Medicine: An International Journal*, *58*, 58–63. doi:10.1016/j.ypmed.2013.10.021

Campbell, K. J., & Hesketh, K. D. (2007). Strategies which aim to positively impact on weight, physical activity, diet and sedentary behaviours in children from zero to five years. A systematic review of the literature. *Obesity Reviews*, *8*(4), 327e338.

Carroll, C., Patterson, M., Wood, S., Booth, A., Rick, J., & Balain, S. (2007). A conceptual framework for implementation fidelity. *Implementation Science*, *2*(40). doi:10.1186/1748-5908-2-40

Clark, H. R., Goyder, E., Bissell, P., Blank, L., & Peters, J. (2007). How do parents' child-feeding behaviours influence child weight? Implications for childhood obesity policy. *Journal of Public Health*, *29*(2), 132–141. doi:10.1093/pubmed/fdm012

Daniels, L. A., Mallan, K. M., Battistutta, D., Nicholson, J. M., Perry, R., & Magarey, A. (2012). Evaluation of an intervention to promote protective infant feeding practices to prevent childhood obesity: Outcomes of the NOURISH RCT at 14 months of age and 6 months post the first of two intervention modules. *International Journal of Obesity*, *36*(10), 1292–1298. doi:10.1038/ijo.2012.96

Daniels, L., Mallan, K., Nicholson, J., Meedeniya, J., & Magarey, A. (2013). Child behaviour and weight outcomes of NOURISH RCT. *Obesity Facts*, *6*(Suppl. 1), 49–230.

Daniels, L., Mallan, K., Nicholson, J., Thorpe, K., & Magarey, A. (2014). Longer term child growth and maternal feeding practices outcomes of the NOURISH obesity prevention trial. *Obesity Facts*, *7*(39), doi:10.1159/000363668

Daniels, L. A., Mallan, K. M., Nicholson, J. M., Thorpe, K., Nambiar, S., Mauch, C. E., & Magarey, A. (2015). An early feeding practices intervention for obesity prevention. *Pediatrics*, *136*(1), e40–e49. doi:10.1542/peds.2014-4108

DiSantis, K. I., Hodges, E. A., Johnson, S. L., & Fisher, J. O. (2011). The role of responsive feeding in overweight during infancy and toddlerhood: A systematic review. *International Journal of Obesity*, *35*(4), 480–492. doi:10.1038/ijo.2011.3

Fangupo, L. J., Heath, A. L., Williams, S. M., Somerville, M. R., Lawrence, J. A., Gray, A. R., … Taylor, R. W. (2015). Impact of an early-life intervention on the nutrition behaviors of 2-y-old children: A randomized controlled trial. *American Journal of Clinical Nutrition*, *102*(3), 704–712. doi:10.3945/ajcn.115.111823

French, S. D., Green, S. E., O'Connor, D. A., McKenzie, J. E., Francis, J. J., Michie, S., … Grimshaw, J. M. (2012b). Developing theory-informed behaviour change interventions to implement evidence into practice: A systematic approach using the theoretical domains framework. *Implementation Science*, *7*. doi:10.1186/1748-5908-7-38

French, G. M., Nicholson, L., Skybo, T., Klein, E. G., Schwirian, P. M., Murray-Johnson, L., … Groner, J. A. (2012a). An evaluation of mother-centered anticipatory guidance to reduce obesogenic infant feeding behaviors. *Pediatrics*, *130*(3), e507–e517. doi:10.1542/peds.2011-3027

Gorin, A. A., Wiley, J., Ohannessian, C. M., Hernandez, D., Grant, A., & Cloutier, M. M. (2014). Steps to growing up healthy: A pediatric primary care based obesity prevention program for young children. *Bmc Public Health*, *14*(72), doi:10.1186/1471-2458-14-72

Green, B. L., Furrer, C., & McAllister, C. (2007). How do relationships support parenting? Effects of attachment style and social support on parenting behavior in an at-risk population. *American Journal of Community Psychology*, *40*(1-2), 96–108. doi:10.1007/s10464-007-9127-y

Gross, R. S., Mendelsohn, A. L., Gross, M. B., Scheinmann, R., & Messito, M. J. (2016). Randomized controlled trial of a primary care-based child obesity prevention intervention on infant feeding practices. *Journal of Pediatrics*, *174*, 171–177.e2.

Hamilton, K., Daniels, L., White, K. M., Murray, N., & Walsh, A. (2011). Predicting mothers' decisions to introduce complementary feeding at 6 months. An investigation using an extended theory of planned behaviour. *Appetite*, *56*(3), 674–681. doi:10.1016/j.appet.2011.02.002

Heinig, M. J., Follett, J. R., Ishii, K. D., Kavanagh-Prochaska, K., Cohen, R., & Panchula, J. (2006). Barriers to compliance with infant-feeding recommendations among low-income women. *Journal of Human Lactation*, *22*(1), 27–38. doi:10.1177/0890334405284333

Hesketh, K. D., & Campbell, K. J. (2010). Interventions to prevent obesity in 0–5 year olds: An updated systematic review of the literature. *Obesity*, *18*, S27–S35. doi:10.1038/oby.2009.429

Higgins, J. P. T. , & Green, S. (2011). *Cochrane handbook for systematic reviews of interventions*. Oxford: The Cochrane Collaboration. (Version 5.1.0 (updated March 2011)).

Hodges, E. A., Johnson, S. L., Hughes, S. O., Hopkinson, J. M., Butte, N. F., & Fisher, J. O. (2013). Development of the responsiveness to child feeding cues scale. *Appetite*, *65*, 210–219. doi:10.1016/j.appet.2013.02.010

Hodges, E. A., Wasser, H. M., Colgan, B. K., & Bentley, M. E. (2016). Development of FEEDING CUES during infancy and toddlerhood. *Mcn-the American Journal of Maternal-Child Nursing*, *41*(4), 244–251. doi:10.1097/Nmc.0000000000000251

Hohman, E. E., Paul, I. M., Birch, L. L., & Savage, J. S. (2017). INSIGHT responsive parenting intervention is associated with healthier patterns of dietary exposures in infants. *Obesity (Silver Spring, Md.)*, *25*(1), 185–191. doi:10.1002/oby.21705

JaKa, M. M., Haapala, J. L., Trapl, E. S., Kunin-Batson, A. S., Olson-Bullis, B. A., Heerman, W. J., … Sherwood, N. E. (2016). Reporting of treatment fidelity in behavioural paediatric obesity intervention trials: A systematic review. *Obesity Reviews: an Official Journal of the International Association for the Study of Obesity*, *17*(12), 1287–1300. doi:10.1111/obr.12464

Johnson, L., van Jaarsveld, C. H. M., Llewellyn, C. H., Cole, T. J., & Wardle, J. (2014). Associations between infant feeding and the size, tempo and velocity of infant weight gain: SITAR analysis of the gemini twin birth cohort. *International Journal of Obesity*, *38*(7), 980–987. doi:10.1038/ijo.2014.61

Knowlden, A. P., & Sharma, M. (2012). Systematic review of family and home-based interventions targeting paediatric overweight and obesity. *Obesity Reviews*, *13*(6), 499–508. doi:10.1111/j.1467-789X.2011.00976.x

Lakshman, R., Sharp, S. J., Whittle, F., Schiff, A., Hardeman, W., Irvine, L., … Ong, K. K. (2018). Randomised controlled trial of a theory-based behavioural intervention to reduce formula milk intake. *Archives of Disease in Childhood*, *103*(11), 1054–1060. doi:10.1136/archdischild-2018-314784

Laws, R., Campbell, K. J., van der Pligt, P., Russell, G., Ball, K., Lynch, J., … Denney-Wilson, E. (2014). The impact of interventions to prevent obesity or improve obesity related behaviours in children (0–5 years) from socioeconomically disadvantaged and/or indigenous families: A systematic review. *Bmc Public Health*, *14*. doi:10.1186/1471-2458-14-779

Ling, J., Robbins, L. B., & Wen, F. (2016). Interventions to prevent and manage overweight or obesity in preschool children: A systematic review. *International Journal of Nursing Studies*, *53*, 270–289. doi:10.1016/j.ijnurstu.2015.10.017

MacDonald, J., Lorimer, K., Knussen, C., & Flowers, P. (2016). Interventions to increase condom use among middle-aged and older adults: A systematic review of theoretical bases, behaviour change techniques, modes of delivery and treatment fidelity. *Journal of Health Psychology*, *21*(11), 2477–2492. doi:10.1177/1359105315580462

Maffeis, C., & Tato, L. (2001). Long-term effects of childhood obesity on morbidity and mortality. *Hormone Research*, 55 (Suppl 1), 42-45. doi:63462

Martin, J., Chater, A., & Lorencatto, F. (2013). Effective behaviour change techniques in the prevention and management of childhood obesity. *International Journal of Obesity*, *37*(10), 1287–1294. doi:10.1038/ijo.2013.107

Matvienko-Sikar, K., Byrne, M., Kelly, C., Toomey, E., Hennessy, M., Devane, D., … Kearney, P. M. (2017). Development of an infant feeding core outcome set for childhood obesity interventions: Study protocol. *Trials*, *18*(1), 463. doi:10.1186/s13063-017-2180-4

Matvienko-Sikar, K., Kelly, C., Sinnott, C., McSharry, J., Houghton, C., Heary, C., … Kearney, P. K. (2017). Parental experiences and perceptions of infant complementary feeding: A qualitative evidence synthesis. *Obesity Reviews*, epub ahead of print. doi:10.1111/obr.12653

Matvienko-Sikar, K., Toomey, E., Delaney, L., Harrington, J., Byrne, M., Kearney, P. M., & Choosing Healthy Eating for Infant Health study, t.. (2017). Effects of healthcare professional delivered early feeding interventions on feeding practices and dietary intake: A systematic review. *Appetite*, *123*, 56–71. doi:10.1016/j.appet.2017.12.001

Michie, S., Carey, R. N., Johnston, M., Rothman, A. J., de Bruin, M., Kelly, M. P., & Connell, L. E. (2016). From theory-inspired to theory-based interventions: A protocol for developing and testing a methodology for linking behaviour change techniques to theoretical mechanisms of action. *Annals of Behavioral Medicine*, doi:10.1007/s12160-016-9816-6

Michie, S., & Prestwich, A. (2010). Are interventions theory-based? Development of a theory coding scheme. *Health Psychology*, *29*. doi:10.1037/a0016939

Michie, S., Richardson, M., Johnston, M., Abraham, C., Francis, J., Hardeman, W., … Wood, C. E. (2013a). The behavior change technique taxonomy (v1) of 93 hierarchically clustered techniques: Building an international consensus for the reporting of behavior change interventions. *Annals of Behavioral Medicine*, *46*(1), 81–95. doi:10.1007/s12160-013-9486-6

Michie, S., van Stralen, M. M., & West, R. (2011). The behaviour change wheel: A new method for characterising and designing behaviour change interventions. *Implementation Science*, *6*(1), 1–12. doi:10.1186/1748-5908-6-42

Michie, S., Wood, C., Johnston, M., Abraham, C., Francis, J., Hardeman, W., … Cane, J. (2013). The behavior change technique taxonomy (V1) of 93 hierarchically-clustered techniques: Testing reliability of the taxonomy. *Annals of Behavioral Medicine*, *45*, S205–S205.

Mukuria, A. G., Martin, S. L., Egondi, T., Bingham, A., & Thuita, F. M. (2016). Role of social support in improving infant feeding practices in Western Kenya: A quasi-experimental study. *Global Health-Science and Practice*, *4*(1), 55–72. doi:10.9745/Ghsp-D-15-00197

N. C. D. R. F Collaboration. (2017). Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: A pooled analysis of 2416 population-based measurement studies in 128.9 million children, adolescents, and adults. *The Lancet*. doi:10.1016/S0140-6736(17)32129-3

Ogden, C. L., Carroll, M. D., Lawman, H. G., Fryar, C. D., Kruszon-Moran, D., Kit, B. K., & Flegal, K. M. (2016). Trends in obesity prevalence among children and adolescents in the United States, 1988–1994 through 2013–2014. *JAMA*, *315*(21), 2292–2299. doi:10.1001/jama.2016.6361

Paul, I. M., Savage, J. S., Anzman, S. L., Beiler, J. S., Marini, M. E., Stokes, J. L., … Birch, L. L. (2011). Preventing obesity during infancy: A pilot study. *Obesity (19307381)*, *19*(2), 353–361. doi:10.1038/oby.2010.182

Pearce, J., & Langley-Evans, S. C. (2013). The types of food introduced during complementary feeding and risk of childhood obesity: A systematic review. *International Journal of Obesity*, *37*(4), 477–485. doi:10.1038/ijo.2013.8

Pérez-Escamilla, R., Segura-Pérez, S., Lott, M., & On behalf of the RWJF HER Expert Panel on Best Practices for Promoting Healthy Nutrition, F. P., and Weight Status for Infants and Toddlers from Birth to 24 Months. (2017). *Feeding guidelines for infants and young toddlers: A responsive parenting approach*. Durham, NC: Healthy Eating Research. Retrieved from http://healthyeatingresearch.org

Peters, G. J. Y., de Bruin, M., & Crutzen, R. (2015). Everything should be as simple as possible, but no simpler: Towards a protocol for accumulating evidence regarding the active content of health behaviour change interventions (vol 9, pg 1, 2015). *Health Psychology Review*, *9*(4), 506–506. doi:10.1080/17437199.2013.858979

Prestwich, A., Sniehotta, F. F., Whittington, C., Dombrowski, S. U., Rogers, L., & Michie, S. (2014). Does theory influence the effectiveness of health behavior interventions? Meta-analysis. *Health Psychology*, *33*(5), 465–474. doi:10.1037/a0032853

Redsell, S. A., Edmonds, B., Swift, J. A., Siriwardena, A. N., Weng, S., Nathan, D., & Glazebrook, C. (2016). Systematic review of randomised controlled trials of interventions that aim to reduce the risk, either directly or indirectly, of overweight and obesity in infancy and early childhood. *Maternal and Child Nutrition*, *12*(1), 24–38. doi:10.1111/mcn.12184

Reilly, J. J., & Kelly, J. (2011). Long-term impact of overweight and obesity in childhood and adolescence on morbidity and premature mortality in adulthood: Systematic review. *International Journal of Obesity*, *35*(7), 891–898. doi:10.1038/ijo.2010.222

Savage, J. S., Hohman, E. E., Marini, M. E., Shelly, A., Paul, I. M., & Birch, L. L. (2018). INSIGHT responsive parenting intervention and infant feeding practices: Randomized clinical trial. *International Journal of Behavioral Nutrition and Physical Activity*, *15*. doi:10.1186/s12966-018-0700-6

Scheiwe, A., Hardy, R., & Watt, R. G. (2010). Four-year follow-up of a randomized controlled trial of a social support intervention on infant feeding practices. *Maternal & Child Nutrition*, *6*(4), 328–337. doi:10.1111/j.1740-8709.2009.00231.x

Schroeder, N., Rushovich, B., Bartlett, E., Sharma, S., Gittelsohn, J., & Caballero, B. (2015). Early obesity prevention: A randomized trial of a practice-based intervention in 0–24-month infants. *Journal of Obesity*, *2015*, 795859–795859. doi:10.1155/2015/795859

Shloim, N., Vereijken, C. M. J. L., Blundell, P., & Hetherington, M. M. (2017). Looking for cues - infant communication of hunger and satiation during milk feeding. *Appetite*, *108*, 74–82. doi:10.1016/j.appet.2016.09.020

Skelton, J. A., Buehler, C., Irby, M. B., & Grzywacz, J. G. (2012). Where are family theories in family-based obesity treatment?: Conceptualizing the study of families in pediatric weight management. *International Journal of Obesity*, *36*(7), 891–900. doi:10.1038/ijo.2012.56

Swanson, V., Nicol, H., McInnes, R., Cheyne, H., Mactier, H., & Callander, E. (2012). Developing maternal self-efficacy for feeding preterm babies in the neonatal unit. *Qualitative Health Research*, *22*(10), 1369–1382. doi:10.1177/1049732312451872

Synnott, K., Bogue, J., Edwards, C. A., Scott, J. A., Higgins, S., Norin, E., … Adam, R. (2007). Parental perceptions of feeding practices in five European countries: An exploratory study. *European Journal Of Clinical Nutrition*, *61*(8), 946–956. doi:10.1038/sj.ejcn.1602604

Taraban, L., Shaw, D. S., Leve, L. D., Wilson, M. N., Dishion, T. J., Natsuaki, M. N., … Reiss, D. (2017). Maternal depression and parenting in early childhood: Contextual influence of marital quality and social support in two samples. *Developmental Psychology*, *53*(3), 436–449. doi:10.1037/dev0000261

Taylor, R. W., Gray, A. R., Heath, A. L. M., Galland, B. C., Lawrence, J., Sayers, R., … Taylor, B. J. (2018). Sleep, nutrition, and physical activity interventions to prevent obesity in infancy: Follow-up of the prevention of overweight in Infancy (POI) randomized controlled trial at ages 3.5 and 5 y. *American Journal of Clinical Nutrition*, *108*(2), 228–236. doi:10.1093/ajcn/nqy090

Taylor, R. W., Williams, S. M., Fangupo, L. J., Wheeler, B. J., Taylor, B. J., Daniels, L., … Heath, A. L. M. (2017). Effect of a baby-Led approach to complementary feeding on infant growth and overweight a randomized clinical trial. *JAMA Pediatrics*, *171*(9), 838–846. doi:10.1001/jamapediatrics.2017.1284

Thomas, H. (2006). Obesity prevention programs for children and youth: Why are their results so modest? *Health Education Research*, *21*(6), 783–795. doi:10.1093/her/cyl143

Toomey, E., Matvienko-Sikar, K., Heary, C., D, L., Queally, M., Hayes, C., … Byrne, M. (2017). Intervention fidelity within trials of infant feeding interventions to prevent childhood obesity: A systematic review.

van der Kruk, J. J., Kortekaas, F., Lucas, C., & Jager-Wittenaar, H. (2013). Obesity: A systematic review on parental involvement in long-term European childhood weight control interventions with a nutritional focus. *Obesity Reviews*, *14*(9), 745–760. doi:10.1111/obr.12046

Walsh, A., Kearney, L., & Dennis, N. (2015). Factors influencing first-time mothers' introduction of complementary foods: A qualitative exploration. *Bmc Public Health*, *15*(1), 1–11. doi:10.1186/s12889-015-2250-z

Wang, J., Wu, Y., Xiong, G., Chao, T., Jin, Q., Liu, R., … Yang, X. (2016). Introduction of complementary feeding before 4months of age increases the risk of childhood overweight or obesity: A meta-analysis of prospective cohort studies. *Nutrition Research (New York, N.Y.)*, *36*(8), 759–770. doi:10.1016/j.nutres.2016.03.003

Watt, R. G., Tull, K. I., Hardy, R., Wiggins, M., Kelly, Y., Molloy, B., … McGlone, P. (2009). Effectiveness of a social support intervention on infant feeding practices: Randomised controlled trial. *Journal of Epidemiology & Community Health*, *63*(2), 156–162. doi:10.1136/jech.2008.077115

Wen, L. M., Baur, L. A., Rissel, C., & Simpson, J. M. (2011). A randomized controlled trial of an early intervention on childhood obesity: Results from the first 12 months. *Obesity*, *19*, S67. doi:10.1038/oby.2011.222

Wen, L. M., Baur, L. A., Simpson, J. M., Rissel, C., Wardle, K., & Flood, V. M. (2012). Effectiveness of home based early intervention on children's BMI at age 2: Randomised controlled trial. *BMJ (Clinical Research Ed.)*, *344*, e3732–e3732. doi:10.1136/bmj.e3732

Wen, L. M., Baur, L. A., Simpson, J. M., Xu, H., Hayes, A. J., Hardy, L. L., … Rissel, C. (2015). Sustainability of effects of an early childhood obesity prevention trial over time: A further 3-year follow-up of the healthy beginnings trial. *JAMA Pediatrics*, *169*(6), 543–551. doi:10.1001/jamapediatrics.2015.0258

Woo Baidal, J. A., Locks, L. M., Cheng, E. R., Blake-Lamb, T. L., Perkins, M. E., & Taveras, E. M. (2016). Risk Factors for childhood obesity in the first 1,000 Days: A systematic review. *American Journal of Preventive Medicine*, *50*(6), 761–779. doi:10.1016/j.amepre.2015.11.012

Yan, J., Liu, L., Zhu, Y., Huang, G. W., & Wang, P. P. (2014). The association between breastfeeding and childhood obesity: A meta-analysis. *Bmc Public Health*, *14*. doi:10.1186/1471-2458-14-1267

Zhang, J., Shi, L., Chen, D., Wang, J., & Wang, Y. (2009). Using the theory of planned behavior to examine effectiveness of an educational intervention on infant feeding in China. *Preventive Medicine*, *49*(6), 529–534. doi:10.1016/j.ypmed.2009.10.002