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How are behavioural interventions delivered to children (5–11 years old): a systematic mapping review

Amberly Brigden ,[1] Roxanne Morin Parslow,[1] Catherine Linney,[1] Nina Higson-Sweeney,[2] Rebecca Read,[2] Maria Loades,[1,2] Anna Davies,[1] Sarah Stoll,[1] Lucy Beasant,[1] Richard Morris,[3] Siyan Ye,[1] Esther Crawley [1]

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[1]Centre for Academic Child Health, Bristol Medical School, University of Bristol, Bristol, UK
[2]Department of Psychology, University of Bath, Bath, UK
[3]Bristol Medical School, University of Bristol, Bristol, UK

Correspondence to
Amberly Brigden; amberly.brigden@bristol.ac.uk

ABSTRACT

Context Behavioural interventions are used to prevent, manage and treat a wide variety of conditions including obesity, diabetes, chronic pain, asthma and emotional difficulties. There has been inadequate attention to the delivery of behavioural interventions to younger children (5–11 years old).

Objective Our objectives were to describe the characteristics of behavioural interventions for children aged 5–11 years.

Data sources We searched five databases: CINAHL, EMBASE, PsycINFO, MEDLINE and Cochrane Library, from January 2005 to August 2019.

Study selection The inclusion criteria were (1) children aged 5–11, (2) cognitive and/or behavioural interventions, (3) randomised controlled trials and (4) 2005 onward. Two researchers independently identified studies for inclusion.

Data extraction Two researchers independently extracted data from eligible papers.

Results The search identified 10 541 papers. We extracted information on 117 interventions (from 152 papers). Many of the interventions were categorised as complex. This was particularly true for clinical populations; 78.7% were delivered to both the child and parent, and 33.9% took place across multiple settings, typically health and school settings. Most (70.9%) were 'First Wave' (behavioural) interventions, and few (4.3%) were 'Third Wave' (characterised by metacognition, acceptance and mindfulness). Thirty-nine per cent used interactive techniques (play, arts, story and/or games). Purely digital and paper-based interventions were rare, but around a third used these tools as supplements to face–face delivery. There were differences in interventions for younger (5–7 years) and older (8–11 years) children.

Conclusions Interventions designed and delivered to children should be developmentally sensitive. This review highlights characteristics of interventions delivered to children 5–11 years old: the involvement of the child's parent, using behavioural (rather than cognitive) modalities, using interactive techniques and some interventions were delivered across multiple settings.

What is known about the subject?

► Behavioural interventions can be used to prevent, treat and manage a range of health conditions. Children 5–11 years old have distinct physical, emotional, social and cognitive developmental characteristics. These developmental differences should be considered when designing interventions for children.

What this study adds?

► This review highlights intervention characteristics to consider when designing and delivering interventions for children 5–11 years old. Interventions for children aged 5–11 years typically involve parents, span multiple settings, use a 'First Wave' behavioural modality and integrate interactive techniques (play, arts, story and/or game-based techniques).

INTRODUCTION

Health in childhood lays the foundations for health across the lifespan.[1–7] Behavioural interventions are used to prevent, manage and treat a range of health conditions in childhood. Behavioural interventions targeting lifestyle behaviours, such as a healthy eating and physical activity,[8] can prevent obesity, dental problems and osteoporosis. Behavioural interventions can support the management of long-term health conditions such as attention deficit hyperactivity disorder (ADHD), asthma, diabetes, chronic pain and cystic fibrosis, by promoting medication adherence, monitoring of health markers (eg, insulin and blood pressure)[9] and engagement in condition-specific health behaviours. In some cases, behavioural intervention can be used to treat a condition, as in depression and anxiety, where the treatments tackle the maladaptive cognitions and behaviours that underlie the disorder.[10]

Behavioural interventions ('First Wave') are based on the theory that all behaviours are learnt (through classical and operant conditioning)[11] and that maladaptive behaviours can be changed using principles such as

reinforcement, modelling, graded tasks and habit formation.[12] Cognitive-behavioural (CBT, 'Second Wave') interventions are based on the principle that thoughts, feelings, physical sensations and actions are interconnected; individuals are supported to identify negative/unhelpful patterns in their cognitions, emotions, behaviours, physical sensations and supported to adopt more adaptive patterns.[13] The 'Third Wave' of cognitive-behavioural interventions are characterised by techniques such as metacognition, acceptance, mindfulness, compassion and spirituality.[11]

While behavioural interventions are commonly used in adolescent populations, less is known about the appropriate or effective ways to deliver interventions in younger, primary-school-aged children (5–11 years). Inadequate attention has been paid to designing/adapting interventions for the specific developmental stage of this age group[14 15] and comparatively fewer trials evaluating them in this younger age group.[15–17]

Theory should be used when developing interventions[18–21]; when designing interventions for children, this means considering development theory.[14 22 22] Younger children have distinct physical, emotional, social and cognitive developmental characteristics. Younger children (under seven) are pre-logical and their thinking is dominated by perception. From the age of seven onward, children start to think logically, but until age 12, they are still limited to concrete rather than abstract thought processes.[13] In line with cognitive development, children hold more basic beliefs about illness ("When you leave the window open, your blankets get cold which can make you a little bit sick") and magical thinking about illness.[23] Children are more reliant on caregivers. Parents/carers are typically the gatekeepers to recognising their child's health needs, accessing services and implementing/overseeing health interventions.[24] Children are also more reliant on caregivers at school, relying on teachers to support the management of their health condition.[25]

A better understanding of the characteristics of behavioural interventions for children will be helpful for researchers developing and evaluating interventions, as well as clinicians implementing them. Mapping reviews are useful when synthesising information from a broad field of study, covering a large volume of literature.[26] This study aims to 'map' behavioural interventions designed for younger primary-school-aged children (5–11 years old) to describe the way they are delivered to this age group in terms of recipients, modality, setting, mode and techniques of delivery.

METHODS

Design

We carried out a mapping review to answer the question: "how are behavioural interventions delivered to children aged 5–11?".

Search strategy

The search strategy was developed with a University of Bristol data specialist. It included keywords and MeSH headings for (1) children aged 5–11, (2) cognitive and/or behavioural interventions, (3) randomised controlled

Table 1 Inclusion and exclusion criteria

	Inclusion	Exclusion
Participants/ population	Interventions designed for children aged between 5 and 11 years at entry to study Interventions delivered directly to the child and indirectly (ie, delivered by a proxy parent) All conditions/diseases or health behaviours	Populations including children aged 5–11 years, but also spanning a wider age range (eg, 5–16 years) Participants with developmental delays as defined by the ICD-10.[86] This review aimed to look at how interventions were delivered to the developmental stages of childhood (5–11 years). Children 5 to 11 years old with developmental delays would not be at a typical 5–11 year developmental stage
Intervention	Any behavioural intervention (First, Second or Third Wave[11]) aiming to change behaviour with a view to changing health outcomes or health behaviours (physical and mental health)	Interventions that were not cognitive and/or behavioural (eg, surgery, medications etc)
Context	Any settings	Not restricted by setting
Time	From 2005 to 2019. The UK's Increasing Access to Psychological Therapies initiative was established in 2005; this was characterised by an expansion in the provision and evaluation of psychological therapies, largely CBT[23]	Any study prior to the year 2005
Study type	RCTs Published in peer-reviewed journals and available in English	Studies that were not RCTs, eg, observational cohort studies and case reports

We use the term 'parent' to refer to the primary caregiver/caregivers within the home.
CBT, cognitive-behavioural therapy; RCT, randomised controlled trial.

trials (RCTs) and (4) 2005 to present (online supplementy appendix A). The search was carried out on relevant databases: CINAHL, EMBASE, PsycINFO, MEDLINE and the Cochrane Library (August 2019).

Screening

Titles and abstracts (stage one) and full-text papers (stage two) were double screened against inclusion/exclusion criteria (table 1) using the data management platform Covidence.[27] Reasons for exclusion were recorded at stage two. Discrepancies at both stages were discussed and resolved in meetings by reviewers. If the full text did not contain the information needed, we made two attempts to contact authors by email. If information was not provided, the study was excluded.

Data extraction and synthesis

Data were independently extracted by two researchers and conflicts resolved in regular meetings. We extracted characteristics of the population and intervention as described in table 2. We created categories for these based on existing taxonomies/coding systems or through an inductive process.

Quality assessment/risk of bias

We believe that there are no quality assessment tools for mapping review methodology.[26] Further, given the large

Table 2 Data extraction

	Categories
Population	
Age	Children's ages were grouped by UK school 'Key Stage' categories[79]: ► 5–7 years, corresponding to Key Stage 1 (KS1) ► 8–11 years, corresponding to Key Stage 2 (KS2) ► Including both KS1 and KS2 participants
Population	Participants were grouped into clinical, at-risk and healthy (based on the coding system indicated, selective, universal)[80] ► Clinical; those identified as have a disease/disorder ► At-risk; those identified as at risk of a health condition ► Healthy; universal interventions targeting a whole population groups
Condition/behaviour	The condition or behaviour that the intervention was designed to target was grouped into ► Lifestyle; day-to-day health behaviours such as diet, exercise, smoking ► Neurodevelopmental ► Social-emotional-behavioural ► Physical symptom management/treatment
Intervention	
Recipients	Codes were used to note whether the intervention was delivered directly to the child, via a parent-proxy or both
Modality	The type of intervention (modality) was coded as either a First, Second or Third Wave[11] behavioural intervention
Setting	Categories for setting were inductively developed: ► School ► Clinical/health ► Community
Mode of delivery	Categorised in accordance with elements of the mode of delivery taxonomy[78]: ► Face-to-face. If the intervention was face–face, we documented whether this was delivered on an individual basis or in group setting ► Paper based ► Digital
Techniques of delivery	Inductive categories were developed for techniques of delivery: ► Interactive techniques: play, arts, story and/or game-based techniques ► Reward-based techniques
Complexity	Interventions were classed as complex if they contained multiple components[76]
Effectiveness	To provide an overview of the effectiveness of interventions, the effect of the intervention on the specified primary outcome was extracted. To identify the primary outcome, the original paper, any published protocols and trial registries were reviewed. If a primary outcome was specified, the following categories were used: ► 'Promising', if there was improvement in the primary outcome in the intervention group compared with the control, as reported by the authors ► 'Not promising', if there was no improvement in the primary outcome in the intervention group compared with the control, as reported by the authors ► If no primary outcome was specified, we categorised this as ► 'Unable to assess effectiveness'

volume of studies in this review, it was not feasible to carry out quality assessment.

Patient and public involvement

We did not involve patients or the public in our work.

RESULTS

The search identified 10 541 papers. In total, 5583 were excluded at the title and abstract review stage, and 1975 were excluded at the full-text review stage. The most common reasons for exclusion at full text were wrong age (n=1070), not an RCT (n=577) and wrong paper type (protocol, abstract, presentation etc; n=206). One hundred and fifty-two papers were eligible for the mapping review. The PRISMA diagram[28] is displayed in figure 1.

Of the 152 citations, 21 interventions were described across two or more papers, and eight papers included two different active interventions. Therefore, in total we extracted data from 117 interventions.

Population characteristics

Populations: 56 interventions (47.9%) targeted clinical populations; 41 (35.0%) targeted healthy populations; 19 (16.2%) targeted at-risk populations. One intervention was for healthy population, with a more intensive component for a subset of at-risk participants. Figure 2 displays the characteristics of intervention for each population.

Age: 72 interventions (61.5%) included both younger (5–7 years old) and older (8–11 years old) children. Twenty-eight (23.9%) included older children only and 17 (14.5%) included younger children only. Figure 3 displays the characteristics of intervention for these different age groups.

Condition/behaviour: 54 interventions (46.2%) targeted lifestyle behaviours (diet, physical activity, dental care, hand washing, injury prevention, sexual health, substance use); 41 (35.0%) were for social–emotional–behavioural presentations (anxiety, conduct/opposition disorder, trauma, depression, behavioural problems); 14 (12.0%) were for neurodevelopmental disorders (ADHD); 8 (6.8%) were for physical symptom management/treatment (bladder/bowel dysfunction, asthma, cystic fibrosis, pain, sleep disorder).

Intervention characteristics

Recipients: 75 interventions (64.1%) involved parents. Of these, 66 (88%) involved both parent and child, and 9 (12%) were parent only. Considering the younger children (5–7 years old), all interventions for clinical populations included parents. None of the interventions for children 8–11 years old were delivered without the child (figure 3). Fifty-nine interventions (78.7%) for clinical and at-risk populations involved parents.

Six of the RCTs were designed to compare the effectiveness of child versus parent involvement; exploring parents exclusively versus parents and child[29–31] or child exclusively versus child and parent.[32–34]

In some cases, a rationale for including parents was not provided. Where a rationale was provided, this included a theoretical rationale (social cognitive and parenting theories)[32 35–37]; the role of parents in controlling the child's

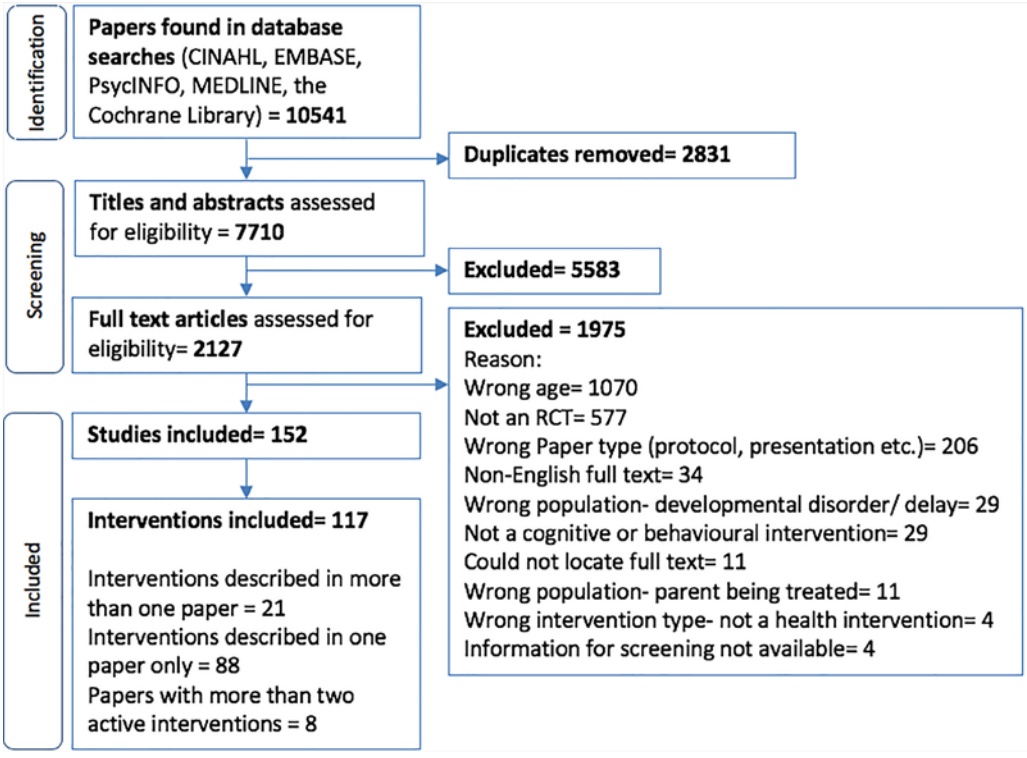

Figure 1 PRISMA diagram of study screening. RCT, randomised controlled trial.

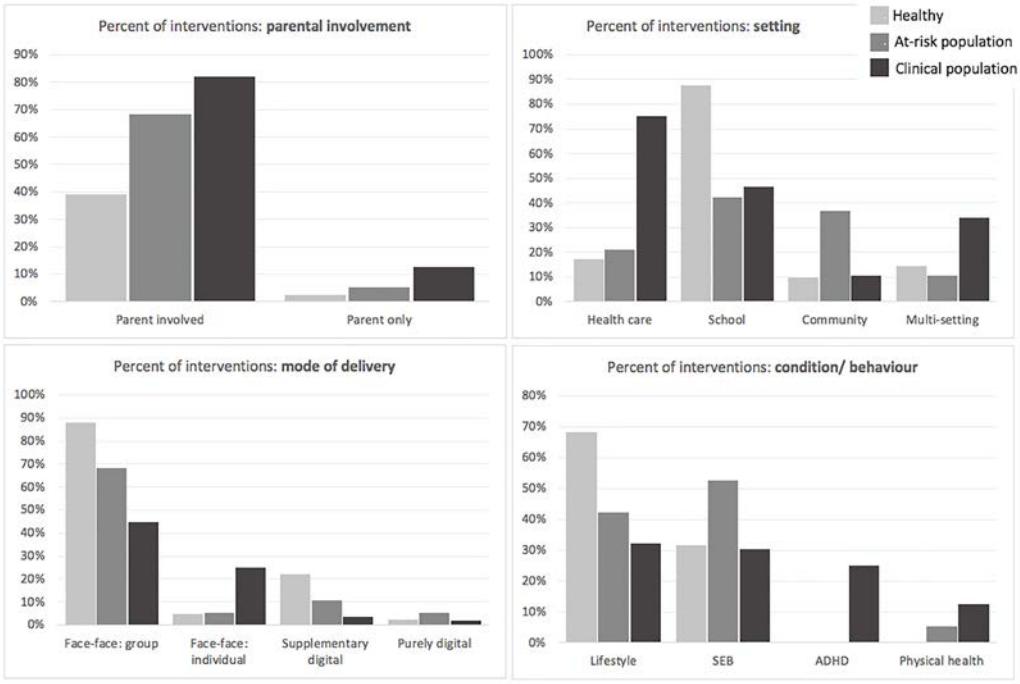

Figure 2 Characteristics of interventions, displayed by population. ADHD, attention deficit hyperactivity disorder; SEB, social-emotional-behavioural.

social and physical environment[38–42]; and providing reward and reinforcement,[29 30 40 43–45] modelling[32 36 39] and a developmental rationale, that is, the child's limited cognitive capacity.[46]

Modality: 83 interventions (70.9%) used a 'First Wave' behavioural approach,[11] 51 (43.6%) used 'Second Wave' cognitive-behavioural approaches and 5 (4.3%) used a 'Third Wave' approach. There were no 'Third Wave' interventions for younger children (5–7 years old) (figure 3).

For some of the intervention components, the child was a passive recipient; the components were based on changing the environment around the child to change their behaviour. Twenty-five (21.4%) used environmental restructuring (ie, changing the physical environment to change behaviour) including the provision of healthy foods,[37 39 47–50] sports sessions and equipment,[37 39 41 51–54] moving a TV out of the child's bedroom,[48 55] provision of fluoride toothpaste[56] and offering recreational activities.[48 56 57] Examples of structuring the social environment

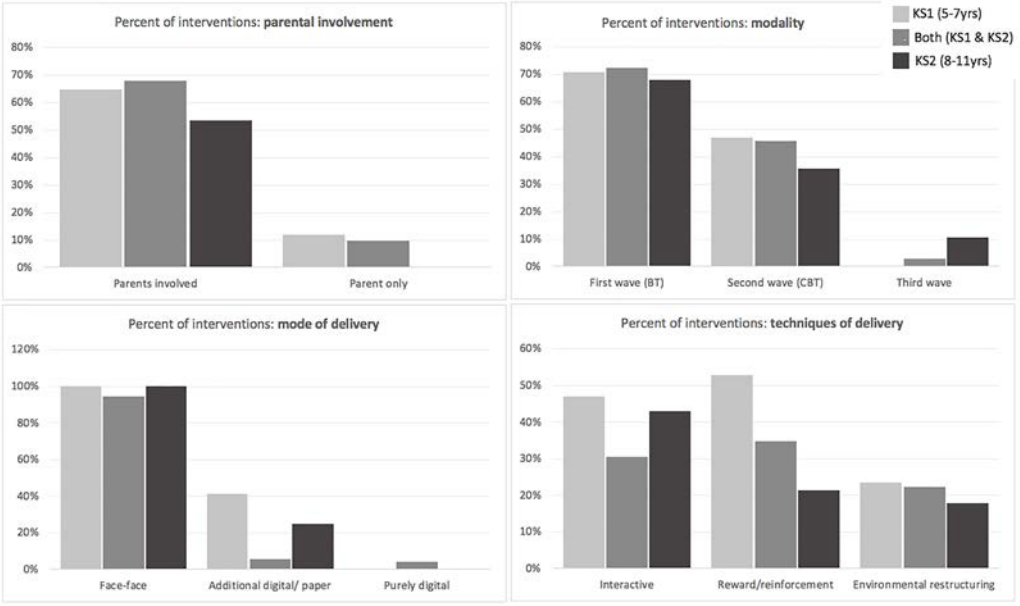

Figure 3 Characteristics of interventions, displayed by age.

included activities designed to change the ecology of the classroom environment[58] and activities changing the school-wide climate.[59]

Some intervention components required the child to be an active participant in therapy.[44 45 59–65] They were required to engage in the intervention through learning psychoeducational material, engaging in self-monitoring, self-regulation and self-management.

Intervention setting: 71 interventions (60.7%) took place within a school setting. Fifty-three (45.3%) took place in a clinical setting and 17 (14.5%) took place in a community setting (including the fire service, police, girl guides/

Table 3 Use of interactive techniques in interventions

Use of interactive techniques in interventions		Examples
Narratives, Storytelling and Characters	Integrated into a CBT programme	▶ "*Zippy's Friends… interactive teaching methods including storytelling, discussion, modelling and role playing*"[56] ▶ "*an audio-based cognitive-behavioural therapy (CBT) program for child anxiety disorders… Children begin by joining six fictitious anxious children in the Turnaround adventure and are educated on anxiety in an entertaining manner by these characters*"[59] ▶ "*curriculum in social–emotional learning… Each curriculum unit focuses on a specific grade-appropriate children's book and begins with a book reading and discussion, ensuring that students understand the primary themes of the story*"[87] ▶ "*Muck Monster… a metaphor for negative self-talk*"[72] ▶ A Cognitive–Behavioral Pain Management Program called "*Stop the pain with Happy-Pingu*"[58] ▶ "*Taming Sneaky Fears CBT Group Program manualized child treatment consisted of … stories, games, and activities designed specifically to teach cognitive-behavioral strategies*"[27] ▶ "*trauma narratives conveyed through storybooks with pictures created by students, 'courage cards' tailored to each student, use of published children's books to introduce certain topics*"[74]
	To impart knowledge and encourage behaviour change	▶ "*nutrition education intervention aimed at increasing the consumption of fruits and vegetables…A graphics package was developed using cartoon characters (The Bash Street Kids DC Thomson & Co. Ltd) which were used as a theme in the communication and promotional materials*"[45] ▶ "*internet based oral hygiene intervention … key characters in the cartoons… developed superhuman powers by brushing their teeth… The Teeth Chiefs had a series of adventures with nasty germ-like monsters, called the 'Plackos', that rot children's teeth. Design of the cartoons was guided by a set of behaviour change principles*"[62] ▶ "*obesity prevention programme… characters with whom the children identify. Children work closely with the character most like them to help them to change their behaviours*"[88]
	Characters as stand-alone interventions	▶ *"a pictorial story about going to the dentist on pain perception, situational anxiety and behavioral feedback during dental treatment"*[73] ▶ "*The child could carry out a version of the treatment (s)he had just undergone on the glove puppet. The application of this behaviour management technique immediately after the dental visit was used to enable the child to become active and so reduce anxiety*"[75]
Games	Reward-based games	▶ "*star charts and … star pyramids to track their dietary intake and frequency of a variety of physical activities. Small rewards, such as stickers, were given for returning completed charts*"[28] ▶ "*a three week chart, with the child's name on it, to put up in the bathroom so their child could add a sticker each morning and evening when they brushed their teeth*" and "*a guide for parents on how to use rewards*"[62] ▶ "*The Good Behaviour Game…The teacher posted basic classroom rules of student behaviour, and during a particular game period all teams received a reward if they accumulated four or fewer infractions of acceptable student behavior*"[63] ▶ "Match Game… *tokens would be given for an accurate self-evaluation… Tokens retained at the end of each session were exchanged for reward coupons which could in turn be exchanged for a daily group reward and a monthly individual home-based reward*"[89]
	Games to Improve Health Knowledge	▶ *"'Top Grubs' a card game based on trumps with pictures of food, such that higher scoring (trumping) foods are the healthier ones"*[90] ▶ *"An oral health education interventions involving 'contests on oral health knowledge'"*[52] ▶ *"'Quiz time'… Review knowledge, understandings, and skills developed throughout the program"*[91]
Group interactive activities		Group interventions used play, arts and game-based activities such as: ▶ treasure hunts, material printing[70] ▶ puppet play, competitive games[71] ▶ map drawing and photographic techniques[92 93] ▶ and other unspecified games[55]

Table 4 Dimensions of complexity

Dimension of complexity	Examples
Multiple components for different settings or different recipients	▶ *"cognitive-behavioral skills training, psychiatric consultation as needed, parent management training, family therapy, school consultation, and peer interventions to encourage affiliation with prosocial peers"*[34] ▶ *"parent and child groups; … family counseling sessions… peer mentoring… academic tutoring"*[94] *"offered in the community, at home, school, at the treatment center"*[16] ▶ *"It aggregates adaptations of several treatments that have individually shown efficacy for ADHD (parent training, teacher consultation/school-home notes, child skills training)"*[26] ▶ *"The therapist was in contact with the children, the parents, and the teachers in the weekly meetings and by telephone. Likewise, the parents and teachers were in contact daily by means of the home-school card"*[95] ▶ *"community-based … team sports program… Home intervention to promote environmental changes… Primary Care Counseling Intervention"*[33]
Multiple components for the child	▶ *"social-cognitive and emotional-coping skills training… peer-relations coaching… academic tutoring… classroom management"*[96] ▶ In other examples, the child's cognitive or behavioural therapy sessions were supplemented with an additional experiential component such as sports sessions,[33 37 48–50 67 68] cooking workshops[36 37] or field trips[97]
Multiple components with different modes of delivery	▶ *"children were given a CD with relaxation exercises (PMR) to do as homework assignments"*[58] ▶ *"online coaching was a three week programme (www.coaching-kidsprogram.com) providing parents with materials and advice on how to encourage their children to brush their teeth"*[62]

ADHD, attention deficit hyperactivity disorder.

brownies and local gyms/recreation centres). Twenty-seven (23.1%) of all interventions, and 19 (33.9%) of interventions for clinical populations, were delivered across multiple settings.

Mode of delivery: The most common mode of delivery was face–face (n=113, 96.6%), either in a group (n=75), individual setting (n=17), a mixture of both (n=19), or group versus individual delivery as comparator arms in the RCT (n=2). Three were purely digital interventions, and one was delivered via printed material. Fifty-four (50%) included multiple modes of delivery; this included face–face with additional printed material (n=26, 22.2%) or additional digital components (n=14, 12.0%). Eighty-seven (74.4%) used some form of standardisation for the intervention delivery, including treatment protocols, manuals and session plans.

Techniques of delivery: 42 interventions included some form of play, arts, story and/or game-based technique (table 3); this equated to 39.3% of the interventions with a child recipient (ie, excluding those delivered to parents only).

Narratives, storytelling and characters were integrated into CBT programmes, used in behavioural/psychoeducational interventions, and two studies used stories or characters as stand-alone interventions. Forty interventions (34.2%) used reward principles, and many implemented this in the form of a game; children could earn points, prizes, stickers and treats for adhering to the treatment plan. In most interventions, caregivers (parents, teachers) were responsible for structuring the reward system.[66–69] Some interventions used quizzes and card games to promote knowledge about health behaviour or health management. This was either as a stand-alone intervention or within a multicomponent intervention. Group activities were used to impart knowledge,[40 70–72] teach skills,[73] engage,[74–76] and encourage interaction between group members.[59]

Many studies did not provide a rationale for including interactive techniques. In the cases where papers supplied a rationale, they stated that interactive techniques were developmentally appropriate,[31] suited the child's stage of cognitive development,[74 77] made concepts concrete,[78] provided visual information,[77] promoted communication,[77] were more engaging,[78] were tools for modelling behaviour[66 79] and were favourable for children's learning.[74]

Complexity: 70 interventions (59.8%) were categorised as complex. The dimensions of complexity are summarised in table 4.

Effect of interventions

Forty-eight papers failed to define a primary outcome, and a further 13 papers did not provide data on effectiveness/efficacy because they were RCT pilot studies, process evaluation studies or other types of paper which did not report effectiveness data. As such, we were able to assess the primary outcome for 56 interventions; of these, 26 interventions led to an improvement on the primary outcome, 23 did not lead to improvement on the primary outcome and 7 had mixed results (there was more than paper reporting on the intervention). Figure 4 displays the results of interventions with a primary outcome, presented by modality (note that an intervention may use more than one modality if it is multicomponent). There were a similar number of effective and non-effective behavioural interventions. We did not identify any effective third-wave interventions.

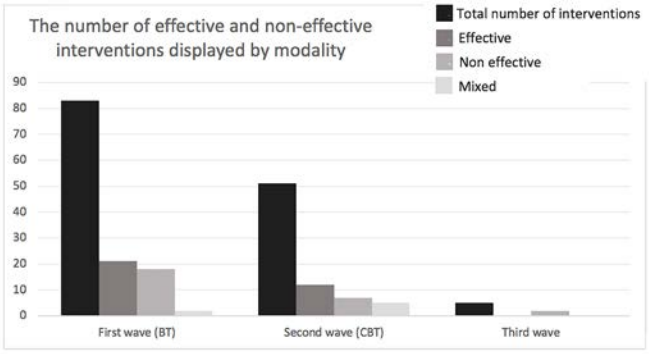

Figure 4 The number of effective and non-effective interventions, displayed by modality.

DISCUSSION

Summary of findings

This is the first systematic review to map and describe how behavioural interventions are delivered to children aged 5–11. Parental involvement in interventions was common (64.1%). Many of the interventions were categorised as 'complex'[18]; they contained several components, included multiple modes of delivery, were delivered to more than one recipient and took place across different settings. This was particularly true for interventions delivered to clinical populations, where the majority were delivered to both the child and parent (78.7%), and around a third (33.9%) took place across multiple settings, typically a healthcare setting and school setting. Most (70.9%) were 'First Wave' behavioural interventions, and few (4.3%) were 'Third Wave'. Many of the interventions integrated interactive techniques. Purely digital and paper-based interventions were rare, but around a third used these tools as supplements to face–face delivery. There were potentially differences in interventions for younger (5–7 years) and older (8–11 years) children; interventions for younger children tended to have more parental involvement (all of the clinical interventions for children aged 5–7 years included parents), did not use 'Third Wave' approaches and more commonly used reward/reinforcement techniques. All interventions for older children involved the child as a recipient compared with 82.4% of the interventions for younger children. However, because of the small number of interventions for children 5–7 years old, it is hard to draw firm conclusions.

Strengths and limitations

This review was not restricted to a specific health condition/behaviour. This allowed us to explore the principles of delivering interventions to younger children across a broad spectrum of health conditions/behaviours. We provided the interventions' modality (First, Second or Third Wave), but because of the size of the review it was not feasible to code specific techniques used in more detail, for example using the Behavioural Change Technique Taxonomy.[12]

We excluded observational cohort studies for pragmatic reasons; including observational studies to the data set would have made analyses unwieldy. While observational studies may have added some richness to the data, there were sufficient data in the RCTs to answer the research questions. Including only RCTs allowed us to focus on interventions most likely to be adopted into clinical care and those that were reported with higher quality.[80] However, there was still wide variation in how interventions were reported, according to level of detail and terminology used. As such, there was a degree of subjectivity in data extraction of elements such as modality (eg, behavioural vs CBT) and standardisation (manualised vs non-manualised treatment). To mitigate this, we carried out independent double extraction, using established coding systems and taxonomies (for modality,[11] mode of delivery,[81] ages[82] and population type[83]) and developed additional guidance documents.

This study was primarily designed to describe the characteristics of the interventions. We do present some data about the efficacy of these interventions; however, we cannot draw strong interpretations from this as we only reviewed primary outcomes (unavailable for 40% of the studies) and we did not carry out quality assessment.

Implications in context of literature

When designing and delivering interventions for children, they should be developmentally sensitive[14 22 22] and rooted in developmental theory. Theory on cognitive development states that children tend to be limited to concrete rather than abstract thought,[13] as well as less sophisticated illness beliefs.[23] As such, concrete interventions focused on behavioural recommendations are more appropriate.[24] Consistent with this, behavioural interventions were most common, though we did find that a similar number of effective and non-effective behavioural interventions. CBT requires logical analysis and abstract thinking, and there are caveats on how this should be used with children.[13] We found fewer CBT-based therapies. There were only five third-wave interventions, and none were delivered to children under the age of 7. The limited use of these approaches is consistent with existing literature stating that third-wave approaches may not be appropriate for children,[3] and concepts such as metacognition are likely to be beyond the cognitive capacities of this younger population. Alternatively, the low number of papers may be because this is a relatively new approach with children; research is in its early stages but is gaining interest, with examples of RCTs currently underway.[4] The papers included in this review suggest it may be possible to adapt third-wave concepts, to make them developmentally appropriate for younger children, using exercises, visuals, characters and drawing to make these abstract concepts more concrete, as well as providing briefer interventions.[5] From the few studies in this review, we did not identify any effective third-wave interventions. At this stage, third-wave approaches for children are novel and untested, but worthy of more investigation to evaluate

effectiveness, and explore how they can be delivered to children in a developmentally sensitive way.

Interactive methods are suited to the cognitive developmental stage of children 5–11 years old. Children can find it difficult to process abstract information and express themselves verbally.[13 84] Art-based methods can provide an opportunity to communicate visually,[85] likewise stories can include visual supports and are engaging for children.[86] Play is an important part of childhood; it is enjoyable, rewarding, and can support children to learn skills and behaviours.[87] Many interventions reviewed here used arts, play and games-based techniques to engage and teach children. Developmental theory also highlights the importance of caregivers; in childhood, caregivers play a key role in structuring the child's environment and shaping the child's behaviour.[24 88] Children are embedded in the family context. Equally, children may spend many hours a day at school in the care of teachers. In this review, many studies included parents and schools, and parental involvement was greatest for the younger children.

Although many interventions included in this review appeared informed by developmental theories, many did not explicitly report how developmental theory guided intervention design. Intervention development and reporting would be improved by doing so.

In this review, there are many examples of interventions which target the same behaviour/condition for similar populations but have been developed independently. However, guidance for developing interventions recommends using a systematic review to identify existing evidence-based interventions,[18] and refining these to investigate optimal delivery, rather than developing a novel one.

This review highlights issues about trial design in this field. A clearly defined and pre-specified primary outcome is important; it reduces the risks of selective reporting of outcomes and false-positive from analysing too many outcomes.[6] However, we found that around 40% of the interventions failed to specify a primary outcome.

Future research

Tools to aid the design and reporting of interventions do not sufficiently capture characteristics important for delivery to children; the Behaviour Change Techniques Taxonomy[12] does not sufficiently cover interactive techniques or delivery via parent proxies. Future work to incorporate these techniques may enhance these tools.

In this mapping review, we identified areas of interest around parental involvement, the use of digital interventions to supplement face–face delivery and setting (delivery in both school and clinics). Future systematic reviews could focus on these areas.

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Contributors AB conceptualised the study as part of a PhD program, drafted the protocol, created the search strategy, screened papers and carried out data extraction, drafted the manuscript, approved the final manuscript as submitted and agree to be accountable for all aspects of the work. RMP drafted the protocol for the study, screened papers and carried out data extraction, critically reviewed the manuscript, and approved the final manuscript as submitted and agree to be accountable for all aspects of the work. CL screened papers and carried out data extraction, critically reviewed the manuscript, and approved the final manuscript as submitted and agree to be accountable for all aspects of the work. NH-S screened papers and carried out data extraction, critically reviewed the manuscript, and approved the final manuscript as submitted and agree to be accountable for all aspects of the work. RR screened papers and carried out data extraction, critically reviewed the manuscript, and approved the final manuscript as submitted and agree to be accountable for all aspects of the work. ML provided supervision of data collection and analysis, critically reviewed the manuscript, and approved the final manuscript as submitted and agree to be accountable for all aspects of the work. AD drafted the protocol for the study, provided supervision of data collection and analysis, critically reviewed the manuscript, and approved the final manuscript as submitted and agree to be accountable for all aspects of the work. SS screened papers and carried out data extraction, critically reviewed the manuscript, and approved the final manuscript as submitted and agree to be accountable for all aspects of the work. LB drafted the protocol for the study, screened papers and carried out data extraction, critically reviewed the manuscript, and approved the final manuscript as submitted and agree to be accountable for all aspects of the work. RM drafted the protocol for the study, provided supervision of data collection and analysis, critically reviewed the manuscript, and approved the final manuscript as submitted and agree to be accountable for all aspects of the work. SY screened papers and carried out data extraction, critically reviewed the manuscript, and approved the final manuscript as submitted and agree to be accountable for all aspects of the work. EC drafted the protocol, created the search strategy, provided supervision of data collection and analysis, critically reviewed the manuscript, and approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

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ORCID iDs
Amberly Brigden http://orcid.org/0000-0002-7958-7881
Esther Crawley http://orcid.org/0000-0002-2521-0747

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