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A rapid review of interventions for children aged 0-5 and their families

VIRTUAL AND DIGITAL INTERVENTIONS

Foundations
What Works Centre for Children & Families

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Author contributions

Alex Cahill and Bonnie Butler conducted the searches, data extraction and initial synthesis. Dr Kathryn Lord led the drafting of the report. Colin Horswell provided subject matter expertise and quality assured the final report. All authors contributed to the drafting of the report and have agreed the final version.

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This rapid review was funded by Foundations – What Works Centre for Children & Families. The authors declare no competing interests.

About Foundations – What Works Centre for Children & Families

Foundations is the national What Works Centre for Children & Families. Foundations researches and evaluates the effectiveness of family support services and interventions, and generates the actionable evidence needed to improve them, so more vulnerable children can live safely and happily at home and lead happier, healthier lives. Foundations was formed through the merger of What Works for Children's Social Care (WWCSC) and the Early Intervention Foundation (EIF) in December 2022.

About Cordis Bright

Cordis Bright provides research, evaluation and consultancy support with the aim of helping public services change lives for the better. We specialise in children's services, criminal justice, integrated health and social care, domestic abuse, mental health, multiple disadvantage and public health

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EXECUTIVE SUMMARY

Introduction

In 2020, the Early Intervention Foundation (EIF; now Foundations) conducted a rapid review of the virtual and digital delivery of interventions (those which can be delivered remotely without any traditional face-to-face interaction between provider and participant) for children and young people in response to the COVID-19 pandemic and its impact on public services across the UK (Martin et al., 2020). The review considered a range of different virtual and digital models and the extent to which they had evidence of improving child outcomes considered important from a public health perspective. Examples of the outcomes considered included improved cognitive and language development, enhanced physical health, improved social and emotional development, and reductions in antisocial behaviour, adolescent substance misuse and risky sexual behaviour.

The review found more than 100 virtual and digital interventions for children and young people, the majority of which supported children's intellectual development and physical health. The interventions encompassed a wide range of delivery models, including one-to-one or group-based services, unguided self-help, games and apps, aimed at various age groups and cohorts.

The review concluded that virtual and digital interventions had the potential to support children's development across a variety of domains, although there was little evidence showing that they were comparable or superior to face-to-face support. Additionally, interventions which had some form of personalisation and/or contact with a practitioner appeared to be more effective than digital services lacking these elements. The review also noted that evidence of impact is strongest for short-term outcomes measured immediately after the intervention has been completed.

However, the review also found that children and families were less likely to remain engaged in virtual and digital interventions, with studies reporting high rates of attrition and low rates of intervention completion. Additionally, no study had reported improvements in long-term outcomes.

In 2022, the Department for Education (DfE) announced that 300 million would be made available to 75 eligible local authorities to open or expand their Family Hubs and Start for Life programmes for the period 2022–25 and that this expansion should include a virtual and digital offer. The aim of Family Hubs is to offer integrated support to families with a child between conception and 19 years (or up to 25 for those with special educational needs and disabilities), with the expectation that it will be evidence-based where possible. Additionally, specific funds have been allocated to local authorities to enhance their early years services within the four following priority areas:

- Improving the quality of the home learning environment
- Infant feeding

- Parenting
- Perinatal mental health and the parent–child relationship.

This review was conducted on behalf of the Department for Education to identify specific virtual and digital intervention models that local authorities might include as part of their Family Hubs offer within each of the four priority areas. Given recent advances in virtual and online delivery as a result of the pandemic and as local authorities are currently making decisions about their virtual and digital offer, it was decided that a rapid review would be sufficient to augment the 2020 EIF review, to inform local area decisions within the 2023–25 time frame.

Objectives

This review will primarily answer two research questions:

1. To what extent do effective virtual and digital interventions corresponding with the four Family Hubs-funded service areas exist?
2. What is the impact of these interventions on children's early cognitive, physical, self-regulatory, social and emotional development?

If a sufficient number of effective interventions are identified, we will then consider:

3. What is known about their differential impacts on different groups of families on the basis of socio-demographic factors such as age, race, gender and socio-economic status?
4. What are the conditions for the success, or failure, of these interventions in practice?
5. What is the acceptability/feasibility of these interventions for families in practice?

Methods

We used a rapid review methodology to address our research questions. We simultaneously searched PubMed and Google Scholar to identify studies investigating virtual and digital interventions for families of children from conception to age five years. All database searches took place in May 2023 and the Family Hubs four funded service areas (Parenting support; Parent–infant relationships and perinatal mental health; Support for children's early language and the home learning environment; Infant feeding) provided the basis of our search terms. We included studies:

- Reporting on virtual and digital interventions for children aged 0 to 5 years and their families
- Published in an academic journal within the last five years (2018 to 2023 inclusive)
- Conducted within the UK and other countries judged to be highly relevant to the UK, i.e. similar socio-cultural contexts to the UK
- That examine both developmentally important child outcomes measured with validated instruments and parent outcomes.

The published research protocol is available here: https://whatworks-csc.org.uk/wp-content/uploads/Research-Protocol.pdf.

We used Foundations' evidence standards to assess the quality of the studies and the strength of the evidence. We judged studies according to the Foundations Level 3 study quality criteria in the guidebook, i.e. a short-term positive impact can be causally linked to the intervention through a minimum of one academically robust evaluation (randomised controlled trial or quasi-experimental design). We synthesised study findings qualitatively and summarised them in the associated tables.

Results

This review was rapidly conducted to augment the 2020 EIF review to help local authorities consider evidence-based options for their Family Hubs digital offer within the 2023–25 time period. While we are satisfied that we have provided a high-quality, independent overview, the rapid review methodology is limited in comparison to a systematic review, and therefore it is possible that key studies may have been missed. The findings and conclusions should be read with this in mind.

Inclusion and exclusion of studies

- A total of 3,840 article titles and abstracts were screened, resulting in a review of the full text of 47 articles after which, seven were deemed to meet the inclusion criteria.
- The primary reasons for the exclusion of papers included lack of relevance to the UK, absence of primary research reported, and the use of mixed methods and/or studies being pre/post-test (i.e. not deemed robust enough for Foundations Level 3 evidence).
- None of the included studies were conducted in the UK.
- The seven interventions comprised of apps, online groups, a webpage, a video-based intervention and an online workshop.

Key findings

- Authors reported limited impacts across all seven studies on both primary and secondary outcomes with several studies unable to evidence that virtual and digital delivery interventions are superior to 'usual care'.
- Of the seven included studies, two had statistically significant evidence of impact: a one-day, online, interactive workshop led to significant mean reductions in Edinburgh Postnatal Depression Scale scores for mothers (Van Leishout et al., 2021); and the 'Early Food for Future Health' intervention resulted in children being served more fruit and vegetables and having beneficial mealtime routines such as not watching TV or playing on tablets during mealtimes (Helle et al., 2019).

- Both interventions align with the parenting support Family Hub priority area with positive impacts on parenting practice regarding parent–infant relationships (Van Lieshout et al., 2021) and child's diet and eating habits (Helle et al., 2019).
- Where data was collected, acceptability, feasibility and engagement with the interventions were relatively high. For the studies that had statistically significant evidence of positive impact: 80% of mothers viewed all or most of the intervention's infant feeding video clips in the Early Food for Future Health intervention (Helle et al., 2019) and similar numbers reported the intervention to be well adapted to the child's age (88%) and easy to understand (96%). For the one-day online workshop, only 6% of those in the intervention group felt they would want the intervention to be delivered differently. Of those involved in the workshops 96% remained online for the entire session, 87% were very satisfied with the workshop, and 89% would refer a friend (Van Lieshout et al., 2021).
- Helle et al. (2019) reported that participants who dropped out of their study (718 completed the baseline questionnaire and 37% of these people dropped out before the T2 questionnaire) were, on average, younger and less likely to have a higher education. However, for those who remained in the study, there was no difference between participants of differing educational levels in terms of engagement and understanding of intervention materials.

Conclusion

This review was commissioned to summarise and update what is currently known about virtual and digital delivery interventions for families with a child between conception and five years of age, with a particular focus on interventions that align with the UK government's Family Hubs requirement.

We have found limited rigorous evidence to support the use of virtual and digital technology for families of children under the age of five years. This review does not provide sufficient evidence to suggest that virtual interventions are superior to face-to-face interventions in supporting families of those with children under the age of five years or should replace face-to-face delivery.

While two interventions did have rigorous evidence of positive impact, the evidence base is small, not based in the UK, and contains limited examination of differences among participants across socio-economic groups or a range of protected characteristics such as ethnicity. These aspects need to be considered further by future research. It also means that practitioners should exercise caution in applying these findings in practice with the communities they support as the research populations involved may not reflect the demographics in the UK.

These findings should not be a reason to abandon these interventions or see them as not useful. They have clear potential (positive user experience, potential for increased reach) and it is the focus on 'what works for whom' that requires further evidence to ensure successful future implementation and integration.

INTRODUCTION

Context

Previous rapid review

In 2020 as a response to the COVID-19 crisis and its impact on public services across the UK, the Early Intervention Foundation (EIF; now Foundations) conducted a rapid review of the virtual and digital delivery of interventions for children and young people (Martin et al., 2020). The EIF's rapid review aimed to support the sector as it quickly adapted to the constraints on delivery imposed by widespread social distancing and lockdown as a result of COVID-19. The review defined virtual and digital services as those which can be delivered remotely without any traditional face-to-face interaction between provider and participant. It therefore included any intervention that had a digital interface, such as video conferencing, online training courses, interventions delivered by phone, email or chatroom, and unguided self-help that had undergone evaluation between 2000 and 2019 (Martin et al., 2020).

The review set out the evidence on virtual and digital delivery of interventions designed to improve the outcomes for families of children and young people aged 0–18 years. In total 116 programmes/interventions were reviewed, with 57 having outcome domains focused on education; 28 on health and obesity; eight on child maltreatment; eight on crime, violence and anti-social behaviour; and 15 focused on other outcome domains.[1]

Of the 116 included programmes/interventions, there was evidence of effectively improving outcomes for children and young people across a wide range of intervention types and outcome measures, particularly when compared to no treatment or minimal support. That being said, the authors also concluded that there was little evidence showing that virtual and digital interventions are superior to face-to-face approaches. Additionally, interventions that were personalised and/or involved contact with a practitioner, rather than self-directed or non-interactive learning, were more likely to improve child outcomes, and the evidence was strongest for short-term outcomes measured immediately after the intervention in comparison to longer-term outcomes (Martin et al., 2020).

The review also concluded that current evaluations of virtual and digital interventions are of mixed quality. They identified underlying methodological issues with most of the studies which frequently lowered the confidence in the findings, such as high attrition and the use of lower-quality evaluation designs subject to a higher risk of bias, such as one-group pre/post studies.

1 Substance misuse; mental health and wellbeing; risky sexual behaviour and teen pregnancy; multiple outcomes: crime, violence, antisocial behaviour + mental health and wellbeing; multiple outcomes: crime, violence, antisocial behaviour + substance misuse; multiple outcomes: crime, violence, antisocial behaviour + substance misuse + risky sexual behaviour and teen pregnancy.

Some of the identified challenges regarding virtual and digital delivery included:

- Some families who face significant socio-economic disadvantage may find it difficult to access online interventions
- High dropout rates were observed across the intervention studies
- Those experiencing severe mental illness or in immediate crisis might not be well suited to these interventions
- There is a need to ensure interventions account for people's varying reading and cognitive abilities.

The purpose of this review

Since the publication of the 2020 review, the Independent Review of Children's Social Care (2022) highlighted that for families who need help, a joined up, multidisciplinary approach is required to reduce the number of handovers between services that families are receiving. The current government's ambition is "for every family to receive the support they need when they need it" (DHSC & DfE, 2022:p.4) and their 2019 manifesto included a commitment to champion Family Hubs. Family Hubs are place-based approaches to integrating local help and support for families from conception to 19 years of age (or up to 25 for those with special educational needs and disabilities) that bring together professionals and services to provide support. A requirement of the funding for this approach is that providers include a digital offer to families.

Following the rapid changes made to practice during the height of the COVID-19 pandemic, local areas are now expected to prioritise evidence-based support through their Family Hubs and Start for Life Offer and include virtual and digital services as part of this mix (August 2022). Additionally, each area's early years offer is expected to include evidence-based support within the following four priority areas: parenting support; parent–infant relationships and perinatal mental health; early language and the home learning environment; and infant feeding.

This current rapid evidence review considers the extent to which evidence-based virtual and digital interventions exist within the four priority areas so that local areas can consider them as part of their Family Hubs offer. Although many services and interventions modified their model for virtual and digital delivery in response to COVID-19 restrictions, the extent to which these models remain effective is still unclear. This rapid evidence review follows on from the 2020 EIF review to consider the efficacy of these changes (where this knowledge exists) and provides an update on what is known more generally about effective virtual and digital interventions for families with young children.

This review will identify interventions that may support the Family Hubs early years offer within four priority areas:

1. Parenting support
2. Parent–infant relationships and perinatal mental health
3. Support for children's early language and the home learning environment
4. Infant feeding.

Family Hubs

A Family Hub is an area-wide approach to providing high-quality, joined-up, whole-family support services for families starting at conception and continuing until the child is 19 (or up to 25 for young people with special educational needs and disabilities). They bring services together to improve access, improve the connections between families, professionals, services and providers, and put relationships at the heart of family support. The government's 2019 manifesto included a commitment to champion Family Hubs (DHSC & DfE, 2022).

The specific services and structure of Family Hubs can vary across different regions in the UK, as they are often tailored to meet the local needs and priorities of communities. Family Hubs are accessed through either professional or self-referral or via existing services and networks. The Family Hubs offer four service priority areas:

1. Parenting support
2. Parent–infant relationships and perinatal mental health
3. Support for children's early language and the home learning environment
4. Infant feeding.

Family Hub services are delivered in-person as well as providing support virtually via online services. Part of the government funding to support the Family Hubs approach is to allow providers to deliver evidence-based programmes or interventions, including through digital delivery. The minimum expectations for the Family Hub providers are that virtual services are available through the Family Hub, including static online information and/or interactive virtual services that ensure:

- Information about perinatal mental health and parent–infant relationships is available online with clear signposting to services available
- Remote/virtual/digital support is promoted and is accessible
- Existing mild to moderate perinatal mental health and parent–infant relationship services offer interventions online as well as in person, according to clinical need and family preference (DHSC & DfE, 2022).

OBJECTIVES

The aim of this review is to summarise what is currently known about the effectiveness of virtual and digital interventions which aim to support families with a child between conception and five years old and could be offered by Family Hubs.

We aimed to answer the following questions:

1. To what extent do effective virtual and digital interventions corresponding with the four Family Hubs-funded service areas (Parenting support; Parent–infant relationships and perinatal mental health; Support for children's early language and the home learning environment; Infant feeding) exist?
2. What is the impact of these interventions on important parent and child behaviours known to support children's healthy development?[2]

If feasible, we will also consider:

3. What do we know about the differential impacts of effective virtual and digital interventions on different groups of families on the basis of socio-demographic factors such as age, race, gender and socio-economic status?
4. What are the conditions for the success, or failure, of these interventions in practice?
5. What is the acceptability and/or feasibility of these interventions for families in practice?

2 The Family Hub Guidance notes "the importance of the early years", highlighting how outcomes such as language, literacy skills, early communication, social and emotional skills are "important for outcomes in later life" (DHSC & DfE, 2022:p.6) and the importance of proper infant feeding practice for infant development (DHSC & DfE, 2022:p.63).

METHODS

Given the limited time frame associated with this review (six months from start to completion), a rapid review methodology was adopted to address our research questions. A rapid review is a tool for collating the available research evidence on a certain topic or issue, as comprehensively as possible, within the constraints of a given time frame (Khangura et al., 2012). This is done by setting parameters around the review to ensure the amount of evidence reviewed is manageable within the timeline (Klerings et al., 2023).

While we are satisfied that we have provided a high-quality, independent overview, the limitations of a rapid review approach are that key sources of evidence and interventions may have been missed (Khangura et al., 2012). In particular, we note that the current review was commissioned to update the previous EIF review, so it only considers studies that were published since 2017. Given the limitations of the time and resources for this activity, we had to adopt a practical approach to screening and reviewing returned articles and limited the bibliographic databases searched (further details provided in the section titled 'Search strategy'). The findings and conclusions should be read with this in mind.

As we undertook a rapid review, we adopted the data collection principles of a systematic review (Hamel et al., 2021). We conducted a desk-based synthesis of secondary data utilising data extraction tools and conducting quality assessments.

Protocol registration

During the review's conception and data collection stage, elements of the review were refined following consultation with colleagues at Foundations. We appreciate this means the review will not exactly match the published research protocol,[3] but we are in agreement with Foundations that this refined focus allowed for a closer and deeper understanding of the intended outcomes.

The main refinements to arise from these consultations were:

- A focus on studies that provide data for both child and parent outcomes
- A focus on primary research only
- A focus on countries with contexts that are highly relevant to the UK only
- A focus on studies that meet Foundations Level 3 study quality criteria.[4]

3 See: https://whatworks-csc.org.uk/wp-content/uploads/Research-Protocol.pdf

4 Please see appendix B for this evidence criteria.

Study eligibility criteria

Population

- Studies reporting on virtual and digital interventions for children aged 0 to 5 and their families only.

Geographical region

- Studies published within the UK and other developed countries but highly relevant to the UK, i.e. similar socio-cultural contexts to the UK.

Intervention and comparator

- Virtual and digital interventions (defined as services which can be delivered remotely without any traditional face-to-face interaction between provider and participant) for children aged 0 to 5 and their families only
- Interventions focused on at least one of the four Family Hub service areas (Parenting support; Parent–infant relationships and perinatal mental health; Support for children's early language and the home learning environment; Infant feeding)
- Studies that employ a randomised controlled trial or quasi-experimental design including a control group.

Primary and secondary outcomes

- Studies that examine both child and parent outcomes
- For outcomes related to children, this refers to developmentally important[5] child outcomes measures aimed at early language development, literacy skills, early communication, social and emotional skills, self-regulation and increases in breastfeeding initiation, duration and exclusivity, infant feeding, nutrition and diet
- For parent outcomes, these refer to perinatal and postpartum mental health, breastfeeding, parenting support, parental sensitivity and parental caregiving
- Outcomes had to be measured with validated instruments and report outcomes at the child and parental level
- Studies that examine Level 3 and above outcomes,[6] in accordance with the EIF evidence standards. This means focusing on studies that use at least one rigorous evaluation to examine evidence of a short-term positive impact of an intervention.

5 The Family Hub Guidance notes "the importance of the early years" highlighting how outcomes such as language, literacy skills, early communication, social and emotional skills are "important for outcomes in later life" (DHSC & DfE, 2022:p.6) and the importance of proper infant feeding practice for infant development (DHSC & DfE, 2022:p.63).

6 See: https://guidebook.eif.org.uk/eif-evidence-standards

Study design

- Randomised controlled trial and quasi-experimental design studies only.

We had also initially intended to prioritise articles for inclusion in the rapid evidence review, using the following order of priority: 1. Meta-analyses and systematic reviews; 2. Randomised controlled trial (RCT) / Quasi-experimental design (QED) studies. However, following consultation with Foundations only RCT and QED studies were included in the review. This was to increase the likelihood of the studies we examined having Level 3 evidence so that the study remained focused on interventions with strong evidence that could be offered through Family Hubs.

Search strategy

All database searches took place in May 2023. Searches were conducted by two authors via DeepDyve Digital Library[7] (a literature management software specifically for small–medium enterprises with access to more than 15,000 peer-reviewed journals). DeepDyve simultaneously searches PubMed and Google Scholar for both academic and non-academic articles.

The limits applied to all searches were that articles must be published in an academic journal, in English, and within the last five years (2018–2023 inclusive). This time frame was selected to ensure the review could act as an update on the 2020 EIF review (2000–2019 time frame) and so that it was inclusive of the period leading up to the COVID-19 pandemic.

We used the search terms outlined below with DeepDyve's advanced search tool allowing titles and abstracts to be searched for these terms. Primary search terms were searched in combination with each secondary and tertiary search team (e.g. Early years + Online + Support). In consultation with Foundations, we took a flexible approach, adding to, or removing, terms as the search proceeded and we became more familiar with the key terms used in the literature.

Primary search terms: population

Early years; toddlers; babies; infant; child; families; perinatal; parent; 0–5 years.

Secondary search terms: virtual and digital

Online; web; internet; digital; virtual; video; app; tablet; computer; smartphone; e-interventions; e-health; e-mentoring; telehealth; SMS; software.

Tertiary search terms: intervention

Support; relationships; early language; speech and language; breastfeeding; infant feeding; home learning; therapy; training; programme; service; mental health; perinatal mental health; postpartum mental health; wellbeing; parenting; nutrition; diet.

7 See: DeepDyve – Unlimited Access to Peer-Reviewed Journals

As this is a rapid evidence review, we adopted a reasoned approach to the database searches. Given the number of search term combinations, we were aware that a large number of records would be identified (a total of n=174,532). Therefore, we examined the first 30 returned articles for each search combination for relevance and then moved on to the next search term. We adopted a flexible approach to our searches, which meant as the process went on it became apparent that our different search terms varied in relevance. Therefore, we did not go through all the possible search term combinations due to time constraints, but rather focused on the combinations that were producing the most relevant results and stopped conducting searches when significant overlap started to appear. This approach aligns with the academic literature that states a rapid review cannot be as thorough as a systematic review (Khangura et al., 2012) but still allows 3,840 records to be screened.

Study selection

Duplicates were removed using DeepDyve. Two authors independently reviewed the titles and abstracts of all articles identified and excluded those that did not meet the inclusion criteria. The authors then independently read all retained papers. Any disagreements on decisions to include or exclude were discussed between researchers and where no consensus was reached, the guarantor of the review and Foundations resolved the matter.

Using the data extraction table, we identified the 47 most relevant publications for review and shared these with Foundations for discussion. These were then included or excluded based on the pre-determined criteria.

Data extraction

A data extraction table (see Appendix A. Data extraction) was created in Microsoft Excel used to capture the following information from studies, relevant to answering the review questions:

- Author and year of publication
- Brief description of the intervention
- Outcomes
- Mode of intervention delivery
- Key Findings
- Evidence quality (see section titled ‘Assessing the certainty of evidence’ for further details)
- Additional notes.

Assessing the certainty of evidence

The EIF Guidebook[8] was used to determine the evidence standards of interventions identified in the review. The guidebook sets out five levels of evidence strength that relate to whether an intervention or programme has evidence of a "positive, causal impact on specific child outcomes".

We judged studies according to the Foundations Level 3 study quality criteria in the guidebook, which is underpinned by the Cochrane Risk of Bias tool for randomised controlled trials. We prioritised studies rated as higher quality but did not exclude studies on that basis. We reported all domains from the checklists for transparency around where the strengths/weaknesses lie.

All included interventions identified in this review have been deemed to have evidence consistent with EIF's Level 3 strength of evidence. Appendix B. Foundations strength of evidence assessment extraction provides a table of the completed strength of evidence forms for included studies.

Consequently, we have judged the studies' effectiveness based on the evidence standards of Level 3. This means that interventions are deemed to have worked if a short-term positive impact can be causally linked to the intervention through a minimum of one academically robust evaluation. While Level 2 interventions may provide preliminary evidence of the impact of an intervention, studies associated with this Level have not been tested rigorously enough to conclude, or assume, any level of causality. Due to this, we have decided to only focus on the evidence standards of Level 3.

As per Martin et al.'s (2020) review, we determined success if an intervention had a positive impact on at least one of the outcomes of interest to the review (early language development; literacy skills; early communication, social and emotional skills; self-regulation and increases in breastfeeding initiation, duration and exclusivity; infant feeding, nutrition and diet; perinatal and postpartum mental health; breastfeeding; parenting support, parental sensitivity and parental caregiving). This impact must have been determined through an academically robust study that can confidently attribute the positive impact to the intervention alone. This meant we only deemed the interventions to have Level 3 evidence of positive impact if the evidence was statistically significant at the p=0.05 level for at least one of the outcomes of interest listed above.

Data analysis and synthesis

As this is a rapid evidence review, we conducted a narrative synthesis of both qualitative and quantitative findings. Each resource was mapped and reported against the research questions and a thematic analysis was conducted. We have provided a basic descriptive summary of studies and their results. We have presented conclusions, recommendations and implications for policy and practice.

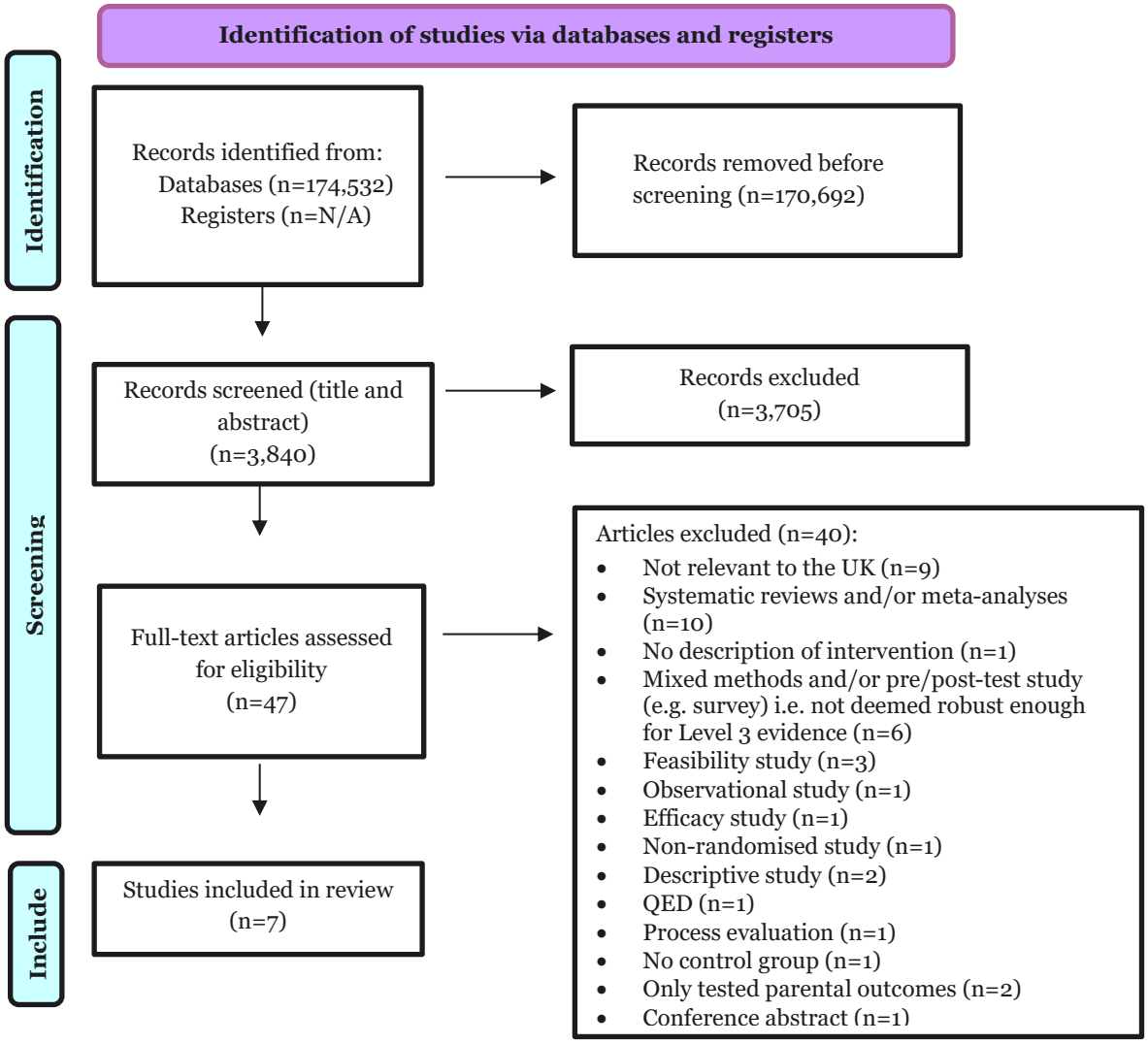
8 See: https://guidebook.eif.org.uk/eif-evidence-standards

RESULTS

Search results

In total 174,532 studies[9] were identified from our searches. The PRISMA flow diagram (figure 1) details the number of studies excluded at each review point. A total of seven studies were included in the final review.

Figure 1. PRISMA flow diagram, outlining the process of study identification and study selection



9 The flow diagram used in figure 1 was taken from the following website: http://prisma-statement.org/prismastatement/flowdiagram

Characteristics of included studies

There were seven included studies; three of these were conducted in Europe, two in Canada, and two in Australia. None were conducted in the UK. Key characteristics of included studies are detailed in Table, including how these correspond with the four Family Hub priority areas.

Participant recruitment

Participants were mostly recruited via healthcare professionals whom they were in contact with as a result of their pregnancy or having recently given birth, e.g. midwives (Røhder et al., 2022) and nurses (Sawyer et al., 2019). Some studies utilised social media to assist with recruitment (Helle et al., 2019; Karssen et al., 2022; Van Leishout et al., 2021).

Participant characteristics

Three studies recruited mothers and their children (not partners) as participants (Røohder et al., 2022; Sawyer et al., 2019; Van Lieshout et al., 2021). All other studies recruited both child's parents, where applicable (Helle et al., 2019; Karssen et al., 2022; Scott et al., 2021; Brian et al., 2022).

Two of the studies recruited expectant parents (Scott et al., 2021; Røhder et al., 2022). One study recruited parents of toddlers aged 12 months to 36 months (Brian et al., 2022). All other studies recruited parents of children of varying ages but all under 15 months old (Helle et al., 2019; Karssen et al., 2022; Sawyer et al., 2019; Van Lieshout et al., 2021).

Where the data was available, the mean age of parent participants across the studies was 31 years (Helle et al., 2019; Karssen et al., 2022; Scott et al., 2021; Sawyer et al., 2019; Van Leishout et al., 2021). Brian et al., 2022 and Røhder et al., 2022 did not provide this data. In addition, three studies reported if participants were first-time mothers (Helle et al., 2019, 58% of first-time mothers; Røhder et al., 2022, 53%; Sawyer et al., 61%).

Categorisation of race and ethnicity varied across studies with no consistent approach used to report these characteristics. Brian et al., 2022 reported that nearly 75% of participants identified as "Black, indigenous, and other people of colour" with 27 different languages spoken across the varying families. Karssen et al., 2022 reported that more than 95% of parents were "born in the Netherlands". Scott et al., 2021 reported that just over 20% of all participants were "born in Africa/Middle East, Asia or Other". Van Leishout et al., 2021 reported that approximately 75% of all participants were White, no other information was provided. Three studies did not report on participants' ethnicity (Helle et al., 2019; Røhder et al., 2022; Sawyer et al., 2019).

Overview of virtual and digital interventions

Of the studies included, Helle et al. (2019), Karssen et al. (2022), Scott et al. (2021) and Sawyer et al. (2019) reported on newly developed digital and virtual interventions. Brian et al. (2022), Rhøder et al. (2022) and Van Lieshout et al. (2021) reported on pre-existing programmes that were re-formatted for digital delivery. There were no clear outcome trends that emerged between these

two groups implying there is nothing to suggest that outcomes are higher in programmes specifically designed for digital delivery or in programmes that are adapted from pre-existing face-to-face interventions. Two interventions were app-based (Karssen et al., 2022; Scott et al., 2021), two were delivered by online groups (Brian et al., 2022; Sawyer et al., 2019), one was a webpage (Helle et al., 2019), one was a video-based intervention (Røhder et al., 2022) and one was a workshop (Van Lieshout et al., 2021).

Table 1. Key characteristics of interventions, relation to Family Hubs and their level of evidence

Intervention	Description	Key features	Outcome measures	Family Hubs the intervention aligns with	Level 3 evidence of impact
Virtual group Social ABCs (Brian et al., 2022)	Group sessions for delivery of didactic content, supported by a Parent Manual and presentation slides.	Location: Canada Sample Population: Toddlers between 12 and 36 months and parents either referred for an ASD diagnostic assessment, a clinician impression of signs indicative of ASD, or a confirmed diagnosis of ASD. Delivery mode: Online group Available in the UK?[10]: No	Primary: parent implementation fidelity and toddler vocal responsivity. Secondary: toddler ASD symptoms, word inventory (use and comprehension), parenting stress and self-efficacy.	Parenting support Support for children's early language and the home learning environment	< Level 3 evidence.
Early Food for Future Health (Helle et al., 2019)[11]	Webpage with monthly short video clips addressing specific infant feeding topics and age-appropriate baby food recipes.	Location: Norway Sample population: Parents with a 3–5-month-old infant who are literate in Norwegian and responsible for providing food to their infant. Delivery mode: Webpage Available in the UK?: No	Primary: Child eating behaviour (Child food intake, child mealtime routines, maternal feeding practices). Secondary: Child anthropometric data.	Parenting support Infant feeding	Level 3 evidence of providing parenting support, in terms of parenting practice. The intervention led to children being served more fruit and vegetables.
The Samen Happie! app (Karssen et al., 2022)	App-based programme to stimulate healthy child weight development, especially among	Location: Netherlands Sample population: Parents with a child who was between	Primary: Child zBMI analysis broken down by socio-demographic	Parenting support Infant Feeding	< Level 3 evidence.

10 Available in the UK, refers to whether the virtual/digital version of the intervention is available in the UK, i.e. for those adapted from an existing in-person intervention.

11 Rows in green refer to studies that showed Level 3 evidence of impact.

Intervention	Description	Key features	Outcome measures	Family Hubs the intervention aligns with	Level 3 evidence of impact
	families with a lower socio-economic position, by encouraging healthy energy balance-related parenting practices.	5 and 15 months old who did not suffer from chronic disease or disability that severely affected normal development. Delivery mode: App Available in the UK?: Unknown	characteristics, i.e. parental educational level, parental BMI and parental depressive symptoms.		
The Milk Man app (Scott et al., 2021)	App to engage fathers with breastfeeding information contained within an information library.	Location: Australia Sample population: Expectant couples. Delivery mode: App Available in the UK?: No	Primary: Duration of exclusive and any breastfeeding. Secondary: Age of introduction of formula and complementary foods, maternal breastfeeding self-efficacy, and partner postpartum support.	Parenting support Infant feeding	< Level 3 evidence.
eMums Plus (Sawyer et al., 2019)	A nurse-led, online group consisting of approximately 20 mothers of similarly aged infants.	Location: Australia Sample population: New mothers awaiting their initial postnatal health check. Delivery mode: Online group Available in the UK?: No	Primary: Level of maternal depressive symptoms assessed and quality of maternal caregiving assessed.	Parenting support Parent–infant relationships and perinatal mental health	< Level 3 evidence.

Intervention	Description	Key features	Outcome measures	Family Hubs the intervention aligns with	Level 3 evidence of impact
			Secondary: Service utilisation Intervention quality App usage.		
Circle of Security-Parenting intervention (COS-P) (Røhder et al., 2022)	A manualised video-based intervention that seeks to enhance maternal sensitivity and decrease the risk of insecure and disorganised attachment.	Location: Denmark Sample population: Pregnant women with psychosocial vulnerabilities. Delivery mode: Online videos Available in the UK?: Unknown	Primary: Maternal sensitivity. Secondary: Mother-reported depressive symptoms, parental reflective functioning, parental stress, infant socio-economic functioning, and maternal wellbeing.	Parenting support Parent–infant relationships and perinatal mental health	< Level 3 evidence.
One-day workshop (Van Leishout et al., 2021)	1-day interactive workshop consisting of didactic teaching, group exercises or discussion, and role-playing in four modules.	Location: Canada Sample population: Mothers with infants younger than 12 months and an Edinburgh Postnatal Depression Scale score of at least 10. Delivery mode: Online workshop Available in the UK?: No	Primary: Postpartum depression. Secondary: Anxiety, social support, mother–infant bonding, and infant temperament.	Parenting support Parent–infant relationships and perinatal mental health	Level 3 evidence relating to parent–infant relationships and perinatal mental health. The workshop led to significant mean reductions in Edinburgh Postnatal Depression Scale scores.

Key: ASD = Autism spectrum disorder

Synthesis of results

In this section, we outline the impact of those studies rated as having Level 3 evidence of impact only (Helle et al., 2019; Van Leishout et al., 2021). We explore the impact of these interventions on important child outcomes and any differential impacts on the basis of socio-demographic factors. We then discuss the lessons learned for success, or failure, of these two interventions for future practice and the acceptability and feasibility of these interventions for families.

What is the impact of these interventions on important child outcomes and the family hub priority areas?

Here we have grouped the evidence of impact around the four family hub priority areas along with further details of the interventions (Table provides a summary of these). Neither of the two studies addressed the "Support for children's early language and the home learning environment" priority area.

Infant feeding

There was evidence of the Early Food for Future Health (Helle et al., 2019) intervention having some positive impacts on infant feeding outcomes.

Parents were emailed each month with video clips of 3–5 minutes. The videos provided information on feeding-related topics such as "appropriate food types and textures, how taste-preferences evolve and responsive feeding practices; and monthly cooking films and recipes, demonstrating how to make a homemade baby- and family-food from easily available ingredients" (Helle et al., 2019). The email link took the parents to a website with the clips with corresponding recipes and cooking films. The intervention was, therefore, parent-led rather than practitioner-led.

Socio-demographic and behavioural data was collected via a web-based, self-administered questionnaire. The primary outcomes in the study were child eating behaviours (measured using the Child Eating Behaviour Questionnaire), dietary intake (evaluated the child's willingness to try new food using the Child Food Neophobia Scale and assessed by a Food Frequency Questionnaire developed for this study), mealtime routines (based upon questions used in the Australian NOURISH study) and maternal feeding practices and feeding styles (measured using the Infant Feeding Questionnaire). The secondary outcomes were child anthropometry, infant weight, and length at birth. All baseline and follow-up measures were collected at the child health clinics and reported by the mothers. Parents completed a baseline questionnaire when their child was 5 months old and a post-intervention questionnaire when the child was 12 months old. Parents in the control group received routine care from their local child health clinic.

The intervention resulted in improvements in children's diet such as children being served fruit and vegetables more frequently (difference between the control and intervention group (β) = 0.51, $p = 0.035$ at 12 months) and children tasting a wider variety of vegetables in their diet compared to the control group ($\beta = 0.43$, $p = 0.015$ at 12 months). They were also more likely to have beneficial mealtime routines, i.e. at 12 months 8.1% of the control group would play or watch a TV/tablet

while eating compared to 2.5% in the intervention group (p = 0.009). Despite this evidence, there were no significant differences in child anthropometry data (e.g. differences in child Body Mass Index (BMI) at 12 months, β = 0.16, p = 0.21) or maternal feeding practices between the two groups (e.g. feeding on schedule β = 0.003, p = 0.96).

The study included both first-time mothers and mothers with older children which differs from other similar studies that have tended to include first-time mothers only (Helle et al., 2019). The authors note this means the findings are likely to be conservative as for mothers with older children their established behaviours are likely more difficult to change.

A point to note is that the authors reported the potential for a recall bias in their study with a reliance on participants to self-report the level of compliance with the programme. Equally, they reflect that self-reporting might lead to social desirability bias and/or recall bias for those involved in the intervention.

Parent–infant relationships and perinatal mental health

There was evidence of the one-day online CBT workshop (Van Leishout et al., 2021) having a positive impact on both parent–infant relationships and perinatal mental health.

Participants self-completed questionnaires at baseline and 12 weeks later. The primary outcome, postpartum depression, was measured using the Edinburgh Postnatal Depression Scale (EPDS). The secondary outcomes included anxiety (measured using Generalised Anxiety Disorder Questionnaire (GAD-7)); social support (measured using the Social Provisions Scale (SPS)); mother–infant bonding (measured using the Postpartum Bonding Questionnaire (PBQ)); and infant temperament (measured using the Infant Behaviour Questionnaire–Revised Very Short Form (IBQ-R)).

The intervention consisted of a one-day cognitive behavioural therapy (CBT) based interactive workshop consisting of didactic teaching, group exercises/discussion, and role-playing in four modules. The modules were: (1) review of causes of postpartum depression with a focus on modifiable cognitive risk factors such as stopping negative thoughts; (2) a focus on cognitive skills, including cognitive restructuring; (3) building behavioural skills such as problem-solving, behavioural activation, and assertiveness; and (4) an opportunity for goal-setting and action planning. Participants received a workshop manual before their workshop took place. The workshops were conducted over Zoom from 9am to 4pm and were delivered by either a registered psychotherapist, a clinical psychology graduate student or a psychiatrist (authors note testing the intervention with other healthcare professionals such as public health nurses could be beneficial). Those in the control group received treatment as usual and were put on a waitlist to complete the workshop 12 weeks later.

In relation to parent–infant relationships, this was the only study that showed positive benefits. Following the one-day workshop, mothers reported improvements in bonding (difference between control and intervention group (β) = -3.22, p = <0.001), reductions in infant-focused anxiety (β = -1.64, p = <0.001), social support (β = 3.31, p = <0.001) and positive affectivity/surgency in infants (β = 0.31, p = <0.001).

Overall, there were positive effects on parents' mental health with regards to postnatal depression, and parental stress and anxiety. There was a significant mean reduction in mothers' postnatal depression scores (16.47 to 11.65, $\beta = -4.82$, $p = <0.001$) which was associated with higher odds of exhibiting a clinically significant decrease in postnatal depression scores. Participants receiving the one-day workshop intervention were also more likely to experience a clinically significant change in reported levels of anxiety (mean scores[12] reduced from 12.41 to 7.97, $\beta = -4.44$, $p = 0.001$) (Van Lieshout et al., 2021).

The authors note that components of the intervention have increased their confidence in the generalisability and robustness of the findings. These include the self-referral, online access, inclusive inclusion criteria and women using treatment as usual.

It should be noted that the authors reflect on how changes in postpartum depression and how mothers self-report mother–infant and infant outcomes are often correlated, so improvements in mother–infant and infant outcomes may be a reflection of improvements in maternal depression.

Parenting support

As noted in the Family Hub guidance (DHSC & DfE, 2022), parenting support is a broad area encompassing a variety of programmes and components. That said, both interventions have outcome measures related to parenting support. Namely, the interventions are looking to support parents in practices such as infant feeding and their perinatal mental health, with the aim of equipping them with the tools to improve parenting. Therefore, the general lack of positive impacts towards the outcome measures across the majority of the interventions also limit the evidence of these digital and virtual interventions providing positive impacts on this Family Hub service area.

What do we know about the differential impacts of interventions on participants in terms of socio-demographic factors such as age, race, gender, socio-economic status?

There was a lack of consistency between the studies regarding the type of socio-demographic data that was collected, as well as a lack of reporting of the differential impacts depending on participant characteristics. We present data reported in terms of ethnicity and educational level below.

Ethnicity

Van Lieshout et al. (2021) acknowledge that participants at the one-day workshop were mainly white individuals, married, with free access to universal healthcare and, as such, do not know whether the results can be generalised to all settings.

Education level

In the Early Food for Future Health study (Helle et al., 2019), 83% of participants had college- or university-level education (the national average for the same age group is 58%) so it is likely that the findings (that the intervention improved children's diet and mealtime routines) are not

12 Generalised Anxiety Disorder Assessment (GAD-7).

reflective of the general population. It is worth noting that participants who dropped out during the study were, on average, significantly younger and less likely to have a higher education. For those who remained in the study, there was no difference between participants of differing educational levels in terms of engagement and understanding of intervention materials (Helle et al., 2019).

What are the lessons learned for success, or failure, of these types of interventions in future practice?

Despite the mixed evidence base in terms of impact on outcomes of the included interventions, there are some lessons to be learned about how this mode of intervention delivery for families takes place in practice. Consideration about design and delivery of the interventions is key, as is consideration about participants' experience and reasons for disengagement.

Accessibility and resource efficiency

Virtual and digital delivery may allow for cost-effective, accessible and resource efficient interventions. In-person, therapist-delivered programmes have barriers to entry such as high costs, low system capacity, long waiting times, and exclusion of those in rural areas (Punton et al., 2022; Frith 2017). Virtual and digital deliveries could counteract this.

For example, Van Lieshout et al. (2021) reported the one-day workshop intervention to be "brief, accessible, intervention based on psychotherapeutic techniques that are acceptable to mothers and that could potentially be taught to nonexperts" (Van Lieshout et al., 2021:p.1205). They note the online workshops could accommodate up to 30 women per session.

Intervention delivery

For the one-day workshop, the authors reflected further on the impact of such a brief intervention. They felt it was an efficient way to increase access to treatment. They mitigate concerns that the brief intervention may not allow for optimal impact by referencing RCTs of full courses of CBT treatment for perinatal depressions that had similar effect sizes as the one-day workshop.

Eighty per cent of the mothers reported in the Helle et al. (2019) study that they preferred using the internet to find information about infant nutrition, with this placing above books or brochures (71.0%), oral communication from public health nurses (44.5%), and information from friends and family (31.5%). The authors reference other studies that state how parents "most often" (Helle et al., 2019) use the internet to find information about child healthcare.

The video clips in the Early Food for Future Health were 3–5 minutes long and only 10% of mothers said this was too long or too short (Helle et al., 2019). This relates to the one-day workshop being noted for it's brief, but impactful intervention delivery design. It could be that, given the remote nature of participation, keeping the interventions as brief as possible is a useful takeaway.

Mental health considerations

Researchers note the need to be conscious of parent stress levels in terms of how stress might affect parents' learning but also with respect to parents' overall mental wellness and coping (Brian et al.,

2022). Van Lieshout et al. (2021) argue that COVID-19 has "profoundly changed the way mothers with infants access mental health care" (Van Lieshout et al., 2021: 1205). The one-day design of this intervention could, therefore, be considered a useful takeaway given it allowed mothers to remotely access a brief intervention that positively impacted Edinburgh Postnatal Depression Scale scores. It is worth considering if keeping the intervention brief is a useful design/delivery approach to replicate.

Mothers' experience

A number of studies reported on whether participants were first-time mothers or had other children. While there were no analyses conducted comparing any differences of the interventions between the two groups, considering parents with older children who may have 'set' practices may impact the effects of interventions (Helle et al., 2019).

Disengagement

Authors of both studies noted moderate levels of disengagement throughout their studies and reflected on what they could learn from attrition breakdowns. For the Early Food for Future Health intervention, 960 parents were given access to the baseline questionnaire and 718 (75%) completed it. Three fathers were excluded at the point of intervention with 455 (48%) mothers (out of 957) completing the follow-up questionnaire. Therefore, 52% of eligible participants did not complete the follow-up questionnaire. The authors acknowledge this as a limitation of the study.

For the one-day workshop, at the point of randomisation, n=403; 202 in the intervention group and 201 in the control group. Ninety-six per cent (192) of those in the control group underwent analysis at the 12-week follow-up and 82% (165) of those in the intervention group underwent analysis. Therefore, overall attrition was 11%. The higher attrition rate in the intervention group was noted as a limitation by the authors. They felt this could have led to a bias in their results as people may have left the intervention for a multitude of reasons, potentially meaning data may not have been missing at random.

Helle et al. (2019) noted that those who dropped out during the study tended to be significantly younger and have lower education levels; while Van Lieshout et al. (2021) acknowledged that they do not yet have a strong grasp on the barriers to participation in virtual and digital delivery, and argue the factors related to these barriers need to be better understood before programmes are scaled outwards. The authors could not confidently state why some women dropped out of the study between recruitment and eligibility assessment.

Group-based and peer support interventions

The Family Hub guidance notes the importance of parenting support including the ability for parent networking and peer-to-peer learning (DHSC & DfE, 2022).

What is the acceptability and/or feasibility of these interventions?

For the two studies that had Level 3 evidence of positive impact, participants were asked to provide feedback on the virtual or digital intervention they used and/or authors collected data on

attendance, engagement, usage and ease of interpretation to assess intervention acceptability. On the whole, both interventions were seen as acceptable and feasible, and engagement with the intervention content was relatively high.

The Early Food for Future Health intervention was deemed as appropriate and feasible by researchers as more than 80% of mothers viewed all or most of the intervention's infant feeding video clips (Helle at al., 2019). Equally, similar numbers reported the intervention to be well adapted to the child's age (88%) and easy to understand (96%) (Helle et al., 2019).

For the one-day online workshop, the authors noted that they did not stringently examine participant satisfaction; however, only 6% of those in the intervention group felt they would want the intervention to be delivered differently (Van Lieshout et al., 2021). The authors provide a breakdown of key statistics that suggest high levels of acceptability for example, 96% of those involved in the workshops remained online for the entire session, 87% were very satisfied with the workshop, and 89% would refer a friend.

DISCUSSION

Summary of findings

This review was commissioned to summarise what is currently known about virtual and digital delivery interventions for families with a child between conception and age five years, with a particular focus on interventions that align with the UK government's Family Hubs requirement.

In total 47 interventions were considered eligible for full review following initial searches and seven are included in the review. Two interventions were identified as effective; one was a webpage, and one was an online workshop. A variety of primary and secondary outcome measures were used across the studies (see Table). The primary outcome measure for Van Leishout et al. (2021) was postpartum depression, while Helle et al. (2019) focused on child eating behaviour.

There were two studies that had sufficiently strong evidence of impact:

- Van Leishout et al. (2021) found that a one-day interactive workshop led to significant mean reductions in Edinburgh Postnatal Depression Scale scores for mothers. This highlights potential for virtual and digital delivery interventions to perhaps complement face-to-face support for parents with depression. More research is needed to compare this brief intervention with longer programmes.
- Helle et al. (2019) found that the Early Food for Future Health intervention resulted in children being served more fruit and vegetables and having beneficial mealtime routines, such as not watching TV/playing on tablets during mealtimes. Eighty per cent of mothers preferred accessing information on infant nutrition online.

A number of the included studies that could not demonstrate statistically significant improvements in outcomes with virtual and digital delivery of interventions often discussed that the interventions could act as cost-effective, accompanying tools to business-as-usual interventions and could allow for increased reach to populations (Brian et al., 2022; Karssen et al., 2022; Scott et al., 2021). However, no evidence was presented to support these claims.

Because of the limited impacts observed across the studies, it was not possible to consider which components, if any, of virtual and digital delivery interventions are most important in driving positive change. Additionally, it is worth noting that all of the interventions identified in the review were compared to 'usual care' within countries that provide a standard package of support for mothers, meaning that the interventions needed to provide measurable value-added. However, the level of usual care varied markedly between studies.

It is also worth noting that – despite the limited impacts on outcome measures – acceptability, feasibility and engagement with the interventions was high when reported (in six studies). Parents, in particular, seem to like these interventions and found them relatively easy to use (Van Lieshout

et al., 2021; Helle et al., 2019). The 2020 EIF review noted a challenge of digital and virtual delivery to be that content needs to be appropriate to a wide range of audiences with different reading and cognitive ability (Martin et al., 2020:p.43). In our review we found that people with fewer years of education were able to use the digital tools with relative ease, have a good understanding of the content and implemented them with fidelity (Helle et al., 2019). This should of course, be understood in the context that there is a wider range of factors that influence reading and cognitive abilities.

There was, though, limited reporting and analysis of any difference among participants across socio-economic groups or a range of protected characteristics such as ethnicity. Therefore, the acceptability, feasibility and engagement among different groups still needs to be explored further. To make confident judgements on virtual and digital delivery interventions potential barriers to participation, and factors potentially associated with attrition such as socio-economic status and ethnicity need to be fully considered to ensure the interventions can be optimised according to what works best for different groups of people. Authors' acknowledgement of this suggests this represents a gap in the literature.

A number of authors note that they are often more cost-effective and have the potential to reach a wider cohort of people by overcoming some of the barriers of face-to-face delivery. However, none of the study designs provided evidence to support these claims. Previous research has highlighted some barriers to the use of virtual and digital interventions; access to reliable internet connections, devices and digital literacy can pose challenges for families, particularly those from underserved communities. A concern with virtual and digital interventions is that they exclude people of lower educational attainment (Vassilakopoulou & Hustad, 2023). However, in our review we found that people with fewer years of education were able to use the digital tools with relative ease, have a good understanding and implemented them with fidelity (Helle et al., 2019).

Future evaluations would benefit from a focus on considering 'what works for whom' with virtual and digital delivery interventions. The studies examined in this review acknowledge how limitations around limited sample sizes and heterogeneous samples restrict researchers' abilities to provide further details on how the interventions impact differently on societal groups or how the interventions can be tailored according to the needs of certain groups. Without additional, more robust studies, researchers cannot confidently state that virtual and digital delivery interventions are more cost-effective than traditional delivery, or that they may help reach a larger number of 'harder to reach populations', despite multiple author's inclinations that this may be the case.

Strengths and limitations of the review methods

This review has been conducted rapidly to inform ongoing work in the sector. While we are satisfied that we have provided a high-quality, independent overview, the limitations of a rapid review should be taken into consideration such as:

- Key sources of evidence and interventions may have been missed due to the limited databases searched and the time restrictions on the ability to screen all returned studies

- Only studies published in the last five years were included
- Only interventions explicitly targeting the four Family Hubs service areas were included.

While a meta-analysis may have been a useful method for synthesising findings, due to the limited robust evidence available and lack of consistent primary outcomes across studies, this was not possible.

We limited the methodology of included studies to RCTs and QEDs to ensure as rigorous an evidence base as possible. That being said, we may have missed studies that employed alternative methodology but whose findings may provide insight or evidence of effectiveness of other interventions. We also excluded a number of potentially promising interventional studies as they reported on parent outcomes only and not child outcomes.

The strength of this review comes from completing and reporting our search strategy in a systematic way that is replicable to others. We also conducted a standardised assessment of the strength of the evidence for all included studies.

Strengths and limitations of available evidence

We used Foundations' evidence standards to assess the quality of the studies and strength of evidence. We judged studies according to the Foundations Level 3 study quality criteria in the guidebook. Appendix B. Foundations strength of evidence assessment extraction B details the quality rating for each included study.

As seen in the PRISMA flow diagram (see Figure 1), our search returned numerous studies reporting on virtual and digital interventions; however, many of these have methodological issues which lower the confidence we can have in the findings, primarily the use of lower-quality evaluation designs subject to a higher risk of bias, such as one-group pre/post studies.

It is important that we also consider when most of the evidence included in this review was collected. Conducting RCTs can be challenging as they require specific expertise and infrastructure and are resource intensive (Djurisic et al., 2017). The review period we included covered the entirety of the COVID-19 pandemic which added potential further challenges to this (Zhao et al., 2021). The health and social care sector were in a time of crisis; therefore, it may not have been a priority to carry out this type of research. Providers rapidly had to adapt and priority shift from collecting the evidence base to working in new and uncertain ways to support people.

Recommendations for policy and practice

We have found limited rigorous evidence to support the use of virtual and digital technology for families of children under the age of five. There are, however, some promising findings showing that a virtual or digital component can increase the efficacy of face-to-face support, and that simple advice about mealtime routines could improve feeding practices. However, we must emphasise that these findings are preliminary and require further rigorous replication.

We also identified a number of lessons from the interventions' studies that may be useful for future practice and policy.

As the sector has rapidly mobilised as a consequence of the COVID-19 pandemic to allow remote delivery of interventions, it is quite conceivable that digital delivery will remain the norm. Technology is increasingly becoming part of everyday life to connect to, and access, services (European Observatory on Health Systems and Policies, 2021).

As we found little evidence to support the use of these interventions in practice, we suggest that practitioners exercise caution with the applicability of the findings to the populations in practice as the research populations involved may not reflect the demographic in the UK.

What works for whom

Some of the challenges of adapting how interventions are developed are about establishing 'what works for whom' and in what circumstances. Namely, the limited heterogeneity and sample sizes involved in the two studies (Van Leishout et al., 2021 and Helle et al., 2019) make it difficult to determine the best practice, according to different groups with varying needs.

Having said this, when examined, no difference emerged between mothers of high education and mothers of low education in terms of engaging with the intervention, with there being no significant difference in mothers who saw all or most of the videos (Helle et al., 2019). There was also no difference when comparing these groups in terms of finding the films easy to understand (Helle et al., 2019). Researchers postulate that video material, rather than written material, may have been beneficial for mothers in lower-education groups (Helle et al., 2019). This could be an important consideration for practice going forwards, as online video material may offer the potential for increased efficacy among those from lower educational backgrounds and could therefore act as a more accessible intervention. It should be stressed, however, that the studies did not confirm this with Level 3 evidence.

Disengagement

Examining disengagement is important to develop an understanding of how users can be supported and encouraged to use the virtual and digital interventions as intended (Karssen et al., 2022). Van Lieshout et al. (2021) provide commentary on the attrition rates of the virtual and digital interventions, with high attrition rates during digital and virtual interventions a theme that was raised in the 2020 EIF review. In terms of consideration for practice, Van Lieshout et al. (2021) argue for the need to further understand user preferences with digital and virtual interventions to ensure engagement can be sustained over a longer period of time.

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APPENDICES

Appendix A. Data extraction table

Author & year	Intervention name	Country	Study design	Participants	N	Outcomes (Primary and Secondary)	Mode of delivery	Key findings
Brian et al., 2022	Virtual group-Social ABCs	Canada	Feasibility and acceptability using a single-blind quasi-experimental, pre/post, sequential group design.	Toddlers aged between 12 and 36 months with a referral for an ASD diagnostic assessment, clinician impression of signs indicative of ASD, or a confirmed diagnosis of ASD and their parents.	82	Primary: Parent implementation fidelity and toddler vocal responsivity. Secondary: Toddler ASD symptoms; Word inventory; Parenting stress and self-efficacy.	Zoom	Parents from diverse linguistic, ethnic, and educational backgrounds gained intervention skills and toddlers evidenced significant social-communication gains. This was also noted in the face-to-face group so the virtual model did not significantly improve or diminish this impact.
Helle et al., 2019	Early Food for Future Health	Norway	RCT	Parents with an infant aged 3–5 months old infant, literate in Norwegian and responsible for providing food to their infant.	718	Primary: Child eating behaviour (Child food intake; Child mealtime routines; Maternal feeding practices). Secondary: Child anthropometric data.	Online webpage	Children in the intervention group were served vegetables/fruits more frequently, had tasted a wider variety of vegetables and were more likely to have beneficial mealtime routines compared to controls. There were no group differences for child anthropometry or maternal feeding practices.

Author & year	Intervention name	Country	Study design	Participants	N	Outcomes (Primary and Secondary)	Mode of delivery	Key findings
Karssen et al., 2022	The Samen Happie! app	Netherlands	RCT	Parents with a child between 5 and 15 months old not living with chronic disease or disability that severely affected normal development.	357	Primary: Child zBMI	App	The app might prevent increases in zBMI of young children in the short term (6 months), particularly if the child's parents have lower educational levels or higher BMIs themselves and use the app more frequently however, these effects did not appear to prevent increases in zBMI in the longer term (12 months). Low levels of sustained app use and moderate app acceptability across participants.
Scott et al., 2021	The Milk Man app	Australia	4-arm factorial RCT	Expectant couples (pregnant women and their partners).	1,092	Primary: Duration of exclusive and any breastfeeding. Secondary: Age of introduction of formula and complementary foods; Maternal breastfeeding self-efficacy; Partner postpartum support.	App	There were no significant differences between the control and any of the intervention groups in any of the infant feeding outcomes or level of breastfeeding self-efficacy and postpartum partner support reported by mothers.
Sawyer et al., 2019	eMums Plus	Australia	RCT	New mothers with infants aged 1 to 2 months.	133	Primary: Maternal depressive symptoms and quality of maternal caregiving. Secondary: Service utilization; Intervention quality; App usage.	Online	No significant differences in the intervention and standard care groups in scores on two of the measures for quality of maternal caregiving. There was little difference in the adjusted mean Parent Sense of Competence scores across the groups at the time of the 8-month and 12-

Author & year	Intervention name	Country	Study design	Participants	N	Outcomes (Primary and Secondary)	Mode of delivery	Key findings
								month assessments. Intervention was rated as helpful and user-friendly.
Røhder et al., 2022	Circle of Security-Parenting (COS-P)	Denmark	RCT	Pregnant women with psychosocial vulnerabilities.	76	Primary: Maternal sensitivity. Secondary: Mother-reported depressive symptoms; Parental reflective functioning, parental stress; Infant socio-economic functioning; Maternal wellbeing.	Video-based	The intervention decreased parental stress. However, there was no impact on maternal sensitivity, depressive symptoms, parental reflective functioning, maternal wellbeing or infant socio-emotional functioning.
Van Leishout et al., 2021	One-day CBT workshop	Canada	RCT	Women aged 18 years or older with an infant younger than 12 months, living in Ontario, with an Edinburgh Postnatal Depression Scale (EPDS) score of at least 10.	403	Primary: Postpartum depression. Secondary: Anxiety, social support; Mother–infant bonding; Infant temperament.	Zoom	Being in the intervention group was associated with higher odds of exhibiting a clinically significant decrease in EPDS scores and a clinically significant decrease in anxiety scores. Mothers reported improvements in bonding, infant-focused anxiety, social support and positive affectivity/surgency in infants.

Table key: ASD = Autism Spectrum Disorder; RCT = Randomised controlled trial; zBMI = Childrens Body Mass Index compared to the average scores for that country.

Appendix B. Foundations strength of evidence assessment extraction form

Foundations level 3 study criteria	Brian et al., 2022	Helle et al., 2019	Karssen et al., 2022	Scott et al., 2021	Sawyer et al., 2019	Røhder et al., 2022	Van Leishout et al., 2021
Participants are randomly assigned to the treatment and control groups through the use of methods appropriate for the circumstances and target population, OR sufficiently rigorous quasi-experimental methods (e.g. regression discontinuity, propensity score matching) are used to generate an appropriately comparable sample through non-random methods.	X	✓	✓	✓	✓	✓	✓
Assignment to the treatment and comparison group is at the appropriate level (e.g. individual, family, school, community). (Should be scored for pre–post studies.)	✓	✓	✓	✓	✓	✓	✓
An 'intent-to-treat' design is used, meaning that all participants recruited to the intervention participate in the pre–post measurement, regardless of whether or how much of the intervention they receive, even if they drop out of the intervention (this does not include dropping out of the study – which is then regarded as missing data). (Should be scored for pre/post studies.)	X	✓	✓	✓	✓	✓	✓
The treatment and comparison conditions are thoroughly described.	✓	✓	✓	✓	✓	✓	✓
The intervention is delivered with acceptable levels of fidelity in the evaluation study. (Sufficient reporting is preferable only – benefit of the doubt given when uncertain.) (Should be scored for pre/post studies.)	✓	✓	✓	✓	✓	✓	✓

Foundations level 3 study criteria	Brian et al., 2022	Helle et al., 2019	Karssen et al., 2022	Scott et al., 2021	Sawyer et al., 2019	Røhder et al., 2022	Van Leishout et al., 2021
The comparison condition provides an appropriate counterfactual to the treatment group.	✓	✓	✓	✓	✓	✓	✓
There is baseline equivalence between the treatment and comparison-group participants on key demographic variables of interest to the study and baseline measures of outcomes (when feasible).	✓	✓	✓	✓	X	✓	✓
Risks for contamination of the comparison group and other confounding factors are taken into account and controlled for in the analysis if possible. (Sufficient reporting is preferable only – benefit of the doubt given when uncertain.)	?	N/A[13]	N/A[14]	N/A[15]	N/A[16]	✓	N/A[17]
Participants are blind to their assignment to the treatment or comparison group. (Only a blinding criteria if feasible.)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
The study should report on overall and differential attrition (or clearly present sample size information such that this can be readily calculated). (Should be scored for pre/post studies.)	X	✓	✓	✓	✓	✓	✓

13 Control group received business-as-usual care so contamination not a strong issue.

14 Waitlist control group so contamination not a strong issue.

15 Control group received business-as-usual care so contamination not a strong issue.

16 Control group received business-as-usual care so contamination not a strong issue.

17 Control group received business-as-usual care and put on waitlist to receive the workshop 12 weeks later so contamination not a strong issue.

Foundations level 3 study criteria	Brian et al., 2022	Helle et al., 2019	Karssen et al., 2022	Scott et al., 2021	Sawyer et al., 2019	Røhder et al., 2022	Van Leishout et al., 2021
If overall study attrition is greater than 10%, then study authors must report differences between the study drop-outs and completers, as well as perform analyses demonstrating that study attrition did not undermine the equivalence of the study groups (and adjusting for this if differences are identified). (Should be scored for pre/post studies.)	X	✓[18]	X	✓	X	✓	X
Measurement is blind to group assignment. (Sufficient reporting is preferable only – benefit of the doubt given when uncertain.)	X	N/A	X	X	X	X	✓
There is consistent and equivalent measurement of the treatment and control groups at all points when measurement takes place. (Sufficient reporting is preferable only – benefit of the doubt given when uncertain.)	✓	✓	✓	✓	✓	✓	✓
Statistical models control for baseline differences between the treatment and comparison groups in outcome measures and demographic characteristics that might be apparent after recruitment.	N/A	✓	✓	N/A[19]	✓	✓	✓
The treatment condition is modelled at the level of assignment (or deviations from that strategy are justified statistically). (Should be scored for pre–post studies.)	✓	✓	✓	✓	✓	✓	✓

18 The authors acknowledge high attrition but stated: 'the dropout appears to be balanced between the intervention and the control group, so a mechanism for introducing bias is difficult to conceive' (Helle et al., 2019).

19 Results section notes: 'There were no differences in the baseline characteristics between the four intervention groups.'

Foundations level 3 study criteria	Brian et al., 2022	Helle et al., 2019	Karssen et al., 2022	Scott et al., 2021	Sawyer et al., 2019	Røhder et al., 2022	Van Leishout et al., 2021
Appropriate methods are used and reported for the treatment of missing data. (Sufficient reporting is preferable only – benefit of the doubt given when uncertain). (Should be scored for pre–post studies.)	X	X	✓	✓	✓	✓	X