



UiT The Arctic University of Norway

Faculty of Humanities, Social Sciences and Education; Department of language and culture

Understanding and investigating how parental smartphone use affects the parent-child relationship and child development, when the child is 0-5 years old.

A thesis submitted in partial fulfilment of the requirements for the degree of
Master of Media and Documentation Studies

by Lone Bjørkman

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Abstract

The present study explores how parental smartphone use affects the parent-child relationship and children's development outcomes, when the child is aged 0-5 years old. The interest in this research initially developed from family life experiences and working in a day-care centre, where parental smartphone use appeared to have negative consequences for the child, and also lead to child emotional and behavioural problems. Eight previously conducted reviews were found; Beamish et al. (2019); Braune-Krickau et al. (2021); Hood et al. (2021a); Kildare & Middlemiss (2017); Knitter & Zemp (2020); Lippold et al. (2022); McDaniel (2019); Nøkleby et al. (2022), but the research on the subject had so far been inconclusive, contradictory or claimed poor reporting. One of the systematic reviews discovered insufficient evidence and sought for more studies using a systematically structured review method to include more qualitative and cross-sectional studies (Nøkleby et al., 2022, p. 54). The other reviews were four systematic reviews, two literature reviews and one scoping review. Therefore, utilizing a wider search strategy and a different review methodology, this study's aim was to create a knowledge summary in the form of a scoping review to enhance the state of the research by identifying if, and if so, in what way parental smartphone use affects the parent-child attachment/relationship, and/or the child's developmental outcomes, as well as provide a broader map of the available research on the subject. This review also aimed at identifying theories, conceptual frameworks and empirical research which could aid in understanding and investigating parent smartphone use regarding the parent-child attachment/relationship and child development effects, as well as the potential for the child's upbringing to be affected. The review question the review aimed to answer, was: *What are the research theories, conceptual frameworks, results, methods and methodological limitations found in the literature on parental smartphone use regarding parent-child attachment and child development, when the child is 0-5 years old?*

Accordingly, a database search was undertaken, starting in September 2022 and finished in December 2022, utilizing the research databases Web of Science, PubMed, APA PsychINFO, Embase Classic+Embase and Ovid MEDLINE®, for retrieving research regarding parental smartphone use and its' effects on the parent-child relationship and child development outcomes regarding the specified child age. In complying with criteria for international research quality and evidence synthesis, the scoping review used the guidelines from *Chapter 11: Scoping reviews* of the *JBI Manual for Evidence Synthesis* (Peters et al., 2020, pp. 406–

451), and the checklist for Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA ScR), as this was extended to scoping reviews in 2018 (Tricco et al., 2018). The final aim of the review is to contribute to strengthening the evidence in the current research field and thereby possibly aid in future research. The scoping review is written for being submitted to the journal *Computers in Human Behavior Reports*, see Appendix A for the journal's author information pack.

The scoping review found that parental smartphone use had negative consequences for the child if used excessively and inappropriately, and that it could negatively affect the parent-child relationship as a form of technoference: technology interference in interpersonal interactions. Children were found to experience more distress because of parental smartphone use, for example in research using a smartphone modified Still-Face Paradigm. Parent sensitivity and responsiveness was found to be negatively affected by parental smartphone use, and this negatively affects the parent-child interaction, which affects the parent-child attachment security and the child's developmental outcomes. Parental smartphone use can displace time that could be spent with their children, and was found to communicate absent presence, that is, being absent-minded due to technology use while present in an interaction. If the parental smartphone use is frequent and excessive, it can therefore affect parent-child synchrony, joint attention, cognitive growth-inducing experiences for the child and the attachment bond between the parent and child. These findings were expanded upon in the results section of the scoping review.

On the other hand, appropriate parental smartphone use could render the parent more sensitive, for example if it was used to learn about parental sensitivity or regularly keep in touch with relatives, as long as the parent was still able to show considerate and contingent responses. These responses were found to be maintaining eye-contact, responding to children's bids for attention, showing care and affection, and providing support and scaffolding. Intermittent use where the smartphone is used and then put away again, was found to be less disruptive to the interaction than active and passive use, which is recognised by the user being absorbed in the use or e.g., holding the smartphone in one's hand, respectively. If the child was frequently ignored or neglected due to parental distraction with their smartphone, known as phubbing, it could harm the child's sense of security, safety, emotional well-being and development, and result in child emotional and behavioural problems. It was discussed if parental sensitivity was affected negatively by smartphone use, or if inconsiderate parental smartphone use was the manifestation of low parental sensitivity.

To further answer the review question, the search results were analysed for study method and methodology limitations and risk of bias. These were investigated and discussed in detail within the scoping review. Finally, the implications of the findings for future research were discussed.

As this master's thesis is article based, it has been divided into two parts. First, the thesis contains an extended summary (Natland, 2020), named *Understanding and investigating how parental smartphone use affects the parent-child relationship and child development, when the child is 0-5 years old*. The second part contains the article manuscript for the scoping review (Natland, 2020), named *Mapping the literature for understanding and investigating how the parent-child attachment relationship and child development can be affected by parental smartphone use, child age 0-5: a scoping review*. The table of content marks the two sections apart, which both have their own reference list (University of Oslo, 2023). The attachments for each part are placed at the end of the master's thesis (University of Oslo, 2023).

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Understanding and investigating how parental smartphone use affects the parent-child relationship and child development, when the child is 0-5 years old.

1 Introduction

The smartphone can be seen as a multimediu, integrated into everyday life as a constant companion, easily portable and with multiple everyday functions (Fortunati & Taipale, 2014, de Reuver, Nikou & Bouwman, 2016, in Wolfers et al., 2020, p. 32). It has been argued that smartphone use is designed to be immersive or create absorption unlike former mediums, with highly personally tailored content and instant accessibility, making a person available in most situations (Ewin et al., 2021, p. 2043). “Many [...] frequently check devices and feel compelled to immediately answer invitations to communicate and to share personal details with others. Smartphones’ acoustic, tactile and visual signals remind us ceaselessly of their presence; they are “always on” and speak to humans’ basic need for communication” (King, 2018, in Braune-Krickau et al., 2021 p. 1-2). According to Sbarra et al. (2019), smartphones are designed to make use of fundamental human evolution-based communicative attachment behaviors, such as disclosure and responsiveness (Sbarra et al., 2019). However, as King (2018) notes, the increase and intensification of digital communication might complementarily be accompanied by a decline in attention to persons who are actually present (King, 2018, in Braune-Krickau et al., 2021 p. 1-2). The connection with a present other may be constantly interrupted in favour of the often widely spanned social network online (Sbarra et al., 2019). Gergen (2002) accurately described this phenomenon in 2002 as “absent presence”: when a person is present, but their consciousness is diverted or divided by communication technology such as the mobile phone, over concrete, face-to-face relationships (Gergen, 2002, p. 227). The empowerment-enslavement paradox also highlights “the juxtaposition of being regularly available even when one is not physically present” (Zayia et al., 2021, p. 65). This refers to how an individual must be ready for work-related tasks and non-work-related communication even when being at home, alone, or engaged in other tasks, like taking care of their children (2021, p. 65). Individuals feel a pressure to respond immediately, and even if it allows for some social advantages, it can also have negative health outcomes, like reduced/disturbed sleep; social and emotional difficulties like anxiety and depression; self-regulation difficulties and loneliness (2021, p. 65). If one cannot fully engage in a conversation with others due to absent presence, it is known as phubbing, a term which derives from snubbing someone present in favour of using one’s phone (2021, p. 65). Phubbing is considered to be “one of the many forms of technofence” (2021, p. 65), or technology interference, that exists, referring to technofence as “everyday intrusions and interruptions due to technology devices” (McDaniel & Coyne, 2016, p. 85).

Recently, media use by children has gained directions from the Norwegian Directorate of Health, advising that children under the age of two years should not have access to any screen time at all (The Norwegian Directorate of Health, 2022), but parental screen time and its' implications on parent-child relationship has not been likeworthy addressed. Still, parental smartphone use remains a current issue, as parents are being reminded to the present day by day-care centres and hospital maternity wards that they need to put away their phones in vulnerable situations like the delivery/pick-up times of children, and during the time immediately following birth (S. Andreassen, personal communication, May 2023). Parental smartphone use has been shown to create parental distractions and dissatisfaction with their child(-ren) as well as consequences for the child(-ren) like hazardous situations and child negative affect (McDaniel, 2019, p. 75). This poses questions as to if, and if so how, this parental use affects infant and toddler development in the first and crucial development years (Håkonsen, 2014, p. 55), the association to parental sensitivity (Wolfers et al., 2020, p. 36) and the parent-child relationship and attachment quality, which is a main concept in development psychology (Tetzchner, 2012, p. 541). For it is the “qualities of closeness and care that determine how the child develops” (*author's translation*, Håkonsen, 2014, p. 46). Young children and infants are a vulnerable group dependent on parents' attentiveness, responsiveness, and sensitivity for both general safety and healthy development (Tetzchner, 2012, p. 541) and are not always able to communicate their needs and feelings, e.g., “I need you to be more attentive to my non-verbal communication and not your smartphone during meal-time/bath-time/play-time”. Therefore, this group invites extra attentiveness and protection from new types of parental distractions such as smartphone use, and children aged 0-5 years old were therefore chosen as the research subjects.

From birth, infants and toddlers are in a crucial development stage that happens in relation to their parents or primary caregivers (Håkonsen, 2014, pp. 45-47). The steppingstones of future development of the child's sense of self, security and trust are laid, and this happens through the strength of emotional bonds, closeness, and quality of care between the child and their primary caregivers (Håkonsen, 2014, pp. 45-47). These bonds, quality of care and closeness is embedded in the concept of parent-child attachment by John Bowlby (Broberg et. al., 2006, pp. 93-95), stating that young children's attachment to parents and primary caregivers is of vital importance for their development and functioning later in life (Håkonsen, 2014, p. 46). Maltreatment, separation and neglect early in a child's life is according to attachment theory able to negatively affect the child's development (2014, p. 46).

The attachment between caregiver and child evolves as the “cumulative product of the caregiver’s responses to the infant’s signals for proximity and contact” and can be constant, or altered by external factors, such as the smartphone’s presence in the caregiver-child interaction (Wolfers et al., 2020, p. 32).

The attachment bond is as thus especially important during early development. Children that suffer from insecure and avoidant attachment styles and an insecure sense of security can “develop severe personality disorders such as fearfulness and insecurity, lack of self-esteem, a struggle to relate to others, and maybe most importantly: the lacking ability to empathize with other people’s thoughts and feelings...” (*author’s translation*, Håkonsen, 2014, p. 46). These are difficulties sometimes called antisociality, that can arise from detachment: a state where the child detaches from the personal support of their parents, which can also happen when parents are non-reactive for other reasons such as depression (Broberg et. al., 2006 pp. 97-99). Young children that have detached from their parents can be observed to not seek to them for comfort when in emotional difficulties, and to avoid eye-contact with them (Coyne et al., 2022, p. 2). Personality disorders can be severe for the individual but can also have an impact on the lives of others, as they can lead to various antisocial behaviors such as abuse, harassment, and violence later in life (Håkonsen, 2014, p. 46). As attachment is so crucial, it is also “crucial to understand how media may or may not interfere, delay or obscure the behaviors and interactions that are the building blocks of attachment” as infants in this day and age will grow up “surrounded by and immersed in media” (Coyne et al., 2022, p. 2).

The American Academy of Pediatrics stated in their article named *Parents of Young Children: Put Down Your Smartphones* that “nonverbal cues are often reduced or eliminated completely” when a parent is using a smartphone (American Academy of Pediatrics, 2016). Nonverbal messages make up a crucial part of how parents and children communicate, as well as speaking and using other language skills (2016). Children miss out on learning how to communicate if they do not learn these skills from adults, and parents can miss out of the child’s sending of nonverbal signals if they are distracted by their smartphone (American Academy of Pediatrics, 2016). Infants and very young children have not yet developed language and communication skills as adults have, and are therefore particularly at risk if parents are distracted and fail to meet their needs because of smartphone distractions.

The review question at hand developed from working in a day-care centre and from personal experiences from family life, where initial observations regarding infants and toddlers and parental smartphone use were that:

- Some children would become loud, noisy, more enervating (“naggy”) and cried more, to regain the attention from-, and/or interrupt the parent’s smartphone use.
- These children showed frustration non-verbally by *externalizing* (McDaniel, 2019, p. 75), e.g., running around; breaking something; making pounding noises; being «disobedient» and showed a very low degree of impulse control.
- Some children took to a more prominent «look at me!» attitude, and struggled to remain calm and quiet.
- Children tried to engage the parent(s) verbally with questions and invitations, but also with threats or other signs of dissatisfaction.
- Some children showed signs of loneliness and helplessness, like becoming sad, pouty and seeking to be alone, also known as *internalizing* (McDaniel, 2019, p. 75).
- Calm children were observed to get less attention overall, because the parent was not interrupted and were allowed to scroll in peace and quiet. This seemed to elongate the duration of smartphone use. This/these child(-ren) also appeared to be frustrated by the parental smartphone use, but had to accept having to be alone, or simply gave up the task they were trying to do.
- Some parents experienced irritation if being interrupted in their smartphone use. Parents reacted with any range of responses, from being calm and balanced to being frustrated and angry.

As such, a number of personal observations from family life as well as working in a day-care centre showed that young children regularly appeared to react negatively to parents’ and caregivers’ extended smartphone use, and experience problematic behaviour or problematic emotions as a response.

The overall theme of the research is therefore early child development, parent-child attachment and immersive parent technology-, specifically smartphone, use. Particularly, it

will be investigated, discussed and questioned whether parents' attention to smartphones can have long-term attachment and health consequences for the child, in relation to feelings of security, attention and support, and whether a lack of this due to smartphone use can lead to an overall deterioration of their childhood due to a lack of attachment to parents and a lack of adequate physical and/or cognitive development.

On investigation, previous reviews were found on the subject, but found inconclusive and scattered results. Therefore, a scoping review, also known as “mapping review” or “scoping study” (Peters et al., 2020, p. 408), was performed to further clarify the effect of parental smartphone use on the parent-child attachment/relationship, as well as the possible developmental outcomes for children. This scoping review sought to summarize the current state of the research including findings giving light to relevant concepts, theories and methods to pinpoint knowledge gaps and implications for further research. The review question this scoping review sought to answer, was: *What are the research theories, conceptual frameworks, results, methods and methodological limitations found in the literature on parental smartphone use regarding parent-child attachment and child development, when the child is 0-5 years old?*

2 Methods

A scoping review method was used to investigate the review question, following the guidelines from *Chapter 11: Scoping reviews in the JBI manual for evidence synthesis* (Peters et al., 2020) to maintain international research quality. The aim of using the scoping review method was to identify the available types of evidence in the field and provide a map of existing knowledge, theories and knowledge gaps regarding the subject (Peters et al., 2020, p. 408). One scoping review had previously been conducted regarding parental smartphone use and parent sensitivity and responsiveness within the parent-child interaction (Braune-Krickau et al., 2021). This scoping review had a narrower scope than the current scoping review, as well as searching less databases, including less articles and being finished in October 2020. With the constant expansion of smartphone use and related research, and a wider scope, the current scoping review provides a broader and more comprehensive mapping of the available evidence per current date.

The scoping review method follows a systematic and comprehensive search and reviewing approach that differs from the traditional literature review and systematic review, in that it can

be used to “map key concepts that underpin a field of research, as well as to clarify working definitions, and/or the conceptual boundaries of a topic”, seeking to provide an “overview of the evidence to answer questions regarding the nature and diversity of the evidence/knowledge available” (Peters et al., 2020, p. 408; Tricco et al., 2018, p. 1). Other reviews used the systematic review format (Beamish et al., 2019; Hood et al., 2021a; Kildare & Middlemiss, 2017; Knitter & Zemp, 2020; Nøkleby et al., 2022), or the traditional literature review format (Lippold et al., 2022; McDaniel, 2019). Compared to systematic reviews, the scoping review format makes it possible to utilize a “broader “scope” with correspondingly less restrictive inclusion criteria than the previous reviews and not being restricted to any form of study design” (Peters et al., 2020, p. 410). Contrary to traditional literature reviews, the scoping review is less subjective and less dependent on the researcher’s prior knowledge and experience (Munn et al., 2018, p. 5). The scoping review is expected to have an explicit and peer reviewed search strategy and standardised extraction forms, but does not necessarily include an a priori review protocol registered in PROSPERO, or mandatory critical appraisal, as in a systematic review (Peters et al., 2020, p. 411). Scoping reviews do not necessarily include appraisal on methodological limitations and risk of bias, because the scoping review format does not aim to include recommendations for practice or guide clinical decision-making or policy development (Munn et al., 2018, p. 2-3). But this was performed as a means for this scoping review’s objective to investigate study methods and possibly answer why previous reviews have found scattered or inconclusive results. Critical appraisal assessments have therefore not been attached, but study methodologies were rigorously analysed, and the findings were presented in the study methodologies subheading of the results. Evidence identified was to be analysed and presented in a review form, eligible for publishing in a journal succeeding the master’s theses. The review process will now be described.

First, a search was made into the library database Oria to consult grey literature on day-care teacher training, social sciences, psychology, and clinical psychology for children to seek out preliminary keywords, phrases and index terms regarding parent-child attachment/relationship and child development stages in ages 0-5 years old. Online sources such as Google and Google Scholar were further investigated for information on parental smartphone use and the consequences for their young children. A search for evidence was thereafter made into two databases, PubMed and Web of Science, looking for previous reviews in any form on this subject. This effort was described in a previous paper submitted as an exam for a knowledge management course (Bjørkmann, 2022), and some results may consequently overlap with this

thesis, as well as the section on initial observations of children and parental smartphone use from the introduction. Eight reviews and one scoping review protocol were discovered when searching for previous reviews using this process. Of these eight reviews, one was a scoping review. Most of the reviews were systematic or literature reviews, and aimed to answer more specific research questions to inform practice and policy (Aromatis & Munn, 2020, second paragraph), rather than to map the evidence in the research field. Previous reviews found inconclusive or contradictory results on the effects of parental smartphone use on the parent-child attachment and child development outcomes, and sought further research and reviews with a wider scope, including other forms of evidence such as qualitative and cross-sectional studies (e.g., Nøkleby et al., 2022, p. 54) as well as longitudinal and observational studies (e.g., McDaniel, 2019, p. 76). To guarantee a comprehensive search for articles, the scoping review approach was chosen as a form of knowledge summary in an effort to map the evidence and discover new research questions that could bring the present research on smartphones and parent-child attachment/relationship and child development out of its current standstill. The scoping review can act as a precursor to new, possibly useful theoretical and empirical approaches within the research field, and this way contribute to the mapping of attention and distraction terms, on the connection between parental smartphone use and parent-child relationship outcomes, and parental smartphone use and possible child development effects.

As per the JBI manual, the scoping review includes an abstract to “accurately reflect and summarize the review” focussing on the results of the review (Peters et al., 2020, p. 428). The abstract enables the reader to quickly get an overview the review and decide if the content is relevant for their interest and purpose. After the abstract, the introduction, review question and inclusion criteria for the review followed. The inclusion criteria aimed to align the records included with the review objective using the PCC: Population, Concept, Context approach (2020, p. 431). This includes specifying the population through types of participants and sources of evidence. For this review, the five databases Web of Science, PubMed, Embase Classic+Embase, Ovid Medline® and APA PsychINFO were searched.

Web of Science is a multidisciplinary database, giving access to citations from scientific literature regarding social sciences, natural sciences, arts and humanities (UiT The Arctic University of Norway, n.d.-b). This database indexes “scholarly books, peer reviewed journals, original research articles, reviews, editorials, chronologies, abstracts” and other items regarding all disciplines (“Web of Science,” 2023). This database was an obvious

choice settled upon in unison with a library and information science specialist at the university to obtain a wide scope, especially considering that the Scopus database no longer is available at UiT The Arctic University of Norway. As the review regarded the parent-child relationship and child development outcomes, databases specifically indexing health related literature were also searched, namely PubMed and OVID. PubMed gives access to “35 million citations for biomedical literature” including MEDLINE® (National Library of Medicine, n.d.), but also includes additional content such as books or chapters, as well as articles in process or ‘ahead of print’ (University College London, 2023). The OVID medical research platform was also included, which “delivers thousands of full-text journal articles, eBooks, database resources and workflow tools in a single integrated solution” and provides a “one one-stop solution for anyone working in healthcare” (Wolters Kluwer, n.d.). On selection, the OVID interface included results from medical research databases Embase Classic+Embase, Ovid MEDLINE® and APA PsychINFO. To determine the selection of these databases and develop a sensitive search, a first librarian and head of subject for psychology, psychiatry, and philosophy at the university was consulted, as well as a professor of media and documentation science. As a result, terms for smartphone use were combined with terms for parent and child, attachment, attention and/or distraction to provide a wider search strategy than previous reviews, see Table 1. The search terms varied slightly between databases due to possibilities and constraints in the different databases’ search engines.

Table 1. Key terms for scoping review search, from the search in database PubMed

Child terms	Parent terms	Media terms	Parent-child interaction and child development terms
child* infant* baby	parent*	smartphone* mobile device* technolog* media phubbing technoference	absor* immers* attach* detach* connect* distract* attenti* sensitiv*

The search was then limited to results published in English language, that were peer-reviewed and published from 2005 to the date of the final search in December 2022. The records had to include empirical studies on the parent-child attachment, bond or relationship in context of parental smartphone use, and regard the child age group 0-5 years old. As this topic is still emerging, the search was not limited to research articles, but also included literature such as conference papers, master's theses and doctoral dissertations, and books/chapters published within the databases. An overview of the source of evidence screening and selection process was made in form of a PRISMA flow diagram, see Figure 1 in the scoping review (section 3.2). The search retrieved 851 documents, which were downloaded to the citation program Zotero (Zotero, n.d.), where all results were downloaded and duplicates were removed. After duplication removals 669 documents remained, of which titles and abstracts of the documents were then screened for eligibility. The screening questions, eligibility criteria and data charting process can be reviewed in *Additional file II Screening questions, eligibility criteria and data charting* of the scoping review, and the data charting process is described further in section 3.3. Following the screening process with inclusion and exclusion criteria, 60 documents were accessed in full-text for eligibility. Full-text documents were then excluded based on inclusion and exclusion criteria, and sources excluded from the scoping review following the full text review were listed in the review's *Additional file III Sources excluded following full text review* with reasons for exclusion. Data charting was conducted on the 14 remaining documents, and 18 new records were identified from "snowballing" practices, which means retrieving preliminary sources from the search results' in-text references and reference lists (Sayers, 2007, p. 759). These were then submitted to the same data charting process as the initial database search results.

The data extraction process revealed the results from 32 included documents pertaining to this scoping review, which were then rigorously analysed and presented in Table 1 of the review, as well as descriptively and analytically mapped in the following part of the results section using qualitative and quantitative content analysis (Vårheim & Skare, 2022, p. 4). Qualitative analysis was performed through inductive analysis (Thomas, 2006, p. 238). The inductive analysis used detailed and repeated readings of the included documents to extract concepts, themes or models "through interpretations made from the raw data", condense the data into a summary format, and provide links "between the research objectives and the summary findings" (Thomas, 2006, p. 238). The quantitative analysis was used for frequency counts (Peters et al., 2020, p. 421) to review sample sizes and other study characteristics. Details

about this process can be found in sections 3.3 and 3.4 of the scoping review. Information about the data chart and the data charting process can also be reviewed in *Additional file II Screening questions, eligibility criteria and data charting*.

This systematic approach to a knowledge synthesis through conducting a scoping review maps available evidence and summarizes the information from many different sources (Tricco et al., 2018, p. 1), potentially creating a useful document for departmental institutions, health care providers, day-care, or parents of children within the target age group. The data chart also expanded on theories, surveys used and sample sizes, to answer the review question and create a useful document for further research endeavours.

To conduct a scoping review which could be published in the expected quality and formatting to benefit the international research field before choosing a prospective journal, this research followed the scoping review methodology proposed in *Chapter 11: Scoping reviews* in the *JBI Manual for Evidence Synthesis* (Peters et al., 2020, pp. 406–451) including the PRISMA-ScR checklist, which can also be regarded in the appendices, in *Additional file III PRISMA-ScR-Fillable-Checklist*. The PRISMA-ScR checklist “is intended to provide guidance on the reporting of scoping reviews” and provides an overview of “Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews” (Tricco et al., 2018, pp. 1, 13). By using the JBI manual and PRISMA-ScR checklist in the creation of the scoping review, the formatting details are of universal character across disciplines and research fields and can easily be adapted to the prospective publishing journal after the master’s theses is submitted. For this scoping review, all authors have been asked for permission to adapt figures from their articles. In general, where permission is not obtainable the figures can be explained in the text and references provided.

The scoping review was created with the aim of publishing in a peer-reviewed, academic, and open access journal. In the Study characteristics section of the scoping review, it was found that common journals for this subject were *Nursing and Health Sciences* and *Computers in Human Behavior*. On further inspection, *Computers in Human Behavior* was found to have an open access companion title, *Computers in Human Behavior Reports* (Directory of Open Access Journals, n.d.), which is “dedicated to examining [...] the impact of computers on human behaviour” (ScienceDirect, n.d.-b) as well as being open to “[r]esearch articles, review articles, negative results studies, scale validations and replication studies” (ScienceDirect, n.d.-b). See also *Computers in Human Behavior* for more on the journal’s profile which

especially “addresses both the use of computers in psychology, psychiatry and related disciplines as well as the psychological impact of computer use on individuals, groups and society” (ScienceDirect, n.d.-a). As the scoping review is a form of review article and this journal fit the theme of the review, this journal was approved and chosen for open access publishing. The journal also had a publication agreement with UiT The Arctic University of Norway (Direktoratet for høyere utdanning og kompetanse, n.d.), and for a new journal it's cite score of 4.0 is good (Scopus Preview, 2023, April 5). Since this is a new journal and the author is novel to the research community, the journal was found suitable for publishing subsequent to the master’s theses. This journal does not require particular formatting before the article is accepted into the revision stage (see Appendix A, p. 3). The *Author information pack* of this journal can be regarded in the appendices (see Appendix A).

3 Results

Following the data extraction, analysis and charting of results, the results segment of the scoping review was presented. First the data chart provided a summary of the results extracted from the included documents. Then, the results segment further outlines results for the different parts of the review in three main themes, each relating to the review question:

- Results on theory/conceptual frameworks used in studies.
- Results on parental smartphone use’s effect on the parent-child attachment/relationship and/or the child’s developmental outcomes.
- Results on study methodologies.

The first main theme outlines results regarding theory/conceptual frameworks used in the studies included in the scoping review, and identifies common theories regarding parental sensitivity and responsiveness, parent-child attachment, child development and parental attention or distraction. A visual presentation of text data was made in form of a tag cloud, visualising each theory or conceptual framework’s importance to the included literature for the reader of the scoping review, where “the importance of each tag is shown with font size or color” (“Tag Cloud,” 2023). The tag cloud was based on frequency, that is, the number of times that tag/word was used to describe one of the record’s main theories, themes, or conceptual frameworks, out of the 32 included records. The word was enlarged in size and darkened in colour for each record listing it, resulting in the most visible word represented to be the most common theory/conceptual framework. The review investigated parental attention and distraction concepts such as technoference, immersion/absorption and phubbing, as well

as concepts regarding child developmental outcomes such as attachment, cognitive growth and developmental delays.

The second main theme considered results of the scoping review on how parental smartphone use affected parent-child attachment/relationship and/or child development outcomes. Results were sorted into 14 categories, relating to the theory or conceptual framework they represented in the first main theme. The categories each expanded upon the result that was relevant to the scoping review's review question, and were: The smartphone's intervention in parent-child attachment, from parental sensitivity and responsiveness; Parent-child attachment and mobile devices in an integrated family systems model; Parental technofence in parent-child interactions; Technofence and parent emotional stability; Parental phubbing in the parent-child relationship; Parental absorption/immersion; Parent displacement hypothesis; The present-absent paradox; Phone use while feeding infants and toddlers; The Still-Face Paradigm as an observation; The smartphone as a tool to facilitate parents' sensitivity; Why parents use smartphones, and excessive smartphone use's impact on the parent-child relationship; Why smartphones and technofence differ from books, magazines or TV; and Screen time and family life balance. Some categories expanded upon results from a single article or document, and others summarised results from several articles. In some categories, a figure from the included document represented a significant finding for the scoping review. In these instances, the figure was included in the scoping review and referenced appropriately, and permission was requested from each article or document's corresponding author for the use of the figure. This was required for publishing the master's thesis in UiT The Arctic University of Norway's open science archive Munin (UiT The Arctic University of Norway, n.d.-a) as well as for publishing the scoping review in the journal *Computers in Human Behavior Reports* (see Appendix A, p. 3). Correspondence containing the requests have thus been included in the appendices (see Appendix B).

The results from the second main theme showed that parental smartphone use affected parental sensitivity and responsiveness (Abels et al., 2018; Alvarez Gutierrez & Ventura, 2021; Ewin et al., 2021; Golen & Ventura, 2015; Jester, 2019; Lemish et al., 2020; Vanden Abeele et al., 2020; Wolfers et al., 2020) and displaced time with their children (Alvarez Gutierrez & Ventura, 2021; Lv et al., 2022), which impacts the parent-child attachment. Parents were more distraught by smartphone use than other distractions (Lemish et al., 2020; Vanden Abeele et al., 2020), and some parents reacted negatively to being interrupted by their child (e.g. Radesky et al., 2014, in Ewin et al., 2021). Others showed delayed or blunted

responses to their child (Abels et al., 2018; Vanden Abeele et al., 2020), or did not respond at all while using their smartphone (Inoue et al., 2022). Smartphone related disruptions impacted joint attention, cognitive growth-inducing experiences, parent-child synchrony (Golen & Ventura, 2015; Inoue et al., 2022; Ventura & Teitelbaum, 2017) and the building of a secure attachment between parent and child (Alvarez Gutierrez & Ventura, 2021; Lv et al., 2022; Tomfohrde & Reinke, 2016). One study found correlations between parental smartphone use and child developmental delays (Davidovitch et al., 2018). Children reacted negatively to their parents' smartphone use in studies using a smartphone modified Still-Face Paradigm (Kildare, 2017; Myruski et al., 2018; Stockdale et al., 2020). Parents' emotional stability was a mediating factor when encountering technofence (Merkaš et al., 2021), while parents' stress moderated the problem if children were being phubbed (Lv et al., 2022). Themes such as technofence and phubbing have been explained in the scoping review text. Some types of parental smartphone use were beneficial to the parent-child relationship, like using an app to learn about child development and parent sensitivity (Larkin et al., 2019), or staying in touch with relatives living far away using phone calls or video chat together with the child (Ewin et al., 2021; Hood et al., 2021b).

The third and final main theme of the results segment of the scoping review regarded results on study methodologies, to investigate study methods, limitations and risk of bias as part of the review question and identify why research findings have so far been inconclusive. Results were categorized into study characteristics, study location characteristics, sample characteristics and method characteristics. The study methodologies section found large inconsistencies in methods, which was further discussed within the discussion segment of study limitations and risk of bias. The review found that studies lacked consistency in methods and reporting, and many had potential for self-report bias due to perceived social norms or inattention blindness (for inattention blindness explanation, see p. 92).

4 Conclusion

This scoping review took a step back and widened the scope of the search to provide a broader mapping of the evidence field than previous reviews. The review utilized less restrictive inclusion criteria and included a wider scope of study design, allowing for more articles and documents to be included. Common themes and theories were discovered and systematically structured in a comprehensive knowledge synthesis. Table 1 of the scoping review provides a descriptive summary of key findings regarding parental smartphone use's

effect on the parent-child attachment/relationship and child developmental outcomes. This can benefit future research summarizing the results regarding the research topic, as well as provide evidence of commonly used survey batteries and methods. The scoping review format also allowed for a mapping of relevant conceptual frameworks, such as regarding parental sensitivity and responsiveness, parent-child attachment, parental attention and distraction, and problematic phone use. The occurrence of these themes was visualised in a tag cloud of common themes and theories in Figure 2. The scoping review also identified and investigated subthemes of parental attention and distraction regarding smartphone use, such as technoference, absent presence, immersion, absorption and phubbing, as well as parental screen distraction, known as PSD. The disruption in the parent-child relationship due to parental smartphone use was commonly linked to parental sensitivity and responsiveness, mutual gaze, joint attention, parent-child synchrony and visual attentiveness. The review also identified child developmental outcomes of parental smartphone use to be linked to attachment, cognitive growth, child emotional and behavioural problems, language acquisition and other developmental outcomes and/or delays. The results were then categorized into 14 subheadings according to themes or conceptual frameworks, where the evidence from the included documents was presented. A discussion juxtaposed the results of this review to previous review findings and highlighted the implications of the findings for future research. This scoping review can hereby contribute to new research regarding e.g. review questions, findings, and theoretical development. Synthesising the evidence on methodological limitations and risk of bias also provides a foundation for future studies, in highlighting longitudinal in-home observations or public non-participant observations of parental smartphone use subjected to randomization processes over parental self-report. This in an effort to reduce the likelihood of researcher confirmation bias, parental social desirability bias and the potential for parental inattention blindness. The scoping review also highlighted a need for more varied participant demographics to add to the generalizability of the studies' results.

4.1 The strengths and limitations of this study

While providing an extensive search for literature, it is possible that some articles were missed due to the selected search terms and database limitations. As smartphones and the affecting technology are constantly developing, it is a challenge for thorough research to stay updated. Grey literature was not searched due to time restrictions, but many of the documents and articles were published within the recent years, allowing this scoping review to provide a

recent update on the research field. This provides a current insight into the effect of parental smartphone use on the parent-child relationship and child developmental outcomes and can further guide future research. Because of the master thesis format, there was a time constraint of one year regarding the research. Likewise, the thesis could not include fellow researchers as would be desirable in a scoping review but included an active supervisor.

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Mapping the literature for understanding and investigating how the parent-child attachment relationship and child development can be affected by parental smartphone use, child age 0-5: a scoping review.

1 Abstract

- **Objective**

The objective of this study is to conduct a scoping review that contributes with a map and summary of the available knowledge regarding how the parent-child attachment/relationship and child developmental outcomes are influenced by parental smartphone use among children aged 0-5 years old. This scoping review is performed as a structured searching and scoping activity because previous reviews have been of different character, mostly being systematic and traditional literature reviews, and have found scattered or inconclusive evidence on this topic. This study aims to research, discuss and question whether parents' attention to and distraction from smartphone use can lead to an overall deterioration of young children's upbringing due to a lack of attachment to parents or lack of adequate physical and/or cognitive development through a comprehensive mapping of the available literature. Therefore, this scoping review will have a broader "scope" than a systematic review, and correspondingly more expansive inclusion criteria. The review includes the PCC mnemonic (Population, Concept, Context) and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) for scoping reviews. The review will identify the types of available evidence in the field, clarify key concepts and conceptual frameworks, and examine how research is conducted on parental smartphone use, as well as identify and analyse knowledge gaps. Implications for future research are discussed. Results can be applied in future research initiatives, as this review can be used as a precursor useful to inform the development of systematic reviews on the same topic.

- **Introduction**

Smartphones have become ever-present, gaining in popularity since their introduction around 2005 and permeating the lives of young families. U.S. statistics from 2019 indicated that 99% of the adult population owned a smartphone (Pew Research Center, 2021) and already in 2013 it was established that they keep it nearby "for all but 2 hours of the day" (IDC & Facebook, 2013, p. 14). Similarly, in Norway 96 percent of adults had access to a smartphone in 2021 (Statistics Norway, 2021). Due to previous reviews not filling the research field's knowledge needs, this scoping review aimed to take a step back and provide a wider search strategy to enhance on the current research, as suggested by e.g., the systematic review by the Norwegian Institute of Public Health (Nøkleby et al., 2022, p. 54) which did not include qualitative studies and cross-sectional studies. This scoping study attempts to provide a connection between the fields of child development and parental technology use that can answer more clearly how children's healthy development and the parent-child attachment/relationship are affected by parental smartphone use. The review question was: What are the research theories, conceptual frameworks, results, methods, and methodological limitations found in the literature on parental smartphone use regarding parent-child attachment and child development, when the child is 0-5 years old?

- **Methods**

A database search was started in September 2022 and finished in December 2022, searching the five databases Web of Science, PubMed, APA PsychINFO, Embase Classic+Embase and Ovid MEDLINE® on parental smartphone use, child

development and parent-child attachment/relationship outcomes. Inclusion criteria for evidence synthesis was that the records must regard parental smartphone use, the parent-child attachment, bond or relationship context, and the child age-group 0-5 years old. The records had to be in English and empirical as well as be peer reviewed and published, including articles, book chapters or books, conference papers, theses, and dissertations. The current scoping review follows JBI-guidelines for qualitative synthesis of evidence (Peters et al., 2020) including the PRISMA-ScR checklist (Tricco et al., 2018). The PRISMA-ScR checklist provides preferred reporting items for systematic reviews and meta-analyses extension for scoping reviews with a fillable checklist.

- **Results**

The total number of studies included in the current knowledge synthesis is 32. Results were extracted into a data chart and categorized into three main themes to analytically answer the review question. The first main theme regarded results on theory/conceptual frameworks of the included studies, which showed that parental attention and distraction were commonly studied, with references to attention themes such as responsiveness and sensitivity, mutual gaze, joint attention, parent-child synchrony and visual attentiveness. Parental distraction themes towards smartphone use were commonly technofeference, phubbing, absorption, immersion, absent presence, problematic phone use and parental screen distraction. Child developmental outcomes were commonly linked to attachment, cognitive growth, child emotional and behavioural problems, developmental outcomes and delays, and language acquisition.

The second main theme outlined and discussed significant results from the records included to identify how parental smartphone use affects the parent-child attachment/relationship and/or the child's developmental outcomes. These results were sorted into 14 categories discovered in the results section regarding theory/conceptual frameworks used in the studies. These categories were: The smartphone's intervention in parent-child attachment, from parental sensitivity and responsiveness; Parent-child attachment and mobile devices in an integrated family systems model; Parental technofeference in parent-child interactions; Technofeference and parent emotional stability; Parental phubbing in the parent-child relationship; Parental absorption/immersion; Parent displacement hypothesis; The present-absent paradox; Phone use while feeding infants and toddlers; The Still-Face Paradigm as an observation; The smartphone as a tool to facilitate parents' sensitivity; Why parents use smartphones, and excessive smartphone use's impact on the parent-child relationship; Why smartphones and technofeference differ from books, magazines or TV and lastly Screen time and family life balance.

Finally, the results on methodologies of the studies included in this scoping review were extracted and presented in the third main theme, to assess methods, methodology limitations and possible risk of bias. A large variety of study methods were found, from differing observation or data gathering methods, to differing quantitative and qualitative surveys, providing unique and in some cases non-comparable results. Participant demographics were often found to be very narrow, mostly inquiring into maternal self-report of smartphone use and its consequences for the parent-child relationship and child development, and many studies had potential for self-report bias or inattention blindness. There was also an absence of studies conducted outside of western societies.

- **Conclusions**

Through this scoping review, it was found that technoferece through parental smartphone use affects parental sensitivity and responsiveness, which can harm the parent-child attachment relationship and negatively affect the child's developmental outcomes throughout their upbringing. Parent smartphone use was found to negatively affect the child's stress levels, and in smartphone modified Still-Face Paradigm studies it generated the still-face effect. This indicates that the child expressed less positive affect, more negative affect, more escape behaviours and more self-comforting behaviours. It was found that parent smartphone use could disrupt the child's inner working model if the use is excessive and interrupts the interactions and bonding frequently over time, and therefore could affect child development, future well-being and relationships. Parental smartphone use can disrupt joint attention, cognitive growth-inducing experiences, parent-child synchrony and the building of a secure attachment with their children. On the other hand, smartphone use could add to the parent's sensitivity towards their children when being used appropriately to keep in contact with friends and relatives, as long as the parent is still able to show considerate and contingent responses like maintaining eye-contact, responding to children's bids for attention, showing care and affection, and providing support without communicating absent presence. Checking the device and putting it away was subsequently found to be less disruptive to the interaction than passive use, such as holding the smartphone in one's hand or placing it at the table. Phubbing, that is, intentionally ignoring the child to focus on the smartphone, was found to predict child emotional and behavioural problems, like anxiety, loneliness and acting out. As such, it was discussed if parental sensitivity was affected negatively by smartphone use, or if inconsiderate parental smartphone use was the manifestation of low parental sensitivity. Finally, the results from the included studies' methodologies revealed that the inconsistency of methods, the potential for maternal self-report bias to fit social norms, the potential for self-report bias when reporting on one's own levels of distraction (inattention blindness), and a lack of variety in participant demographics, resulted in differing results and inconsistencies within the evidence field. This may contribute to explaining why previous reviews have found scattered results. The implications of the findings for future research were discussed. This review provides a map of existing knowledge, which can lead to new research questions and underpin new systematic reviews, and possibly lead to fruitful research outcomes in the future.

2 Introduction

Parental smartphone use while caring for young children has lately been widely debated, as the smartphone has become an integral part of many parents lives (Christakis, 2018; Gold, 2015; Kiss, 2018; Matthews, 2017; Neighmond, 2014; Pearson, 2020). Since the smartphone's inception, parents can amongst many things do social networking, answer emails and look up parenting tips while taking care of their children. At the same time, general statistics for child injuries has gone up (Palsson, 2017, p. 200), and many parents admit to feeling guilty towards their children about their own smartphone use (e.g., Kildare, 2017, p. 94). For whilst being distracted by the smartphone, parents may neglect, overlook or forget other areas of great interest, like being attentive to and caring for their young children and their healthy development. Some admit to losing track of time while being immersed in the smartphone's content, and some parents have not thought about how their smartphone use could affect their children, for example by affecting "face-to-face communication, gaze coordination, and shared attention" (Braune-Krickau et al., 2021, p. 164). But at a young age, children are particularly vulnerable if parents are distracted and inattentive, and subsequently fail to meet the child's needs (Tetzchner, 2012, p. 541) because of smartphone distractions. The long-term developmental outcomes for children have so far been undetermined, but research has started investigating the effect of parental smartphone use on the parent-child relationship and the child's health, although with scattered or inconclusive results (e.g., the reviews by Beamish et al., 2019; Braune-Krickau et al., 2021; Hood et al., 2021; Kildare & Middlemiss, 2017; Knitter & Zemp, 2020; Lippold et al., 2022; McDaniel, 2019; Nøkleby et al., 2022).

As the previous systematic reviews are unable to "meet the necessary objectives or requirements of knowledge users" the current scoping review will take a step back to examine the evidence and provide synthesized knowledge highlighting studies on a wider range of relevant topics, as allowed by the scoping review format (Munn et al., 2018, p. 2). The scoping review is different to a systematic review, in that it does not aim to answer a precise clinical question and provide a critically appraised and synthesised answer to a particular question; it includes a wider "scope" and has correspondingly broader inclusion criteria (Munn et al., 2018, p. 3). The scoping review format does not generally seek to assess methodological limitations and risk of bias, unless this is a specific requirement in the scoping review's aim (Munn et al., 2018, p. 3). As this scoping review did aim to investigate why previous research had been inconclusive or scattered, the scoping review examined how

research was conducted on the topic (2018, p. 3). Systematic reviews are also performed by “review groups with specialized skills” within the topic, and can be used to produce statements to guide clinical decision-making, the delivery of care or policy development (2018, p. 2). Scoping reviews are on the other hand an ideal tool to determine the scope of a body of literature as well as give an overview of its focus, examining emerging evidence such as smartphone use when it is unclear what “other, more specific questions can be posed” (2018, p. 2). This scoping review aims to identify the types of available evidence in the research field, clarify key concepts and conceptual frameworks and examine how research is conducted, as well as identify knowledge gaps within the literature (2018, p. 2).

The scoping review format should still not be confused with traditional literature reviews, which can be considered subjective and reliant on the author’s pre-existing knowledge and experience (2018, p. 5). Scoping reviews provide an alternative to traditional literature reviews, when systematic, transparent, and comprehensive searching for information is done, where “clarification around a concept or theory is required” (2018, p. 5). Analysis will be conducted on results, theories and conceptual frameworks, research methodologies and limitations, and the aim is to bring the present research on smartphones and parent-child attachment and interaction out of its present impasse and form a precursor to new and useful theoretical and empirical approaches within the field.

2.1 Previous reviews and knowledge synthesis

As part of the scoping review process, a search for reviews was conducted in databases Web of Science and PubMed to synthesize the current state of the research. Parental smartphone use and the parent-child attachment outcomes for children of age 0-5 years was reviewed to gain understanding of common themes and the status of the research so far. This search found eight reviews that had been carried out on the subject, whereof five reviews were systematic reviews (Beamish et al., 2019, Hood et al., 2021b; Kildare & Middlemiss, 2016, Knitter & Zemp, 2020; Nøkleby et al., 2022). The remaining reviews consisted of one scoping review (Braune-Krickau et al., 2021) and two literature reviews (Lippold et al., 2022; McDaniel, 2019). A scoping review protocol was also identified (Mackay et al., 2022), the results of which will further enlighten the state of the evidence, once published. But regarding the published reviews, findings were scattered, inconclusive or even contradictory relating to the parent-child attachment consequences from parental smartphone use. This scoping review thus aimed to provide a wider search strategy to enhance on the current research, as suggested

by e.g., the systematic review by The Norwegian Institute of Public Health (Nøkleby et al., 2022, p. 54) which did not include qualitative studies and cross-sectional studies, and McDaniel's review (2019, p. 76), seeking more longitudinal and observational studies.

To sum up evidence from the previous reviews, Hood et al.'s review (2021b) found there to be limited direct evidence of any association between the duration of time parents used smartphones and the parent-child attachment outcomes. Knitter and Zemp (2020) found evidence that parental technofence, that is, interruptions or interference by technological devices in parent-child relationships, had negative effects on child emotion. Moreover, the research assessed factors such as when the disruption happened and how it happened to be of importance for how disruptive the use was. The research also found parental smartphone use to pose some benefits to the relationship. The Norwegian Institute of Public Health's review found parental technofence to have negative short-term consequence on parents' sensitivity and responsiveness; that it elevated the child's stress and negative emotionality; and to have negative short-term consequence on parent-child interaction in general, in nine of the 20 studies that were reviewed (Nøkleby et al., 2022). The review found the rest of the studies included to have speculative evidence, or debatable quality.

Beamish et al. found that parent mobile device use allowed parents to stay in touch with family while apart, manage child-focused activities and worry less about absent children, but also that it affected their response to children bids for attention or eradicated the response entirely in nearly half of observations made (Beamish et al., 2019). High absorption in the device was associated to lower parental sensitivity. Braune-Krickau et al. (2021) found research to indicate that parental smartphone use may be associated with a decrease in parental sensitivity and responsiveness in their scoping review. The review had a narrower scope, searched two databases, included 12 records and the search was finalised in October 2020 (2021, p. 164-165). The current scoping review searched five databases, includes 32 records, and was performed at a later time than Braune-Krickau et al.'s review, allowing for more research to have been conducted on the emerging subject and to be included in the evidence synthesis. Kildare and Middlemiss (2017) found that increased use and reliance on mobile devices increased the potential for parents' mobile device use to disrupt parent-child interactions. Parents who used their phones during parent-child interactions were less sensitive and responsive both verbally and nonverbally to their children's bids for attention, and the research concluded that this could potentially lead to lower quality parent-child

interactions (Kildare & Middlemiss, 2017).

Lippold et al. (2022) found that parent technology use such as with mobile devices could be used to help parents gain empathy and develop compassion for themselves and their child, regulate their own emotions, and connect to other supportive individuals via social media and other internet sites. But they also found that parent technology use could create distractions that makes it challenging for the parent to be present-centred, listen with full attention, and calmly and intentionally respond to child behaviour. Technology use was found to potentially lead to social comparisons that could inhibit parents' compassion and acceptance for themselves and their child, and so the media use appeared to be multifaceted in value regarding the parent-child relationship (Lippold et al., 2022). And lastly, McDaniel's review (2019) found that parenting was affected by smartphone use due to displacement of time with children; difficulty of multitasking between device and child; and highlighted the emotions and stresses that can come from device use (McDaniel, 2019).

2.2 Review question

After investigating the previous reviews on the research topic, the findings were found to be scattered and sometimes contradictory. As the reviews provided inconclusive results regarding the effect of parental smartphone use on the parent-child attachment, this scoping review builds on the previous reviews while introducing a wider search strategy for mapping the broader literature, looking for new perspectives, findings and research gaps. This can identify more relevant studies and contribute to a renewal of the research field rejuvenating the research on technology and parent-child attachment/relationship and child development. The research as thus seeks to map the broader literature on parental smartphone use for the parent-child attachment, relationship or bond, as well as the possible developmental outcomes for children in the age group of 0-5 years old. The review question at hand is therefore as follows:

RQ: What are the research theories, conceptual frameworks, results, methods and methodological limitations found in the literature on parental smartphone use regarding parent-child attachment and child development, when the child is 0-5 years old?

Combining child development and parental technology use, specifically smartphone use, will attempt at furthering the state of the evidence in the field per current date, which will prove vital for discovering new research questions. The search results will be analysed for common theories, conceptual frameworks, methods and methodology limitations, to investigate why findings so far have been scattered or inconclusive.

2.3 Inclusion criteria

As per the *JBIM Manual*, the PCC: Population, Concept, Context approach was utilized to specify the sources of evidence considered for inclusion in the scoping review (Peters et al., 2020, p. 417). *Additional file II Screening questions Eligibility criteria and Data Charting* outlines the eligibility criteria for the review.

Population

The search was started 12th of September 2022 and ended on the 15th of December the same year. This scoping review included the following document types: empirical articles, dissertations, books and book chapters dated from 2005 until December 2022 in English language. The five databases searched were Web of Science, PubMed, Embase Classic+Embase, Ovid Medline® and APA PsychINFO. Records had to focus on children aged 0-5 years old and their parent(s)/primary caregiver's smartphone use. Some records had a larger child age range but could provide evidence for the age group 0-5 years due to a large number of participants being within that age, e.g., 50% in Ewin et al.'s article (2021). School starts around age 5-6 years in most western countries, so research outcomes from this review can be provided to day-care centres and parents and caregivers of infants and toddlers before that time, as well as departmental institutions and health care providers for this age group.

Concept

Records included would shed light on the consequences of distracting parental smartphone use regarding their child's development and the parent-child interaction, relationship, bond or attachment quality. The research questions were discovered to be interdisciplinary in nature within the sciences of sociology/social sciences, cognitive and clinical psychology, developmental psychology, nursing, pediatrics, technology, and media and communication sciences.

Context

This review considered any quantitative and qualitative studies in which observations were made on parent-child interactions and attachment in relation to parents using smartphones. No limit was set on type of study setting e.g., laboratory study, home setting, in playground, food courts, internet surveys, etc. However, the studies had to be peer-reviewed and published, and presented utilizing an empirical approach.

3 Methods

Due to the review question being exploratory and situated in an emerging research field, a scoping review method was used. Scoping reviews can “be used to map the key concepts that underpin a field of research, as well as to clarify working definitions, and/or the conceptual boundaries of a topic” with the “objective of providing a ‘map’ of the available evidence” (Peters et al., 2020, p. 408). The scoping review method differs from the systematic review method, in that “[s]ystematic reviews ideally aim to answer specific questions, rather than present general summaries of the literature on a topic of interest” (Aromataris & Pearson, 2014, p. 55). The aim of this review was thus not to ask a single or precise clinical question, but map the literature within sociology, psychology and media research that relate to how child development can be affected by parental smartphone use and identify limitations and possible knowledge gaps for future studies. The scoping review methodology was used following guidelines from the *JBI Manual for Evidence Synthesis, Chapter 11: Scoping reviews* (Peters et al., 2020, pp. 406–451). Due to time-constraints, a scoping review protocol was not published.

Searches were conducted on keywords and definitions from databases Web of Science, PubMed, APA PsychINFO, Embase Classic+Embase and Ovid MEDLINE® on child development and parental smartphone use. The search strategy was peer-reviewed and approved by a professor of library and information science; see *Additional file I Search strategy*. Screening questions, eligibility criteria and the data charting process can be reviewed in *Additional file II Screening questions, eligibility criteria and data charting*. To gain further understanding on the attachment and child development related concepts, a first librarian and head of subject for psychology, psychiatry, and philosophy was consulted to tweak the search strategy. To gain further understanding on the media related concepts, a professor of media and documentation science was consulted for the same purpose. This review utilized the Preferred Reporting Items for Systematic Reviews and Meta-Analyses

extension for Scoping Reviews (PRISMA ScR) checklist (Tricco et al., 2018, p. 1), see *Additional file III PRISMA-ScR-Fillable-Checklist*.

3.1 Search strategy and sources of evidence

A search for reviews using the databases Web of Science and PubMed offered earlier systematic, scoping and literature reviews on the topic detailed in the introduction to this review, which guided the search strategy and produced an overview of the current state of the evidence as well as providing relevant keywords and index terms (Peters et al., 2020, p. 418). These earlier reviews have not been included in the results of the review. A comprehensive search was thereafter conducted using the databases Web of Science, PubMed, Embase Classic + Embase, Ovid Medline® and APA PsychINFO. The databases Embase Classic + Embase, Ovid Medline® and APA PsychINFO were searched using the OVID database search engine and so the results are compiled together in the PRISMA flow diagram in Figure 1. The database results were downloaded in RIS file format to the open-source citation program Zotero (Zotero, n.d), for data extraction and content analysis, and duplicates were removed. Using Zotero enables direct access to databases and articles, as Zotero can “automatically redirect you through your institution’s proxy” (Zotero, n.d., paragraph 6). To search for additional sources of evidence, the in-text references and reference lists of initial full-text sources were examined, and 18 new records were found eligible to include in this review. These are referred to in the PRISMA flow diagram as “records added by snowballing ...”, see Figure 1 in section 3.2. This means that the in-text references and reference lists of the records from the search were examined for additional preliminary sources (Sayers, 2007, p. 759). The search strategy can be further examined in *Additional file I Search strategy*.

3.2 Source of evidence screening and selection

Following JBI-guidance, the PRISMA flow diagram shows the process of selecting sources of evidence (Peters et al., 2020, p. 440), see Figure 1. The search results offered 851 records on the 15th of December 2022. After initial duplicates were removed, 669 records were screened for eligibility. Non-eligible records concerned inappropriate subject-matters for the research question. Among these, five records concerned an incorrect age group with the subject child age exceeding 5 years old, and six records did not concern parent-child attachment or relationship. Also, 21 records did not concern parental smartphone use in this context, and as such were excluded from the results. One record was excluded because it was not in English language, and five records were non-empirical and excluded for that reason. Systematic,

scoping and literature reviews were not included in the results, but mentioned in the introduction, and have been used to synthesize the state of the knowledge so far.

The studies that had been published before the time of 2005 were excluded based on the time of the arrival of the smartphone. The first iPhone came into market in 2007 (Kiss, 2018) and online social media gained popularity from 2005 despite of being available since the 1990s (Fuchs, 2021, p. 27). Titles and abstracts were screened for 669 records, using the inclusion

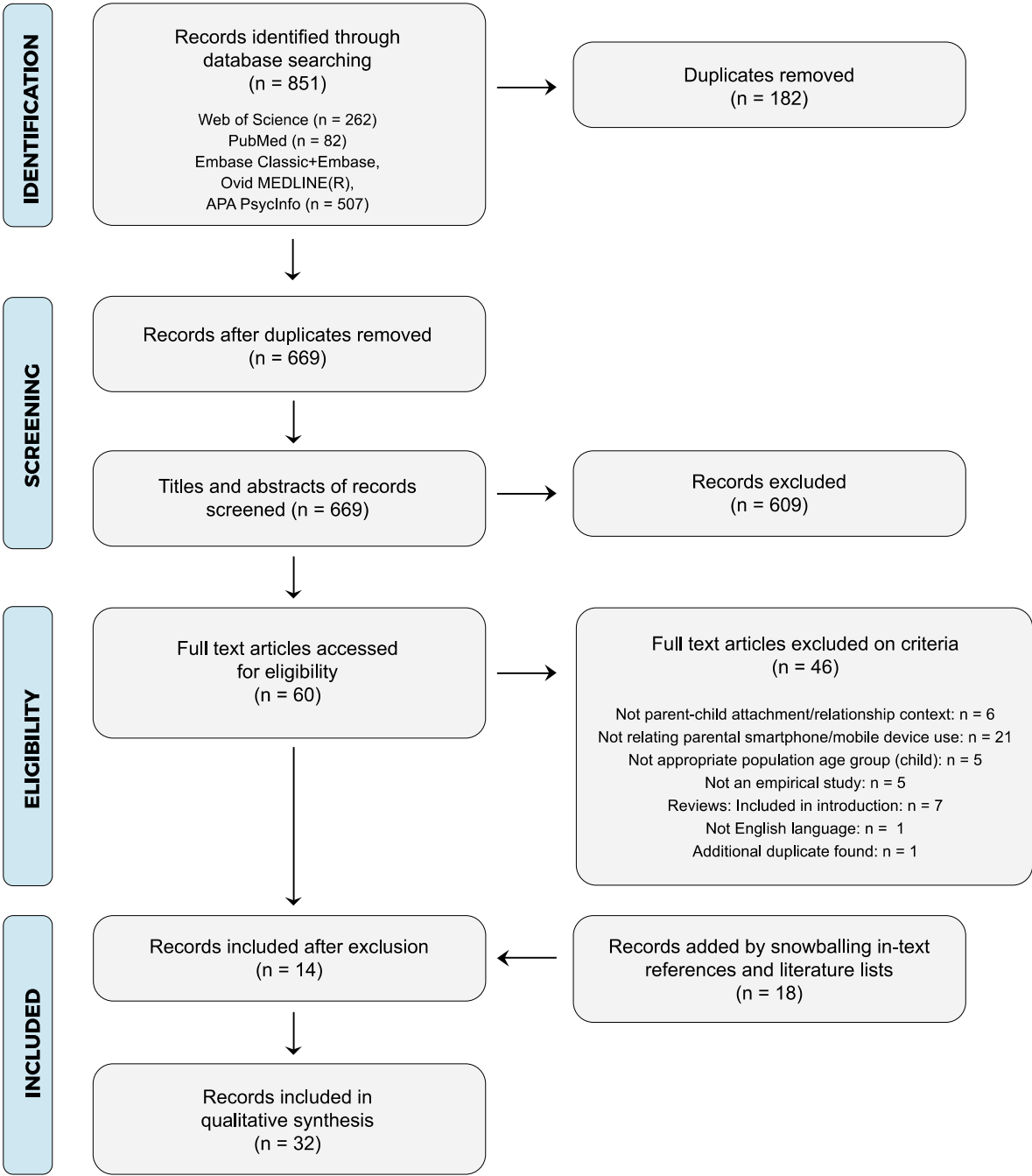


Figure 1. PRISMA flow diagram.

and exclusion criteria from *Additional file II Screening questions, eligibility criteria and data charting* to assess eligibility. An example of an excluded record is Bachaspatimayum et al.'s study, *Effectiveness of Smartphone-Use to Alleviate Preoperative Anxiety in Children*, which was found to not regard parental smartphone use's consequence on the parent-child interaction or relationship although containing many of the appropriate key words and index terms. 60 articles were obtained and examined in full text, whereof 14 proved eligible for data charting, and 18 records were as mentioned added by snowballing strategies. When the eligibility of records for the review was uncertain, a professor of library and information science was consulted to solve the matter. Thereby, the final result of records included in the current review synthesis for data extraction and content analysis is 32.

3.3 Data extraction

As the purpose of the scoping review was to produce an effective mapping of the evidence in the research field with a “descriptive summary of the main results”, data was extracted from the included records following JBI-guidance using a matrix form, as well as descriptive and analytical mapping (Peters et al., 2020, p. 435). The matrix form consisted of a charting table with extraction fields that included generic data fields common for scoping reviews (2020, p. 420) as well as extractions fields building upon the work of previously conducted reviews, see Table 1 in section 4. Column A visualised a reference number for each document included in the scoping review, which was later used for frequency counts on concepts, theories, etc (2020., p. 421). Column B was used to map the country of origin of the studies as part of mapping the context of the included study (2020, p. 435) as well as for the analytical results on study characteristics in section 4.3. Column C reported on the citation details of the document included (2020, p. 435). In this scoping review, all authors for each document were listed in column C to map which documents stemmed from the same researchers, as this is not visualised in many citation styles for articles containing three or more contributing authors. This was intended to increase the transparency of the research. The reference for each source, under column C in the Table 1, was also linked to the reference list of the document, so that the complete reference could be taken into further regard if needed. Column D mapped the purpose/objective of the included documents (2020, p. 435) as described in their abstract and/or introduction to map study methods and results relating to the concept of this review.

This scoping review's charting table also built upon the work of previous scoping and systematic reviews with similar research questions or areas of interest, namely the reviews by

Hessel & Dworkin (2018), and Kildare & Middlemiss (2017). A key extraction point rooted in Hessel and Dworkin's review (Hessel & Dworkin, 2018, p. 361) was the theory/conceptual framework field in column E, in which information about the record's theoretical background can be found, e.g., *attachment theory by Bowlby*. This extraction point visualised which documents were based on the same theoretical background and conceptual frameworks, which related to the review question and purpose of the scoping review being conducted (Peters et al., 2020, p. 435), and aided in the mapping of theory/conceptual frameworks in section 4.1.

Column F and G then further presented common extraction fields for scoping reviews, mapping type of data/method and the sample type and size (Peters et al., 2020, p. 420) for information about the included document's method, possible methodological limitations and risk of bias relating to e.g., surveys used or participant demographics. Kildare and Middlemiss' literature review (2017, p. 582) gave rise to column H, mapping variables of interest. This column extracted keywords or index terms such as *smartphone use* and shows the thematic similarities or differences between the included documents that were not extracted in column E about theory/conceptual frameworks.

Hessel and Dworkin's systematic review (2018, p. 361) researched media-use within the family perspective, and provided extraction field I, named "Measure of relationship quality". This extraction field fit this scoping review's aim of mapping study methods because it visualizes if, and if so how, the research measured the effect of technology use on parent-child relationships and child developmental outcomes. In the current review, where for example the measure of relationship quality was found to be *parent-child attachment*, it was visualized in column F if this was measured in mother's self-reports or the researchers' observations of relationship quality. Kildare and Middlemiss' literature review gave rise to the last extraction field for the extraction chart, namely key findings (Kildare & Middlemiss, 2017, p. 582) in column J. The key findings extraction field was also a suggested extraction field for scoping reviews, or "outcomes" (Peters et al., 2020, p. 435), summarising the findings of the record that are of interest to the current review, in short form. *Additional file II Screening questions, eligibility criteria and data charting*, page 2, shows the charting table without data, for clarity.

Initially, testing of the data extraction form was carried out using three publications, and peer reviewed by fellow students and a library and information science specialist at UiT The Arctic University of Norway, see acknowledgements. The data charting process was followed up by

the same specialist, and any discrepancies in data extraction were discussed and resolved in unison. This pilot testing approach is “favored by other authors on the conduct of scoping reviews” (Arksey & O’Malley, 2005; Armstrong et al, 2011; Valaitis et al, 2012, in Peters et al., 2020, p. 420).

After the data extraction process, the review continued with qualitative content analysis to identify and analyse the research themes, aims and findings (Vårheim & Skare, 2022, p. 4). This included mapping of the results regarding common theories and conceptual frameworks used in the studies; descriptively mapping the results on the effects of parental smartphone use on the parent-child attachment/relationship and/or child development; and analysis of the results regarding study methodologies. Inductive analysis was performed for the mapping purpose of this review to condense the extensive data “into a brief, summary format” and establish transparent and justifiable links “between the research objectives and the summary findings” (Thomas, 2006, p. 238). As the results part of this scoping review is extensive due to comprehensive mapping, the sections are followed by a summary of the results in section 4.4.

3.4 Analysis and presentation of results

Scoping reviews may analyse and present results in a manner of ways (Peters et al., 2020, p. 421). This review used simple frequency counts as well as descriptive and analytical content mapping to outline the results of the review (2020., p. 421). Table 1 provides a descriptive summary of central results in tabular form (2020, p. 436) from the 32 included records in this scoping review, see Table 1 in section 4. The review continues with mapping the results regarding common theories and conceptual frameworks used in the studies. This is performed using frequency counts and presents a tag cloud of common themes in section 4.1. Section 4.2 follows with a descriptive summary of significant results from the studies and the data charting process, including significant figures from the studies if these presented a significant result. Extraction and analysis on the results regarding study methodologies in section 4.3 were performed using frequency counts and presented descriptively (Peters et al., 2020, p. 436) as well as through a map chart of research locations/countries of origin.

4 Results

This section will provide an overview of significant results from the records, relating to the review question. First, Table 1 provides the data chart extracting the evidence in the research

field with a “descriptive summary of the main results” (Peters et al., 2020, p. 435). To provide a comprehensive understanding on the research theories, conceptual frameworks, results, methods and methodological limitations found in the literature, the results have been further categorized into three main themes (section 4.1; 4.2; 4.3). The first section maps key findings in the results relating to theories and conceptual frameworks found in the mapping process of the data chart, in section 4.1. Next, the results are descriptively mapped using qualitative, inductive analysis (Vårheim & Skare, 2022, p. 4) of parental smartphone use regarding parent-child attachment and child development when the child is 0-5 years old, in section 4.2. The last section analyses the methodologies of the included articles and documents, to investigate methods, possible methodology limitations and risk of bias in the research field, in section 4.3. This in an effort to answer why previous reviews found inconsistent or scattered results. A summary of results can be found in section 4.4, preceding the discussion.

Table 1. Data chart with summary of results concerning parental smartphone use and the parent-child attachment-/relationship or child developmental outcomes.

A. Ref. no.	B. Country of origin	C. Reference	D. Purpose	E. Theory/ Conceptual framework	F. Type of data (Method)	G. Sample	H. Variables of interest	I. Measure of relationship quality	J. Key findings
1	Netherlands	(Abels et al., 2018) Authors: Abels, M.; Vanden Abeele, M.; van Telgen, T.; van Meijl, H.	Observe the impact of smartphone use on parental responsiveness towards small children. Assess whether the tendency to respond and the timeliness, strength and emotionality of caregivers' responses to children's bids for attention are negatively affected by phone engagement. Investigate whether phone engagement differed from distraction by other activities when caring for a child.	Parental sensitivity and/or responsiveness by Ainsworth; Baumbrind; Feldman. Attachment by Bowlby. Child development by Dozier, Meade and Bernard, Problematic phone use.	An exploratory study in which caregiver-child dyads were systematically observed; Przybylski et al.'s 10-item FOMO scale; 7-item Self-report Habit Index; Smartphone Addiction Scale.	(n = 25) parent-child dyads between ages 0-5 years old.	Absent presence, absorption, child development, mobile media, mobile phone, parental responsiveness, phubbing.	Parents responsiveness towards their infant/child.	Smartphone use lowered caregivers' responsiveness. Caregivers were less likely to respond, and responses were weaker and less timely. Smartphone use did not predict the emotionality of the response. In intervals where caregivers were more absorbed in their smartphones, responses were less likely to occur and less timely than when the caregivers were not as absorbed. Children had to heighten their bids for attention to get parental attention when parents used smartphones, compared to when parents were distracted with other activities.
2	Jordan	(Ali et al., 2020) Ali, R. A.; Alnuaimi, K. M.; Al-Jarrah, I. A.	Examine the association of excessive smartphone use with mother-infant bonding, maternal mental health, and family functioning in Jordan.	Bonding, by Bowlby. Parental sensitivity and/or responsiveness. Excessive smartphone use.	Interview and web-based questionnaire. Smartphone Addiction Scale short version (SAS); Mother-to-Infant Bonding Scale (MIBS); 12-item General Functioning regarding family functioning; 21-item Depression, Anxiety and Stress Scale (DASS-21) regarding maternal mental health.	(n = 114) mothers with infants	Addictive behaviors, family functioning, mental health, mother-infant bonding, excessive smartphone use.	Self-report on mother-infant bonding and family functioning.	Excessive maternal smartphone use predicted poor family functioning. No association was found between mother-infant bonding and maternal excessive smartphone use.

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3	USA	(Alvarez Gutierrez & Ventura, 2021) Authors: Alvarez Gutierrez, S.; Ventura, A. K.	To examine associations between maternal technology use during mother-infant interactions and indicators of mother-to-infant attachment during early infancy.	Attachment Theory; Parental sensitivity and/or responsiveness; Child development; Problematic phone use.	Cross-sectional quantitative survey (online) including Maternal Distraction Questionnaire (MDQ), Infant Behavior Questionnaire-Revised Very Short Form (IBQ-RVS) and Maternal Postnatal Attachment Scale (MPAS).	(n = 332) parents of children ages 2-6 months.	Distraction, mother-to-child attachment, parent technology use, infant feeding, infant caregiving, infant temperament.	Mother's self-report on infant negative affectivity, mother-to-infant attachment quality and mother's hostility toward motherhood.	Greater maternal technology use was associated with greater perceptions of infant negative affectivity and poorer mother-to-infant attachment quality. Greater maternal technology use was also significantly associated with greater hostility toward motherhood. Associations between technology use and indicators of mother-to-infant attachment were not mediated by infant negative affectivity. Research gaps were found and directions for future research were to investigate the underlying mechanisms of the associations between poorer mother-infant attachment and maternal technology use.
4	USA	(Ante-Contreras, 2016) Author: Ante-Contreras, D.	Study whether parental social media use influenced a number of parental qualities and the parent-child attachment.	Attachment by Ainsworth and Bowlby; Parental sensitivity and/or responsiveness; Problematic phone use; Parental attention/distraction, Ecological theory.	Parental self-report using the Distracted Parenting Survey; Parenting Styles and Dimensions Questionnaire; Parent-Child Attachment survey.	(n = 167) parents of children 0-4 years old.	Parent-child attachment, distracted parenting, parent phone use, parent social media use, parenting styles, parent-child bonding, child injuries due to parental social media use.	Parent-child attachment from parental self-report.	The study regarded parental social media use as an extension to parental smartphone use: 97% of respondents used phones to access social media. Parents who spent more time on social media were more likely to react harshly to their children, like use physical punishment, threats or other negative consequences (authoritarian parenting techniques, p. 35). Parents with a low educational background were more likely to spend more time on social media. 60% of the parents responded using social media 3 or more times per day, while 15% of the parents responded using social media constantly.
5	USA	(Courtney & Nowakowski-Sims, 2019) Authors: Courtney, J. A.; Nowakowski-Sims, E., 2018.	To highlight the impact of technology on children and infants, its impact on the parent-child attachment relationship and then to present a new infant play therapy intervention not including technology use.	Attachment Theory by Bowlby, Modern Attachment Theory by Schore and Schore.	Case vignette of play therapy with instructor, mother and infant.	(n =1) parent of child aged 1 month.	Parent-child attachment, infant development, portable device use, first play experiences and therapy, massage.	Home observations of mother-child interactions, mother's report on relationship quality with her infant.	Parent digital technology use via smartphones and tablets was found to be a modern-day threat to the parent-child attachment and healthy child development. A parent introduced to instructed play therapy and education on social and emotional needs of child development was found to better her relationship and bonding with her infant, and her own mental health.

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6	USA	(Coyne et al., 2022) Authors: Coyne, S. M.; Shawcroft, J.; Gale, M.; Reich, S. M.; Linder, L.; McDaniel, B.; Stockdale, L.; Booth, M.	Examine the impact of parental media use while feeding infants on the development of infant attachment, parent/infant relationships, and dysfunction during the first year of the infant's life. Qualitatively examine mothers' experiences with media use while feeding infants.	Attachment Theory by Bowlby; Ainsworth; Barbaro; Parental sensitivity and/or responsiveness; Technoference.	Cross-sectional qualitative study and mixed methods longitudinal study. Project M.E.D.I.A., IGDI-IPCI (Early Growth and Development Indicator-Indicator of Parent Child Interaction), PSI (Parenting Stress Index—Short Form), AQS (Attachment Q-Sort).	(n = 325) primary caregivers of infants. (n = 76 for study 1, n = 249 for study 2) In study 2, 263 were mothers and only five were fathers.	Parent-infant attachment; dysfunction and relationship quality, technoference, infant feeding, smartphone use, infant cues, mutual gaze, digital home environment, mother's reasons for media use while feeding	Study 1: none mentioned. Study 2: Early Growth and Development Indicator – Indicator of Parent Child Interaction (IGDI-IPCI); Attachment Q-sort scores; Parenting Stress Index – short form (PSI)	Media use while feeding was positively related to parent-child dysfunction but was also related to less parent-child dysfunction a year later. Authors correlated this finding with parental use of media to alleviate stress, loneliness, frustration, pain or boredom, which could create more positive associations with feeding. They found no evidence of attachment instability due to media use while feeding, though attachment was not measured longitudinally.
7	Israel, Canada	(Davidovitch et al., 2018) Authors: Davidovitch, M.; Shrem, M.; Golovaty, N.; Assaf, N.; Koren, G.	Discover if child development can be affected by parental smartphone use, specifically for autistic spectrum features of development such as joint attention development and social cognition.	Joint attention by Mundy and Jarrold; Joint attention by Eggebrecht et al.; Child development and autism spectrum disorder.	Observations of parents and infants in developmental assessments in two clinics.	(n = 111) parents and infants (no infant age described in study).	Parental smartphone use, infant autism spectrum diagnosis, environmental changes such as the occurrence of the smartphone.	None.	Parental phone use has the ability to be a major parental distraction, disrupting eye contact and joint visual attention with infants, which is crucial for infants' development and later development of social skills. Joint attention is theorised to lay the foundation for basic social-communicative functioning and language development, as well as empathy and theory of mind (Eggebrecht et al., 2017, p. 1710). Significantly more parents of children with language and motor delays used their phone during the assessments, providing a link between parental smartphone use and infant development and social cognition. 66% of parents used their phone during child assessment and 83,9% of parents used it in the waiting room. 30,8% used it for more than 50% of the time in the waiting room.

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8	Australia	(Ewin et al., 2021) Authors: Ewin, C. A.; Reupert, A.; McLean, L. A.	This study explores the relationship between independent and joint caregiver device use and a wide range of attachment behaviors; second, it acknowledges the bidirectional nature of attachment relationships by evaluating how young children behave throughout individual and joint use.	Attachment theory, by Ainsworth; Parental sensitivity and/or responsiveness; Child development; Parental attention/distraction; Technoference.	Qualitative naturalistic observations of caregiver-child dyads in Australian malls.	(n = 66) caregivers of children < 12 years, observation time average 20.59 minutes. 50% of the children were of estimated age 0-4 years.	"Absent presence", insecure/secure attachment style, parental distraction, parental warmth, the influence of devices on parent-to-child communication, the impact of devices on other forms of stimulation such as joining play, shared eye-contact, and scaffolding.	Parents attentiveness, initiative, responsiveness and aggression towards children. Children's behaviour towards caregiver (engagement, interaction, attention seeking)	Parental device use has a detrimental impact on parental responsivity, sensitivity, engagement with children and dependent on the level of technoference and warmth. By engaging less often with children or sharing low quality interactions, there may be an increased risk of reduced attachment security. Some device use may have reflected responsive parenting and supported a strong parent-child relationship and development, e.g., through having parenting breaks and gaining social support while giving the child time for independent exploration of play to develop independence. Fifty-four of 66 caregivers used mobile devices in Australian playgrounds and food malls. Device using caregivers joined play, began conversations and responded to children less often than non-device using caregivers. Four device using caregivers were unresponsive when their children were in risky situations. During caregiver device use, children either continued their activities, sought attention or escalated their attentional bids.
9	Canada	(Glick et al., 2022) Authors: Glick, A. R.; Saiyed, F. S.; Kutlesa, K.; Onishi, K. H.; Nadig, A. S.	Review evidence on advantages of video chat over other screen media for word learning and socio-emotional development in 1-to 3-year-olds.	Communication science, learning, language acquisition and psychology: child development; Attachment theory.	Empirical article.	N/A. Not an independent study.	Social-emotional development, video chat, social contingency, word learning, young children, contingent dyadic social interactions, visual cues, gestures, turn-taking, triadic interactions, multi-party interaction.	Attachment security and contingent communication (timely and appropriate responses, shared interest/environment).	Creating trusting relationships through contingent interactions and maintaining bonds with family members even when they are physically distant is critical [for the infant/toddler] and can be accomplished by video chat. Video chat is limited compared to in-person dyadic interaction because of (1) potential technical difficulties; (2) not making eye contact and that (3) shared physical contact and manipulation of objects is absent. These limitations can in turn reduce social contingency. In-person interactions remain the gold standard for caregivers to provide physical comfort to-, engage with-, and teach children.

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10	USA	(Golen, R. P., & Ventura, A. K. 2015) Authors: Golen, R. P.; Ventura, A. K.	Describe mothers' engagement in distraction during infant bottle-feeding ("mindless feeding") by stimuli such as mobile devices.	Child development; Attachment theory by Ainsworth, Bowlby, etc.; Parental sensitivity and/or responsiveness; Parental attention/distraction.	Mothers' self-report, Infant Behavioural Questionnaire - Revised Very Short Form (IBQ-R)	(n = 66) caregivers of infants < 6 months of age.	Infant feeding by bottle, maternal feeding practices (distractions), mother-infant interactions, mother-infant attachment, parental sensitivity, parental attention.	Infants' level of surgency/extraversion, orienting/regulation capacity and negative affect.	Mothers reported technological distractions during almost one-third of feedings (32,4%). Of these reported distractions, most were technological (~62%). 48% of the feedings were reported with doing nothing else or interacting with the infant. As such, the majority of the feeding interactions may not have synchrony due to mothers being distracted, where the level of absorption/immersion would depend on distraction type (visually and/or cognitively engaging). The study highlights a need to manage and minimize distractions during infant care to optimize the quality of interactions between mothers and their young infants, as maternal sensitivity to infant feeding cues plays a role in shaping infants' development of self-regulation abilities and attachment security. The study found it possible that mothers who engaged in "mindless feeding" also places their infant at higher risk of overfeeding and weight gain, although their findings from mothers' self-reports did not support that claim.

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11	Australia	(Hood et al., 2021a) Authors: Hood, R.; Zabatiero, J.; Silva, D.; Zubrick, S. R.; Straker, L.	Explore how the first wave of the COVID-19 pandemic influenced family routines, relationships and technology use (smartphones and tablet computers) among families with infants.	Attachment theory by Bowlby, and Ainsworth et al.; Family systems theory by White and Klein; the bioecological model by Bronfenbrenner and Morris and the human-computer interaction model by Straker and Pollock, and Straker et al; Child development; Parental attention/distracti on.	Semi-structured qualitative interviews by audio or video call, adapted from the Maternal Postnatal Attachment Scale (MPAS).	Convenience sample of (n = 30) mothers of infants 9-15 months old.	Impacts of device use on parent-child attachment. Impact of pandemic on family routines such as technology use. Mobile touch screen device use in an integrated family system.	Parents' thoughts, feelings and behaviours towards their infant, based on answers to interview questions used to evaluate parent-to-infant attachment.	Access to devices have played a positive role, as feelings of isolation and loneliness (in relation to COVID-19) were mitigated to a degree by continuing virtually with their activities and staying in touch with extended family and friends via mobile devices. Devices were also a form of distraction towards family members who were actually present, but benefits and disadvantages of mobile device use was related to the nature of use, not the amount of use. Proposed a model of family human-computer interaction (in a COVID-19 context) "recognising the importance of considering multiple layers of influences on relationships and device use" (see Figure 1, p. 2). Researchers sought for more studies investigating associations between mobile device use, parent-child attachment and child development outcomes unrelated to the COVID-19 situation to further recommend guidelines for mobile device use to the family situation.
12	Japan	(Inoue et al., 2021) Authors: Inoue, C.; Hashimoto, Y.; Ohira, M.	Examine mothers' habitual use of smartphones and their observations of their infant during breastfeeding and identify changes in the relationship between mother's breastfeeding habits and bonding with their infants.	Bonding by Klaus, Kennel and Klaus. Parental sensitivity and/or responsiveness; Parental attention/distracti on; Technoferece.	Online longitudinal survey based on mothers' self-report and using the Mother-Infant Bonding Scale: Japanese version (MIBS-J).	(n = 195) mothers of infants aged 1-10 months old.	Habitual parental smartphone use, parental smartphone disturbance on mother-infant bonding, nature of smartphone use, mothers' observations of infant during smartphone use.	Mothers self-report on bonding using MIBS-J (Mother-Infant Bonding Scale – Japanese version) at 1-3 months, and subsequently 6 months after, rating whether they felt loving; resentful; neutral or felt nothing; joyful; dislike; protective; disappointed or aggressive towards their infant (Taylor et al., 2005, p. 50).	Using smartphones while breastfeeding could negatively impact the mother-infant interaction quality, but the correlation to habitual smartphone use and bonding over time was not clear. Rather, most women reported to using smartphones while still observing their infant feeding (68%), reporting most common uses to be "searching, browsing, selecting (online shopping etc.)" and "checking the screen (time and notifications)". 2% reported only looking at their smartphone and not paying attention to their infant, while 86% reported not watching long videos while feeding the infant.
13	Japan	(Inoue et al., 2022)	Investigate the association between maternal smartphone use during breastfeeding and	Bonding by Klaus, Kennel and Klaus; Parental	Observation (video-recordings) of breastfeeding in	(n = 13) mother-infant dyads	Distracted breastfeeding, maternal smartphone	Researchers' assessment of Mother-Infant	Smartphone use might continually affect maternal responsiveness. Smartphone use increased the time of maternal distraction

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		Authors: Inoue, C.; Hashimoto, Y.; Nakatani, Y., Ohira, M.	the quality of mother-infant interactions and maternal visual responsiveness to the infant's bids for attention.	sensitivity and/or responsiveness; Attachment theory; Technoference.	laboratory settings that simulated the dyads daily environment with daily use of smartphones, and subsequently without smartphones. Assessment of Mother-Infant Sensitivity (AMIS) scale – Japanese version.	(totals 26 participant count) with infants between 2-6 months old.	use, mother-infant interaction, mother's gaze, maternal visual responsiveness, infant's attention bids.	Sensitivity (AMIS) scale – Japanese version. Mother-infant bonding was measured using mothers' reports on the Mother-to-infant Bonding Scale – Japanese version (MIBS-J). Quality of mother-infant interaction was measured through the observation of mother-infant behaviour and mother's gaze.	during breastfeeding, from distracted 0.5% of the time without the smartphone, to distracted 19.5% of the time with the smartphone. Smartphone use interfered with the mother's ability to respond visually to the infant's bids for attention, this included when the child tried to push the smartphone out of the way and when the child choked. Mothers' responses were restricted because of prolonged smartphone use, especially when sending messages. Mothers were not able to send a message and simultaneously respond to her child (also called multitasking). Smartphone use during breastfeeding may result in the mother ignoring her child's bids for attention. These bids escalated with the mother's use of the smartphone.
14	USA	(Jester, 2019) Author: Jester, C. B.	Examine how infant and toddler behavior issues can be caused from attachment needs not being met with caregivers, lack of caregiver knowledge of nurturing and attachment, toxic stress and adverse childhood experiences, such as effects of modern technology.	Nurturing and attachment by Bandura's model of causation; Honig; Bowlby; Ainsworth; Maslow and Erikson; Parental sensitivity and/or responsiveness; Child development; Parental attention/distraction.	Qualitative study with in-depth interview methodology	(n = 10) early childhood caregivers	Theory related to nurturing and attachment and a comparison and alignment with current practices in early childhood settings. Effects of modern technology (esp. smartphones) on the caregiver-child relationship.	N/A	Based on the available literature the researcher concluded that caregivers' disengagement and tendency to being tuned out because of their smartphone use was a severe problem for children's development. Caregivers' smartphone use could be considered "a direct danger" to infants' and toddlers' development, as it was stated to withhold a basic need from the child: interrupting interactions that are necessary for the child's brain growth and cognitive needs. Caregivers' smartphone use (non-engagement in the child) was found to be a form of psychological withdrawal and non-responsiveness that could hinder the caregiver from providing uninterrupted and predictable care. The researcher found that the caregiver would be present physically but not emotionally, while the child needs fluent conversations, uninterrupted interactions and learning of social cues to grow and thrive. Smartphone use could therefore hinder caregivers in connecting with the child and participating in interaction with them, depriving the child of "experiences that promote cognitive growth".

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15	USA	(Kildare, 2017) Authors: Kildare, C. A.	The study explores 3-6-month-old infants' behavioural and physiological responses to mothers' screen distractions during mother-infant interactions using a modified still-face procedure.	Attachment by Ainsworth; Face to face interaction and relation to infant-mother attachment by Blehar, Lieberman and Ainsworth; Developmental psychology by Gunnar et al; Parental sensitivity and/or responsiveness; Parental attention/distraction; Language acquisition; Parent addiction; Infant's stress response system.	Study including modified Still-Face Procedure, self-report on The Media and Technology Usage and Attitudes Scale (MTUAS).	(n = 34) mother-infant dyads, infant age 3-6 months old.	Infant behavioural and physiological responses to mother's mobile phone use.	Infant positive and negative affect, infant regulation.	When the mother was texting, infants decreased looking at the mother and increased comforting behaviour and escape attempts, in line with the expected Still-Face effect. Infant positive emotionality decreased, and infant negative emotionality increased. The research showed no significant change in infant cortisol levels due to mothers' texting behaviour. Maternal sensitivity, maternal responsiveness and dyadic interactions (synchrony) is suggested to be researched in further work regarding maternal smartphone use during the procedure, especially parental lack of facial expressions and eye contact.
16	UK, USA	(Larkin et al., 2019) Authors: Larkin, F.; Oostenbroek, J.; Lee, Y.; Hayward, E.; Meins, E.	To evaluate parenting intervention through the use of the smart-phone app BabyMind, aimed to facilitate mothers' "mind-mindedness" - attunement to their infants' internal states. The purpose of the app was to provide psychoeducation around infant development and mind-mindedness to insure a secure infant-caregiver attachment.	Attachment theory and social development of cognition, by Meins; Parental sensitivity and/or responsiveness; Child development.	Qualitative study including mother's registering via smartphone app and video observation from a 10-minute free play session	A total sample of (n = 217) mothers of infants, whereof (n = 66) in the intervention group (and n = 151) in the control group.	Mind-mindedness, Mind-related comments (MRC), infant-caregiver attachment, parental training (information about infant psychological development), parental interventions, smartphones, applications, socio-economic status (SES), parental age.	Appropriate vs. non attuned mind-related comments from mother to child.	The study showed that parenting intervention with a smartphone app facilitates mothers' "mind-mindedness", or attunement to their infants' internal states. The mothers who received the intervention had more mind-related comments and less non-attuned comments during a free play session 6 months after starting to use the app. It proved equally effective in facilitating attunement in younger and older mothers. These findings suggest that the intervention helps to reduce the disadvantage in mind-mindedness typically associated with being a younger mother. It was also demonstrated that the more often users reported engaging with the BabyMind app, the fewer non-attuned mind-related comments they made during actual infant-mother interaction.

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17	USA, Israel	(Lemish et al., 2020) Lemish, D.; Elias, N.; Floegel, D.	Examine in depth the implications of mobile device use for the quality of parent-child interaction and parental emotional availability, as well as the aspects of mobile device use related to children's safety, emotional well-being and social learning.	Child development by e.g., Ginsburg, attachment and inner working model by Bowlby; Parental sensitivity and/or responsiveness; Bonding; Technoference.	Qualitative study based on naturalistic observations in playground.	(n = 60) families with toddlers (2-3 years old) or preschoolers (4-6 years old)	Phubbing, parental mobile device use, absorption, parent-child attunement, parent-child interaction, technoference, parent emotional availability, parental disengagement, the mediatization of childhood, parental screen distraction (PSD), child development, dyadic synchrony.	Observations of child affect and attentional bids. Observations of caregiver affect and emotional support.	79% of parents used their phone at least once in the playground, and the average usage time was about a third of the entire time spent on the playground. Most children tried to obtain their parent's attention, and communicated defeat when they did not obtain it. Children were found to act disappointed, frustrated or sad as a response. Parental distractions with (mainly smart-)phones were the most common and most pervasive type of parental distraction. This put children at safety risk, made parents less (or non-)responsive and lacking emotional support and scaffolding. If parent distraction with their smartphone is constant, their child will be put at a developmental disadvantage from the ignoring, lack of scaffolding and lack of interactions, risking children's safety, emotional well-being and development.
18	China	(Lv et al., 2022) Authors: Lv, H.; Ye, W.; Chen, S.; Zhang, H.; Wang, R.	Explore the mediating role of mother-child attachment in the relationship between mother phubbing and children's emotional and behavioral problems, as well as maternal parenting stress.	Attachment theory by Ainsworth and Bowlby, inner working model, and family ecosystems theory by Bronfenbrenner; Parental attention/distraction; Child development; Parental acceptance/rejection theory; Parenting stress; Child emotional and behavioural problems.	Cross-sectional study surveying mothers using the Phubbing Scale, the Parent-Child Attachment Scale (Attachment Q-sort), Parenting Stress Index-Short Form (PSI-SF) and Strengths and Difficulties Questionnaire (SDQ) via self-report.	(n = 998) mothers of toddlers aged 3-6 years old.	Mother phubbing, mother-child attachment, children's emotional and behavioural problems (EBP), maternal stress.	Parent-child attachment, parental stress and child emotional and behavioural difficulties.	Mother phubbing (ignoring the child while on her phone) was significantly and negatively correlated to children's emotional difficulties and behavioural problems. Maternal stress enhanced the problem, while mother-child attachment served as a protective factor, relieving the problem.

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19	Australia	(Mangan et al., 2018) Authors: Mangan, E.; Leavy, J. E.; Jancey, J.	Understand how carers and parents use mobile devices while at the playground with children aged five years and younger. Examine their associated beliefs about mobile device use whilst caring for a child.	Early child development by Darling-Churchill & Lippman; Velea & Tamburlini; and Phillips & Shonkoff. Parent-child bonding by Ginsburg. Parental sensitivity and/or responsiveness.	Mixed methods approach with observations (n=50) and interviews (n = 25)	(n = 50) parents/carers of children up to five years of age.	Parent-child interaction, parent-child bond, parental phone use, type of use, time on device, parental beliefs about device use.	Parent-child interaction, child's bids for attention, ignoring child bids, parents leaving the interaction.	Opportunities for parents and children exchanging information, building social skills and role modelling may be diminishing in playgrounds and restaurants with the advent of parental mobile phones. Mobile device use may impinge on activities such as interaction with children during their formative years. Of the 50 observed parents/carers, 76% (n = 38) used their mobile device during the 20-minute observation period. The mean time that parents/carers were observed using their mobile device during the 20 min observation was almost 4 minutes with times ranging from 0 minutes to 17.5 minutes. Most (n = 22) used their device for less than 5 minutes. 6.7% of the total time on phones was spent using photo or video functions, which could be more of a shared activity with the child than 69.9% of the time on typing tasks and 23.7% on talking tasks. 47.9% of the time was spent while the child independently played, while 19.5% of the time consisted of talking interaction and only 2.3% of play interaction. Many parents/carers thought that the playground was a safe place to be distracted by their phones.
20	USA	(McDaniel & Radesky, 2018b) Authors: McDaniel, B. T.; Radesky, J. S.	Investigate longitudinal bidirectional associations between parent technology use and child behavior, and understand whether this is mediated by parenting stress.	Parental responsiveness, early life toxic stress, child development: early social relations by Sameroff; Technoference; Child emotional and behavioural problems.	Self-report surveys: Technology Device Interference Scale (TDIS); Child Behavioural Checklist 24 item (CBCL); Parenting Stress Index short form (PSI); Coparenting Relationship Scale, 35 items; Centre for Epidemiologic Studies Depression Scale (CES-D), child screen use.	(n = 183) couples with a child aged 5 years or younger, follow up assessments at ~1, 3, and 6 months.	Technoference (Technology Device Interference), parental stress, coparenting quality, and child emotional and behavioural difficulties.	Parental stress and child emotional and behavioural difficulties.	Higher technoference (technology-based interference in parent-child interactions) was connected to greater child externalizing and internalizing behaviour for both mothers and fathers and was also connected to higher parenting stress. For mothers, technoference was also related to more depressive symptoms, and for fathers technoference was related to lesser coparenting quality. Mobile devices and other digital technology are potentially serving stress-relieving purposes for parents, but at the same time potentially displacing opportunities for parent-child connection important to child health and development.

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21	USA	(McDaniel & Radesky, 2018a) Authors: McDaniel, B. T.; Radesky, J. S.	Examine cross-sectional associations among problematic parent digital technology use (e.g., having trouble resisting the urge to check the device, using the device too much, etc.), technoference (i.e., technology interference) in parent-child interactions, and child behavior.	Parental responsiveness and child social-emotional outcomes; Problematic phone use; Parental attention/distraction; Technoference.	Self-report surveys: parent problematic digital technology use, 3 items; Technology Device Interference Scale; Child Behavioral Checklist, 36 items for internalizing behaviour and 24 items for externalizing behaviours, Coparenting Relationship Scale, 35 items; Center for Epidemiologic Studies Depression Scale (CES-D), Parenting Stress Index short form (PSI); child screen use.	(n = 170) couples with a child aged 5 years or younger, follow up assessments at ~1, 3, and 6 months.	Child behaviour problems, parental absent presence, parental technoference, parenting stress, parental depression, parent-child interaction quality, coparenting relationship.	Parental stress and child emotional and behavioural difficulties.	Even low and seemingly normative levels of technoference were found to be related to greater child behaviour problems. 48% of parents reported technoference (technology-based interference in parent-child interactions) to occur 3 or more times on a typical day. Both mothers and fathers reported greater internalizing problems by their child when reporting more maternal technoference, but not by paternal technoference. Mothers also reported more child externalising problems. Fathers reported more parenting stress, more depressive symptoms and worse perceptions of coparenting when experiencing more technoference. Parental problematic digital technology use significantly predicted technoference.

A. Ref. no.	B. Country of origin	C. Reference	D. Purpose	E. Theory/ Conceptual framework	F. Type of data (Method)	G. Sample	H. Variables of interest	I. Measure of relationship quality	J. Key findings
22	Croatia	(Merkaš et al., 2021) Authors: Merkaš, M.; Perić, K.; Žulec, A.	Test the possible moderating role of parents' emotional stability on the relationship between parent distraction with technology and child social competence during the COVID-19 pandemic.	Attachment theory by Ainsworth and Bowlby, inner working model; Parental sensitivity and/or responsiveness; Child development; Parental attention/distraction; Technoference; Child emotional and behavioural problems; Child social competence; Social learning theory; Parenting style, Parent emotional stability.	Cross-sectional study including parental self-report on Distraction in Social Relations and Use of Parent Technology (D.I.S.R.U.P.T), Technology Interference in Parenting Scale (TIPS), parental emotional stability from the International Personality Item Pool (IPIP 50), child social competence from the Social Competence Scale – Parent Version.	(n = 281) with oldest child ranging from 3 – 14 years old.	Parent distraction with technology, child social competence, parents' emotional stability, technology interference, technoference, digital devices, parent-child interaction, pandemic situation.	Parental self-report on child social competence.	Nearly 20% of parents reported that technology interfered with or interrupted "playtime" (17,5%) and "spending time with child" (18,2%) often or very often. Parents' experience of overall technological interference in parenting predicts lower levels of child social competence. This effect is moderated by parents' emotional stability. A higher frequency of technological interference in parenting is related to lower emotional regulation and poorer prosocial behaviour in children. This can interfere with the child's development of attachment and building of a secure inner working model, lowering the child's level of social competence. Suggests counsellors to educate parents on the negative effects of technological interference in parenting on child development as well as working with parents on acquiring skills of emotional regulation and skills necessary for reducing stress due to digital technology use and technological interference.
23	USA	(Myruski et al., 2018) Authors: Myruski, S.; Gulyayeva, O.; Birk, S.; Pérez-Edgar, K.; Buss, K. A.; Dennis-Tiwary, T. A.	Investigate the impact of parental mobile device use on infant development, infant social-emotional functioning, and parent-infant interactions. Establish whether a modified SFP (Still Face Paradigm) that incorporates maternal mobile device use could serve as an analog to the original SFP, probing the impact of distracted or unresponsive parents on child socioemotional behavior. Examine whether or not maternal device use habits predict individual differences in infant behavior during the SFP.	Psychology; Developmental science: infant affect and affect regulation, mother's physical and emotional unavailability on emotion regulation (Field), Parental sensitivity and/or responsiveness.	Study utilizing a modified version of the classic Still Face Paradigm (SFP) being video-recorded and surveys: IBQ-R (Revised Infant Behaviour Questionnaire Short Form) or TBAQ (Toddler Behaviour Assessment Questionnaire). Parental reports on their typical mobile device use.	(n = 50) infants aged 7.20 to 23.60 months with their mothers.	Still Face Paradigm, parent attentiveness, parent mobile device use, parent-infant affect, children's social-emotional development, mother's engagement, infant social-emotional functioning, parent-infant interactions, parent sensitivity, attachment.	Observations of infant behaviors during the SFP (negative affect, positive affect, engagement with toy or other object, engagement with mother, social bids, room exploration). Complimented with parents filling out survey IBQ-R (Revised Infant Behaviour Questionnaire Short Form) or TBAQ (Toddler Behaviour	Infants were showing the most distress when mothers were disengaged. Greater maternal habitual device use was associated with less room exploration. More frequent device use in front of infant was associated with less positive affect. During the maternal distraction phase of the study, infant negative affect increased, positive affect decreased, and infant social bids escalated drastically to re-engage the mother. Infants were less interested in toys and exploring the room after the maternal distraction phase, and the researchers speculated this to be because the infant was busy re-engaging with the mother. Maternal self-reports on device use did not predict infants' reactions during the SFP.

A. Ref. no.	B. Country of origin	C. Reference	D. Purpose	E. Theory/ Conceptual framework	F. Type of data (Method)	G. Sample	H. Variables of interest	I. Measure of relationship quality	J. Key findings
								Assessment Questionnaire).	
24	Israel	(Nomkin & Gordon, 2021) Authors: Nomkin, L. G.; Gordon, I.	Explore the decrease in mothers' attention to her infant cues due to smartphone use in this digital age, especially early in life in the primary interactive contexts of breastfeeding and face-to-face interactions, and the consequences for infant cognitive, emotional, and social development.	Infant development: parent-infant synchrony by Feldman; developmental psychology by Northrup & Iverson; Neuropsychology by Baram & Bolton; Breastfeeding, sensitivity and attachment by Britton et al.; Bonding; Problematic phone use; Parental attention/distraction; Infant's joint attention; Parent-child synchrony.	Study using gaze tracking glasses, video recording of interaction and physiological measuring instruments. Surveys: Smartphone Addiction Scale (SAS); The Infant Behavior Questionnaire– Revised Very Short Form (IBQ-R); The Mobile Attachment Scale (MAS), The Maternal-to-Infant Bonding Scale (MIBS); The short form of the State-Trait Anxiety Inventory; The Affect Grid.	(n = 20) mothers and infants, infant ages 3-6 months old.	Maternal smartphone use, gaze patterns during breastfeeding and face-to-face interactions, physiological responses.	Maternal-to-infant bonding scale (MIBS).	The mothers' gaze towards their infants decreased when breastfeeding while using the smartphone compared to face-to-face interaction, indicating that the context of breastfeeding may allow for a break in attention that face-to-face interaction with the infant does not. Longer gaze fixation on the smartphone led to higher physiological arousal in the mothers than lower use. Having to put the smartphone on mute and putting it away in a bag also heightened the mothers' state of arousal, possibly for the lack of control over the content. The article did not report on the result on mother-to-infant bonding.

A. Ref. no.	B. Country of origin	C. Reference	D. Purpose	E. Theory/ Conceptual framework	F. Type of data (Method)	G. Sample	H. Variables of interest	I. Measure of relationship quality	J. Key findings
25	USA	(Ochoa et al., 2021) Authors: Ochoa, W.; Reich, S. M.; Farkas, G.	Observe caregiver-child dyads in socioeconomically diverse public settings to investigate whether mobile device use was related to 5 key components of high-quality caregiver-child interactions typically studied in TV research: 1) joint attention, 2) parental and child initiation of interactions, 3) parental sensitivity and responsiveness, 4) parental and child talk, and 5) parental and child emotions.	Early parent-child interactions and early literacy development, media effects on quality of parent-child interactions; Infant's joint attention; Child development; Parental sensitivity and/or responsiveness.	Non-participant anonymous observations in public spaces.	(n = 98) caregiver-child dyads where the child appeared to be 4 years or younger.	Smartphones, mobile device use, joint attention, initiation of interaction, responsiveness, talk, positive emotions, negative emotions, affect.	Caregiver-child quality of interaction.	Mobile device use lowered the quality of caregiver-child interactions through changing adult behaviour. Absorbed users were less responsive to their child and engaged in less joint attention. The probability of caregivers engaging in joint attention, initiating interactions with the child, talking and displaying positive emotions was lower when using a mobile device than when they did not. Children did not show less positive affect or start less conversations, and so changes in interaction quality was deemed to be caused by adult distraction with the device. The quality change of the interaction depended on the activity type with the mobile device. The quality lessened when the adult was scrolling or texting, but not as much when they were taking a picture of the child or just looking at the screen.
26	USA	(Stockdale et al., 2020) Authors: Stockdale, L. A.; Porter, C. L.; Coyne, S. M.; Essig, L. W.; Booth, M.; Keenan-Kroff, S.; Schvaneveldt, E.	Study the influence of technoferece on parent–infant interactions and infant behaviors using a modified Still Face Paradigm (SFP) with mobile phones in the participants' homes. Examine whether patterns of parental technoferece as well as parental beliefs about the appropriateness of device use in the presence of infants is linked to infants' behaviour during the SFP.	Technoferece by McDaniel; Infant development including attachment formation, emotional regulation and social, motor, language and cognitive development (several theorists, see p. 573). Mother's physical and emotional unavailability on emotion regulation (Field), Parental sensitivity and/or responsiveness; Parent-child synchrony, Child self-regulation capacity; Parent-child interaction;	Study including modified Still Face Paradigm with in-home observations, and surveys of parental technoferece occurrence and parental technoferece beliefs.	(n = 227) parent–infant dyads, 221 mothers, three fathers, and three unknown.	Technoferece, primary caregivers' disengagement, disruptions to parent–infant interactions due to mobile phone use, affect, infants' self-comforting behaviors.	SFP. Behavioural coding: Positive affect, negative affect, self-comforting behaviours, parent orientation, object orientation and escape behaviours.	Results showed a robust still-face effect indicative of distress/discomfort to parental technoferece. Infants displayed increased negative affect, decreased positive affect, increased self-comforting, increased object orientation, and increased escape behaviours during the "Still face" or phone distracted phase of the paradigm and frequently failed to return to baseline during the reunion phase. For all infants, parent technoferece beliefs (how appropriate parents reported thinking it was to use media with their child) were associated with lower negative affect.

A. Ref. no.	B. Country of origin	C. Reference	D. Purpose	E. Theory/ Conceptual framework	F. Type of data (Method)	G. Sample	H. Variables of interest	I. Measure of relationship quality	J. Key findings
				Infant's stress response system.					
27	Sweden	(Sundqvist et al., 2020) Authors: Sundqvist, A.; Heimann, M.; Koch, F. S.	Investigate how Swedish families' digital media use is related to the child's behaviour: internalized and externalized behaviour and prosocial behaviours.	Child psychology and developmental science, Problematic phone use; Parental attention/distractio; Technoference, Language acquisition; Child emotional and behavioural problems; Self-regulatory capacity; Parent-child interaction; Prosocial behaviour.	Online anonymous survey of 60 questions including demographic data, technology use, technoference and problematic cell phone use, and the child's behaviour (Strengths and Difficulties Questionnaire [SDQ]). The media survey originated from the Comprehensive Assessment of Family Exposure (CAFE) tool, and the questions regarding technoference were adapted from McDaniel and Radesky.	(n = 152) parents of children aged 4 and 5 years old.	Technoference in the parent-child interaction, child behavior, problematic cell phone use by parents, digital media use and the omnipresence of smartphones.	Parents' report on child strengths and difficulties.	The study showed that parent perceived technoference, triggered by the parent's use of digital media, is associated with an increase in reported internalized and externalized child behaviour problems. Technoference was experienced daily as an interruption in interpersonal interactions due to parents' media use, but also due to the children's media use. A possible explanation of the observed increase in the children's problematic behaviour repertoire is that it is caused by decreased parental attention, due to the parent's preoccupation with their digital devices, which may affect the child's ability to develop emotion regulation. This can in turn result in more internalizing and externalising behaviour, as the parent is preoccupied and emotionally unavailable to help the child with their emotions.
28	USA	(Tomfohrde & Reinke, 2016) Authors: Tomfohrde, O. J.; Reinke, J. S.	Address breastfeeding mothers' use of technology such as Facebook while breastfeeding. Bridge the gap between breastfeeding habits and technology use to account for technological distractions in mother-child interactions.	Attachment theory by Ainsworth & Bell, and Bowlby; Early relationships and eye contact, by Lohaus; Parental sensitivity and/or responsiveness; Parental attention/distractio; Parenting stress; Social media.	Descriptive statistical study with survey.	(n = 309) mothers over the age of 18 years old who were or had been breastfeeding in the previous five years.	Smartphone use while breastfeeding, particularly social media; Facebook. Parent-child attachment, child developmental outcomes. Technology.	Not measured.	Only mothers with social media were recruited. Of these, 96% reported using social media while breastfeeding. 49% of the participants used social media or email "often" while breastfeeding, while 28% reported using it "all the time" while breastfeeding. Of these numbers, 92% reported using Facebook. Results of the study indicate that the opportunity for eye contact may be disrupted by the surge in technology and social media use, though not being able to definitely conclude that using technology is preventing mothers from making eye contact.

A. Ref. no.	B. Country of origin	C. Reference	D. Purpose	E. Theory/ Conceptual framework	F. Type of data (Method)	G. Sample	H. Variables of interest	I. Measure of relationship quality	J. Key findings
29	Netherlands, Norway	(Vanden Abeele et al., 2020) Authors: Vanden Abeele, M. M. P.; Abels, M.; Hendrickson, A.T.	Examined whether parents are less responsive to their young children (0–5) when they use a phone using naturalistic observational methods: both pre-consensual and post-consensual to determine social desirability bias.	Parental responsiveness and parent-child attachment by Ainsworth; Child development; Language acquisition; Child emotional and behavioural problems; Parent-child interaction.	Naturalistic observations.	(n = 53) parent-child dyads, child age 0-5 years old.	Parental phone use, parental responsiveness, parent-child interactions, child phubbing, child development, cyberpsychology, social desirability bias.	Caregiver-child interaction: child bids for attention, caregiver response.	Parental phone use predicts a decrease in parental responsiveness and response quality. When parents are on their phones, their “still face” is associated with increased emotional distress in children and can lead to parents being emotionally and behaviourally disengaged. In intervals of phone use, parents were less likely to respond to child bids for attention. The odds of parents responding timely, strongly, with positive affect, and by prioritizing the child were also decreased during phone use (responses were consistently of lower quality). Passive (like holding the phone in one’s hand) and fully absorbed phone-use was more disruptive than occasional use and checking the device. Responsiveness also decreased in other attention craving nonchild-directed activities than phone use, but phone use seemed to be more absorbing and more often used. “This suggests that the dialogic nature of phones makes them more likely to bring users into a state of “absent presence” than other activities.”
30	USA	(Ventura et al., 2019) Authors: Ventura, A. K.; Levy, J.; Sheeper, S.	Examine whether mothers exhibited lower sensitivity and responsiveness to infant cues and less engagement in socioemotional and cognitive growth fostering when they used digital media (a portable device) during feeding compared to when they did not, and if infants similarly would show altered feeding behaviours indicative of distracted feeding (e.g., lower intake, longer feed duration, slower rate of feeding)	Responsive parenting by Black & Aboud. Responsive feeding by Engle & Peltó; Savage et al.; Hurley et al. Parenting sensitivity by Farrow & Blissett; Paul et al., Child development; Parent-child synchrony; Self-regulation capacity; Parent-child interaction.	Observational study using video recordings and coded using the Nursing Child Assessment Parent-Child Interaction Feeding Scale (NCAFS)	(n = 25) mother-infant dyads with infant age 8 months or younger.	Distractions while feeding infants, digital media use, technology, responsiveness (attachment), feeding responsiveness.	Assessment of the quality of the maternal-infant dyadic interactions, such as maternal sensitivity to cues and social-emotional growth fostering.	Mothers showed lower sensitivity towards infant cues when occupied with the portable device and engaged in significantly less cognitive growth fostering. In return, infants were less responsive to their mothers during the Digital Media Use condition if the mother typically had lower levels of technology use, than in the control condition.

A. Ref. no.	B. Country of origin	C. Reference	D. Purpose	E. Theory/ Conceptual framework	F. Type of data (Method)	G. Sample	H. Variables of interest	I. Measure of relationship quality	J. Key findings
31	USA	(Ventura & Teitelbaum, 2017) Authors: Ventura, A. K.; Teitelbaum, S.	Explore the prevalence and correlates of maternal distraction during infant feeding, including technological distractors such as smartphone use.	Attachment theory by Bowlby; Responsive feeding by Black; Engle and Hurley; Parental attention/distraction; Infant's stress response system; Child emotional and behavioural problems; Self-regulation capacity.	Survey over 1-6 days of infant feeding situation and possible maternal distractions. Infant Behaviour Questionnaire – Revised Very Short Form (IBQ-RVSF). Infant Feeding Style Questionnaire. Baby Eating Behaviour Questionnaire.	(n = 75) mothers of infants under six months of age.	Distractions while feeding infants, smartphones, technology, attachment, feeding responsiveness, mother and infant characteristics.	Not measured. Infant negative affect was self-reported by mothers through the IBQ-RVSF.	Mothers reported distraction from technology in 26% of the feedings, with respectively 5% stemming from smartphone or tablet use and 4% from talking on the phone or to another adult. Reports on technological distractions ranged from 0% to 97% of the total of recorded feedings per mother. Significant predictors of maternal technology distractions during feeding were racial/ethnic minority status, laid back feeding style, younger infant age, and perception of lower infant food responsiveness and greater infant appetite. Smartphone and tablet use differed from breastfeeding and bottle feeding, from on average 10% of breastfeeding sessions to 3% of bottle feedings. 1% also reported on using multiple technologies.
32	Germany	(Wolfers et al., 2020) Authors: Wolfers, L. N.; Kitzmann, S.; Sauer, S.; Sommer, N.	Discover how mothers' smartphone use is related to maternal sensitivity with naturalistic observations in a playground setting.	Attachment theory, by Ainsworth, Bowlby; Parental sensitivity and/or responsiveness; Child development; Problematic phone use; Parental attention/distraction; Language acquisition; Child emotional and behavioural problems; Parent-child interaction; Inner working model.	Qualitative observation of mother child dyads during 10 min on playground using Mini-Maternal Behavior Q-Sort (MBQS) method and a following interview and survey.	(n = 89) mother-child dyads, child aged 7 to 36 months.	Maternal sensitivity, smartphone use, child development, mother-child attachment, types of smartphone use; duration, frequency, habits, reasons for use.	Mini-maternal behaviour Q-sort.	Nearly half of the observed mothers used smartphones while on playgrounds with their infants and toddlers. Duration of use was on average 1.3 minutes out of 10 minutes observation time. Phones were used mostly to text/chat with family and friends (45% of the time), as well as take photos (29%) and organize everyday life (29%). The duration and not the frequency of phone use was associated with lower maternal sensitivity, making mothers distracted from child signals and resulting in less responsiveness and sensitivity. The frequency of use was not related to lower maternal sensitivity, indicating that quick checks and non-absorptive device use was more beneficial for the interaction quality.

4.1 Results: Characteristics of theory/conceptual frameworks used in the studies

To answer the review question, common theories and conceptual frameworks were gathered from in the included articles and records. The most frequently used conceptual framework was parental sensitivity and/or responsiveness, referred to in 27 studies. Second was child development in 21 of the studies, and attachment theory, in 19 studies. Parental attention or distraction was referred to as the theme in 17 studies, with the parental smartphone use inducing distraction characteristics such as “absent presence” and “immersion” (ref. no: 8), “absorption” (ref. no: 10), “parental screen distraction” (ref. no: 15) and “phubbing” (ref. no: 17). Technoference was commonly mentioned in 10 studies, followed by problematic phone use, child language acquisition and child emotional and behavioural problems in seven studies each. Each document’s theories and conceptual frameworks have been outlined in Table 1, see column E. A tag cloud gives an overview of the most common frameworks, see Figure 2.



Figure 2. Tag cloud of common themes

In the tag cloud, the words describing the common theories, themes and conceptual frameworks were placed on the same page in the same size. If the same theory was used in three records, the word was enlarged to 130%, and if it was used in ten records, the word was enlarged to 200%. The tag cloud therefore acts as a chart, where the largest word represents the most common theories and/or conceptual framework(s) of this review.

The theories and conceptual frameworks extracted represent key findings for this review and will be discussed in further detail below regarding their relation to the results on parental

smartphone use's effect on the parent-child attachment/relationship and/or the child's developmental outcomes.

4.2 Results: Parental smartphone use's effect on the parent-child attachment/relationship and/or the child's developmental outcomes.

This section will provide a descriptive overview of significant results from the records relating to the review question, which sought to identify the current evidence on if parental smartphone use affects the parent-child attachment/relationship, and/or the child's developmental outcomes. The aim of presenting the results in a descriptive way using inductive analysis (Thomas, 2006, p. 238), beyond e.g. frequency counts as in section 4.1, is to perform qualitative content analysis on the extracted results to investigate the occurrence of concepts in the included documents (Peters et al., 2020, p. 421). This qualitative in-depth analysis form is a way of mapping findings in line with the scoping review format although not normally required, and does not seek to "assess certainty" as in a systematic review (2020, p. 421). The key findings were categorized into 14 subheadings according to theories and/or conceptual frameworks discovered in the results on theory/conceptual frameworks in section 4.1. These are: The smartphone's intervention in parent-child attachment, from parental sensitivity and responsiveness; Parent-child attachment and mobile devices in an integrated family systems model; Parental technofence in parent-child interactions; Technofence and parent emotional stability; Parental phubbing in the parent-child relationship; Parental absorption/immersion; Parent displacement hypothesis; The present-absent paradox; Phone use while feeding infants and toddlers; The Still-Face Paradigm as an observation; The smartphone as a tool to facilitate parents' sensitivity; Why parents use smartphones, and excessive smartphone use's impact on the parent-child relationship; Why smartphones and technofence differ from books, magazines or TV; Screen time and family life balance. Each category is descriptively expanded upon within the following sections.

4.2.1 The smartphone's intervention in parent-child attachment, from parental sensitivity and responsiveness

Hood et al. describes parent-child attachment as the "enduring emotional closeness between parents and their children that prepares children for future development and independence" (Ainsworth et al., 1978 and Rees, 2005, in Hood et al., 2021b, p. 1608). Alvares Gutierrez and Ventura describes attachment as how the mother, specifically, conceives her child and her bond to her child emotionally. The mother needs contingent and reciprocal dyadic behaviours

to build an affectionate relationship and high-quality attachment to her child over time (Alvarez Gutierrez & Ventura, 2021, p. 2). Alvarez Gutierrez and Ventura describes that “maternal sensitivity and responsiveness to infant cues and engagement with the infant” are key contributors to such a bond, and that technology disturbances have the ability to compromise this emotional connection. They further state that indicators of the attachment bond from mother to infant includes “*absence of hostility* toward motherhood, or acceptance of and lack of resentment for the personal sacrifices and difficulties associated with infant care, and *pleasure in proximity*, or the desire for interaction with the infant”. Children, on the other hand, have an attachment style to their primary caregiver(s) ranging from secure, to insecure, anxious or avoidant (Coyne et al., 2022, p. 2). Secure attachment contributes to “long-term emotional well-being, facilitate early learning and development and insulate the individual from stress and trauma throughout the life course” (Benoit, 2004; Meltzoff, 1999 and Okello et al., 2014, in Coyne et al., 2022, p. 2). Developing and maintaining secure attachment has lifelong consequences for the child or infant, as it can guide the child’s inner working model and “cognitive schema of what relationships should be like” (Coyne et al., 2022, p. 2).

Coyne also stated that infants were now entering a new digital landscape and digital home life because of emerging technology, that is not well researched. According to Alvarez Gutierrez and Ventura, “maternal attention to technological distractions may negatively impact the quality of mother-infant interactions by decreasing maternal sensitivity to infant cues and engagement of the infant in cognitive growth fostering, which encompasses the quality and frequency of verbalizations to the infant, as well as permitting the infant to explore his or her environment during interaction” (Golen & Ventura, 2015; Ventura et al., 2019, in Alvarez Gutierrez & Ventura, 2021, p. 2). Such technological distractions by the parent, then, if continuous, could negatively affect the child’s ability to develop in an appropriate way.

According to Abels et al., parental responsiveness is related to the parent-child attachment quality because it refers to “the contingency and sensitivity of parental verbal and non-verbal response to child behaviour during child-parent interaction” (Ainsworth, 1969; Baumrind, 1978; Feldman, 2007, in Abels et al., 2018, p. 196), which in turn stimulates a secure attachment (2018, p. 198). Their study aimed to measure the impact that parental smartphone use has on parental responsiveness towards their infant or toddler by performing a consensual observational study of parent-child dyads in playgrounds and health care centres in the Netherlands. They found that phone use predicted a lower response rate towards child bids,

and also negatively affected the timeliness and strength of the response (2018, p. 211). There was no association towards the emotionality of the parents' response, meaning that when parents responded, they showed no difference in response according to if they previously used their phone or not. Still, children needed to show more bids for attention for the parent to respond than if the parent was occupied with something else, and so the study showed that smartphone use was more absorbing than other distractions. A limitation of the study was that the parents were told that the study was about parent-child interactions, and several parents subsequently changed their mobile phone use pattern after being informed of this, like putting their phone away. This could have negatively skewed the results of how many parents used their phones due to social desirability bias compared to a nonparticipant observational study, such as the one by Wolfers et al (2020).

Wolfers et al. found that maternal sensitivity was negatively associated with the duration, but not the frequency, of smartphone use (Wolfers et al., 2020, p. 37). The research conducted with non-participatory observations of 89 mothers showed that frequent checking of the device seemed to be less disruptive to maternal sensitivity than longer duration, absorbing smartphone use. Mothers that in the subsequent interview and surveys reported on frequently keeping up with family and friends through smartphone use showed more sensitivity, and so the researchers argued that some types of smartphone use could increase rather than decrease a mother's sensitivity towards her infant or toddler. This regarded keeping in contact with friends and relatives, seeking immediately available advice and support or having an outlet for emotions, which could potentially aid the mothers in being more sensitive and emotionally regulated (Wolfers et al., 2020, p. 36). The researchers therefore highlighted that longitudinal data must be used to examine whether maternal smartphone use is a cause, or an expression of low sensitivity because this could not be established by their observational study.

The same was discussed by Vanden Abeele et al (2020). They found that parental phone use predicted lower responsiveness and poorer interaction quality than non-use, and stated that a reverse causal explanation for the findings could be that parental phone use was a behavioural manifestation of their low responsiveness rather than its cause (Vanden Abeele et al., 2020, p. 367). Emotionally and behaviourally disengaged parents with a "still face" due to phone use was associated with increased emotional distress in children. Parents who used their phones responded less timely, weaker, displayed less affect and were less likely to prioritize the child over other activities than when they were not on their phone (Vanden Abeele et al., 2020, pp. 364–365). Overall, phone use predicted lower responsiveness and lower quality responses

from the parent, and more absorbed use was more disruptive than occasional glances at the phone, which was not reliably different to not using a phone (p. 365).

Contrastingly, Jester stated that parental smartphone use could be considered “a direct danger” to infants’ and toddlers’ development, as it could hinder the parents from providing uninterrupted and predictable care (2019, pp. 73–74). Regarding the effects of modern technology on nurturing and attachment within the childhood setting, the researcher found that the parent was present physically, but not emotionally when using the smartphone. The parent would therefore withhold a basic need from the child, interrupting interactions that are necessary for the child’s brain growth and cognitive needs. According to Jester, the child needs fluent conversations, uninterrupted interactions and learning of social cues to grow and thrive. This was further highlighted in the study’s dedication page, with a quote from Zero-to-three: “When a caregiver reads and responds to the young child’s messages with sensitivity, the child’s hunger to be understood is satisfied. The conviction that “I am someone who is paid attention to” becomes part of the infant or toddler’s identity” (Zero-to-three, 2010, paragraph 7, in Jester, 2019, p. v). Being someone who is paid attention to would feel quite different than someone who is “less valuable than an email”, as early childhood educator Erika Christakis put it in *The Atlantic* magazine, in regard to non-engaging parents “chronically” distracted in their smartphones (Christakis, 2018). Jester found this parental non-engagement to be a form of psychological withdrawal from and non-responsiveness to their children, depriving them of “experiences that promote cognitive growth” when in fact, time should be spent trying to make a mindful connection with them (Jester, 2019, pp. 72–73). Jester’s research concluded that parents’ and caregivers’ disengagement and tendency to being tuned out because of their smartphone use was a severe problem for children’s development.

Golen and Ventura also found that mother-infant interactions needed synchrony to develop a secure attachment (2015, p. 790). Three primary features were found to explain this synchrony: maintained engagement, temporal coordination and contingency. According to them, caregiver attunement to their child in form of reciprocal interactions, being mutually regulated and harmonious comes from a caregiver’s sensitivity: “[the mother] sensing [the] infant’s state and adjusting her behavior accordingly” (p. 790). Golen and Ventura’s study was about distractions, like using smartphones, during infant feeding. They found that caregiver attention during feeding was important to maintain parent-infant synchrony, as feeding is a prime interaction time between the parent and child. This included distractions

from smartphones, other mobile devices and other technology as well. The research concluded that further studies were needed towards understanding how to help mothers focus on their infants, and so to strengthen sensitivity and attachment in the relationship from the very start. They also sought for future longitudinal studies determining the specific developmental outcomes for children that have endured mindless parental feeding while the parent was distracted with for example a smartphone.

4.2.2 Parent-child attachment and mobile devices in an integrated family systems model

Hood et al. provided a model for understanding the influence of mobile touch screen devices on the parent-infant relationship, including key frameworks from attachment theory, family systems theory, the bioecological model and the human-computer interaction model (Hood et al., 2021a, p. 2). They found the disturbances brought on by the pandemic to be an opportunity to “explore the flow-on effects of disturbing typical family routines on how the different parts of the integrated model relate to one another”. The model will be reproduced in its entirety here with its explanation, see Figure 3, as it was found to be highly relevant in exploring and understanding the effect that interacting with e.g. a smartphone could have on the parent-child attachment. The model also shows that influences on relationships and device use such as the wider family and community, also has the possibility to affect the parent-child dyad interaction.

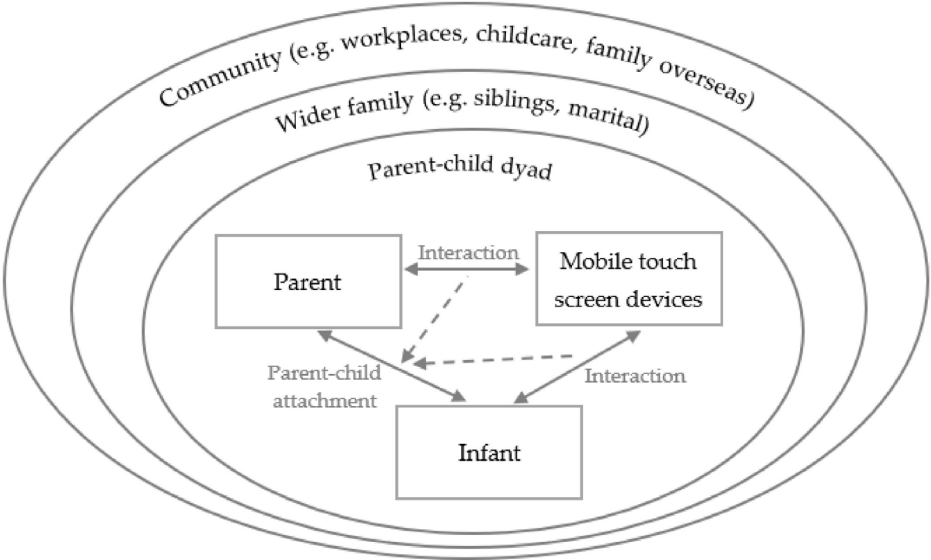


Figure 3. Mobile touch screen device use in an integrated family systems model (Hood et al., 2021a, p. 2).

“Figure [3] shows an integrated family systems model of mobile touch screen device use, with solid line arrows depicting the interaction and flow of information. The double headed

arrow between parent or infant and mobile touch screen device represents the parent/infant sending information to the device (e.g., opening an App) and the device sending information to the parent/infant (e.g., the device playing music or a guided meditation). The dashed line arrows represent the potential influence of parent-device interaction or infant-device interaction on parent-child attachment” (Hood et al., 2021a, p. 2).

4.2.3 Parental technofence in parent-child interactions

Technofence is a term of the words “technology” and “interference” that refers to the potential disruption and distractions within social interactions and relationship development that for example the parent-child dyad experiences due to technology such as the smartphone (Coyne et al., 2022, p. 2; McDaniel, 2020, p. 3). The reason and type of parental use has a consequence for how disruptive the use becomes in the interaction. This can be explained by attachment theory, as attachment security is formed when the parent reacts sensitively and timely to child challenges and behaviour (Coyne et al., 2022, p. 2). Infants express attachment behaviours such as “smiling, laughing, crying, cooing, or gazing at a caregiver” to seek and maintain proximity to them (Coyne et al., 2022, p. 2), and as such this also has the potential to be disrupted by parental technofence, with the parent being distracted and looking away, having their attention and engagement elsewhere while still being together. The consequences of such technofence can according to Ewin et al. and Hood et al. be that “if parents regularly provide little response to children’s attention requests then children may be placed at a developmental disadvantage” (Winnicott, 1960, in Ewin et al., 2021, p. 2050) as the formation of a secure attachment bond is “predictive of future cognitive development [...] social and emotional development [...] and physical development” (Hood et al., 2021b, p. 1608). Ewin et. al found that caregivers “reduced their interaction with children while using devices” and found indications that technofence has a detrimental impact on parental responsivity, sensitivity, engagement, and warmth (Ochoa et al., 2021; Wolfers et al., 2020; Radesky et al., 2015 and Modecki et al., 2020, in Ewin et al., 2021, p. 2049). According to Radesky et al., parental technofence in the parent-child dyad was also found to reduce parental initiations (Radesky et al., 2018, in Coyne et al., 2022, p. 2).

To investigate the occurrence of technofence in the parent-child dyad, Lemish et al. conducted observational studies of anonymous families on playgrounds. Technofence was found to be common. 79% of parents used a smartphone on the playground, and the average time was a 31% of the total time spent on the playground (Lemish et al., 2020, p. 7).

Analysing parent-child interaction, the research found that parents distracted with phones

were more absorbed in their distraction, and only 12% of parents were able to offer appropriate emotional reinforcement to their toddler or preschooler while using a parental screen distraction, in contrast to 55% of cases where the parent was not using a phone. Contrastingly, parents with high engagement in their children are active in children's activities, attuned to the child, communicates verbally and non-verbally, and shows positive affect and appropriate responses (2020, p. 8). The researchers highlighted the importance of maintaining eye-contact, responding to children's bids for attention, showing affection and providing support (2020, p. 14). Disengaged parents from e.g. smartphone distractions, were observed to be physically and emotionally unavailable to their child, not providing scaffolding and emotional support and would even put the child's safety at risk (2020, p. 10). Scaffolding, in this instance, refers to supportive strategies aimed at supporting, encouraging or teaching the child something (The Glossary of Education Reform, 2013), such as saying "You can do it!" or helping the child with tying their shoelaces (p. 8). These parents were clearly more immersed in their phone use and disconnected from their surroundings, reducing the parent-child interactional synchrony and thereby risking the child's development of social competence (2020, p. 4). This raised the researchers' concerns for children's safety, emotional well-being and development due to parental technofence (2020, p. 13). The study was only based on short time observation, but the researchers claimed that this interactional pattern of constantly ignoring the child's needs and refraining from interactions and scaffolding for long periods of time would put children at a developmental disadvantage (Lemish et al., 2020, p. 14).

4.2.4 Technofence and parent emotional stability

Some studies have highlighted that parental emotional intelligence could affect how the parent reacts to technofence. In a study with the research participant age group, but also older children, Merkaš et al. found that parental emotional stability may serve as a protective factor when encountering technologic interference in the interaction (Merkaš et al., 2021, p. 197). They hypothesized that technologic interference could hinder the parents from reacting in a timely and adequate fashion to children's bids for emotional connection, thereby creating stress and an inappropriate environment for mastering emotional skills necessary for initiating and maintaining relationships (Merkaš et al., 2021, pp. 195–197). They further predicted that parents could respond to children sensitively and with warmth if the parent was emotionally stable during technofence, showing the child that they are "worthy of love, support and connection" which would foster a secure inner working model in the child and lead to higher

child social competence. According to Barbaro, the inner working model is formed by attachment in the child’s upbringing and forms their views on how they should be treated and treat others, what a relationship is and how it is formed. If children have a secure attachment form, they “may be more likely to feel safe, secure, and like they can rely on others in future relationships” (Barbaro, 2020, in Coyne et al., 2022, p. 2). Parents with higher difficulties in regulating psychological distress and with low emotional stability may react with harshness and negative emotionality to children’s needs, requests and bids in technofence situations, thereby potentially hindering the child’s development and future relationships (Merkaš et al., 2021, pp. 195–197). Their proposed model theorised how parental emotional stability could serve as a protective factor regarding parental technofence on child social competence, see Figure 4.

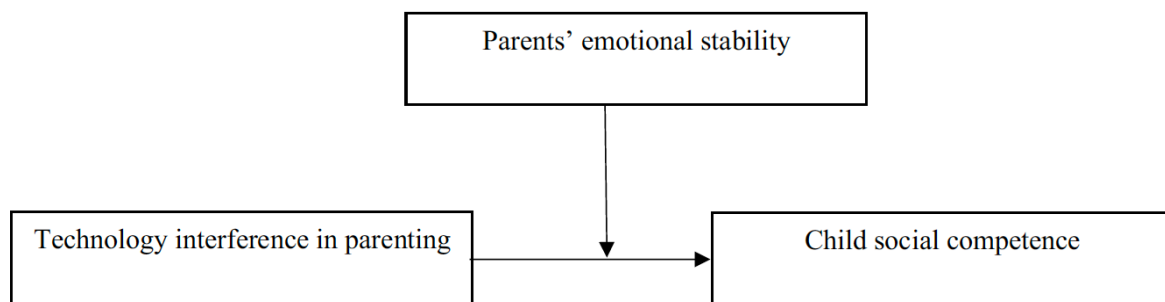


Figure 4. Merkaš et al.'s model of the moderation effect of parental emotional stability on parental technofence with child social competence (Merkaš et al., 2021, p. 190).

4.2.5 Parental phubbing in the parent-child relationship

Another term regarding parental technology distractions is parental phubbing. Lv et al. researched the effects that mother phubbing would have on the parent-child relationship. Phubbing was described as a portmanteau of the words “phone” and “snubbing”, describing the act of paying attention to one’s smartphone or digital device over actual conversation or interactional partners that are present (Lv et al., 2022, p. 1). Phubbing or technofence can happen regardless of parent gender. The research hypotheses were that mother phubbing would reflect negatively on the mother-child attachment, and lead to heightened emotional and behavioural problems in children. This was based on Chotpitayasunondh and Douglas’ article *The effects on “phubbing” on social interaction*, finding that phubbing leads to poorer perceptions of interaction quality, less trust within the interactional dyad, less interactional intimacy and more experiences of jealousy and a deflated mood from the one being “phubbed” (Chotpitayasunondh & Douglas, 2018, p. 304). Lv et al. stated that “[p]arental

phubbing is a common negative parenting behaviour that impacts parent-child relationships and children’s emotions” based on the articles by Davey et al., McDaniel et al. and Stockdale et al. (Davey et al., 2018, McDaniel et al., 2018. Stockdale et al., 2018, in Lv et al., 2022, p. 1). These studies had researched mostly adolescents, as they are more able than infants and toddlers to voice their opinion on parental smartphone use and phubbing, but in Lv et al.’s study, the participants were mothers of children aged 3-6 years old. They found that mother phubbing significantly and negatively correlated with the child’s emotional and behavioural problems. The study also found that attachment in the relationship mediated the problems, while mothers’ stress moderated the problems (Lv et al., 2022, p. 8). This was visualised in their moderated mediation model, see Figure 5.

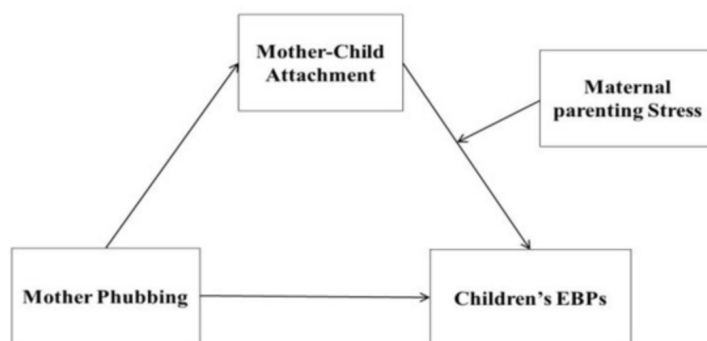


Figure 5. Moderated mediation model to explore the mechanisms by which mother phubbing interacts with children's EBP's (emotional and behavioural problems) (Lv et al., 2022, p. 3).

It was discovered that phubbing could cause a hindrance in the child’s development through “an indifferent environment, uncaring parents, and a lack of interactive language”, as young children in a sensitive development period needs parental responsiveness and good parent-child interaction quality (2022, p. 2). The research therefore concluded that phubbing and displaced interactions could be considered a form of reject, neglect or indifference to the child. This could lead to the child feeling more alienated, less belonging and have a more insecure attachment, thereby increasing child emotional difficulties and behavioural problems. Low parenting stress was found to be a protective factor, as it was “associated with better cognitive, self-regulatory and socioemotional development in children” (2022, p. 3). This is significant to this review, as parental stress has been found to stem from exaggerated smartphone use in some studies (Hood et al., 2021a, pp. 11–12).

4.2.6 Parental absorption/immersion

The nature of parental distraction was found to be of significance regarding how much it affected the parent-child interaction. Absorption and immersion refer to the level of

involvement or preoccupation an individual experiences when using a device, as e.g. smartphone apps are designed to be “highly immersive” for the user, with highly personalized content such as tailored Facebook feeds and push notifications (Ewin et al., 2021, p. 2043). In their study, Coyne et al. found mutual gaze to be a positive parenting behaviour that fostered secure attachment (2022, p. 2), and so, absorption/immersion in smartphone technology has the ability to directly interfere with this. More absorbed mothers have been found to be less sensitive and less responsive to infant cues and bids for attention, and this postponed timely parental reactions to the child in basic, but also potentially dangerous situations (Abels et al., 2018, p. 195-196; Vanden Abeele et al., 2020, p. 363). When disturbed in their smartphone use, parents even showed impatient or aggressive behaviour such as snapping fingers, pushing or kicking the child, like 7,5% of parents did in Ewin et al.’s study (Radesky et al., 2014, p. 847, in Ewin et al., 2021, pp. 2043, 2048) Ewin et al., argued that this sort of behaviour over time can lead to the child losing trust in the parent and form an insecure attachment style that can negatively affect future relationships (Ewin et al., 2021, p. 2043). Their observational research showed that device disruptions resulted in reduced interaction, with a reduction in shared play and conversation within the parent-child dyad (Ewin et al., 2021, p. 2047).

Ochoa et al. and Wolfers et al. found that more absorbed mothers were correspondingly less sensitive to children than less absorbed mothers (Ochoa et al., 2021, and Wolfers et al., 2020, in Ewin et al., 2021, p. 2043) and this also reflects a finding from Hood et al.’s study. It was discovered that the nature of the device use determined whether it was beneficial or disruptive to the family interaction, rather than simply the amount of time spent on the device(s) (Hood et al., 2021, p. 13). Some use greatly enhanced family connectedness during COVID-19 lockdown, for example using video chat with relatives, while some mothers reflected that their personal use was potentially disturbing for family interactions, when asked to reflect. Increased general device use also led to “more opportunities for disrupted interactions within the family unit” (p. 13) which is an important consideration as mothers were asked to self-report in this study and may not have been aware of missed or disrupted interaction situations.

4.2.7 Parent displacement hypothesis

Any time spent on the device is simply put time not spent with the child, which leads to fewer interactions and responses. This is termed the displacement hypothesis (McCombs, 1972, in McDaniel, 2019, p. 75), and also accounts for other distractions, be they technologic or otherwise. Alvarez Gutierrez and Ventura found that “maternal technology use displaces time spent engaging with the infant or disrupts the quality interactions via negative impacts on

maternal sensitivity and reciprocity” (Van, 1995 and Pederson et al., 1998, in Alvarez Gutierrez & Ventura, 2021, p. 7), but could not rule out that disrupting technology use could be an effect of low maternal attachment, and not the other way around.

4.2.8 The present-absent paradox

Another way to explain the effect of being immersed in one’s smartphone is by the present-absent paradox. Ewin et al. explained that the mental state of absent presence is marked by an “emotional and cognitive disconnection from physical surroundings” hindering multitasking, and that immersive apps can induce such a state drawing parental attention away from the child (Gergen, 2002, and Montag et al., 2019, in Ewin et al., 2021, p. 2042-2043). The parent can be present, but emotionally unavailable in the interaction. Still, Ewin et al. highlights some potential benefits of such use, as the parent can be physically present, but “cognitively entertained”, leaving the child room for playful exploration while e.g. themselves keeping in touch with relatives or having “parenting breaks”. The research hypothesized that this can have benefits for the parent-child relationship, as the parent can have mental pauses and return to the interaction more mentally rested and less distraught (Ewin et al., 2021, p. 2043).

Vanden Abeele et al. suggested that smartphone use seemed more likely to bring parents into a state of absent presence than other parental distractions, due to the availability of the phone and its often absorbing content (Vanden Abeele et al., 2020, pp. 366–367). The parents in the research were often distracted by other things when observed with their child, but the incidence of fully absorbed phone use was greater than parents being fully distracted with other things (p. 363). The research hypothesized that parents using their smartphone shifted into a type of dual-mode, where they could shift attention between the child and their phone while spending time together (p. 366). Interestingly, they also found that passive phone use, like carrying the phone in one’s hand or placing it at the table, was more disruptive to the parent-child interaction than occasionally taking it up to glance at it or check notifications. This then ties in with the argument that the type and frequency of smartphone use determines how it affects the parent-child interaction and relationship.

4.2.9 Phone use while feeding infants and toddlers

Several records investigated parental (smart)phone use while feeding their infant or toddler. Coyne et al. discovered that the majority of mothers in the study used their smartphone while feeding their infant, and the purposes for media use was to remain productive, alleviate stress and social networking: connecting with family members or other new mothers (Coyne et al.,

2022, p. 4). Feeding time, according to some, was an opportune time to catch up on media use, and in context to interaction with the infant some felt that they could manage doing two things at once. Still, the research concluded that media use while “feeding was associated with higher levels of parent/infant dysfunction” (2022, p. 7), but no longitudinal or cross-sectional link between attachment security and parent media use while feeding was found. On the contrary, more time spent on media during infant feeding predicted less parent-child dysfunction one year later.

In Golen and Ventura’s study, mothers reported technological distractors as very much present in the infant’s feeding situations (2015, pp. 788–789). Mothers self-reports showed only 2% reporting being distracted with their mobile device while bottle-feeding, but logistically, hand-held device use may be more limited in bottle feeding, as especially with infants one hand is used to hold the baby and another is used to hold the bottle, “allowing no hands to hold mobile phones or other small electronic devices (2022, p. 7). As such, bottle feeding may make distractions like watching TV or listening to the radio more likely than using a smartphone or reading a book, as the parent would have to remain more physically engaged in the child. This could quite possibly enhance the parent-child synchrony while feeding, which again could place the infant at lower risk of overfeeding and developing weight problems (Golen & Ventura, 2015, p. 790).

In their study on infant feeding distractions, Ventura and Teitelbaum found that 10% of mothers who breastfed used a smartphone or tablet, compared to 3% of mothers who bottle fed (Ventura & Teitelbaum, 2017, p. 174). They claimed that synchronous feedings and contingent and responsive parental interactions during feeding was predictive of infants’ development of “effective emotional, cognitive, and behavioural self-regulatory abilities” (Ventura & Teitelbaum, 2017, pp. 169, 173), and that the current, technology satiated way of life could offer new forms of distractions to mothers and caregivers. Technological distractions during feeding was also linked to a laid-back maternal feeding style, as well as racial/ethnic minorities, younger infant age, maternal perception of lower infant food responsiveness as well as greater infant appetite (2017, p. 173). And so, the technologically distracted mothers believed that their infant was less responsive to food, while the infant actually had a greater appetite than other infants in the same study, suggesting that the feeding interaction was less synchronous when the mothers were distracted.

The same was also the case in Inoue et al.'s study. The study was particularly useful in accurately recording mothers' activity and visual responsiveness while breastfeeding in- and out of the smartphone setting, using a gaze tracking camera (2022, p. 226). In five out of 13 mothers, their gaze virtually never left the child while they were breastfeeding while permitted to use their smartphone. On the other hand, six out of 13 mothers did not respond to child signals while permitted to use their smartphone, even in two instances in which first, the child pushed the smartphone away and in the second instance, when the child choked while feeding. This mother did not respond to the child's eye contact or vocalization attempts either, but continued her smartphone use regardless (Table 4, Case ID. K and L, in Inoue et al., 2022, p. 232,). When mothers were instructed to breastfeed as they would at home, permitting smartphone use, mothers were distracted from feeding 19.5% of the feeding duration. Without permitted smartphone use, mothers were distracted 0.5% of the feeding duration. This attests that smartphone use may distract mothers significantly during infant feeding. The study was based on infant social cognition theory by Lamb and Easterbrooks (Lamb & Easterbrooks, 1981, in Inoue et al., 2022, pp. 226–227), in which the mother goes through a four stage process when dealing with her infant's bids for attention. First, she perceives the infant's signals or needs. Secondly, she interprets it accurately. Third, she selects an appropriate response, and fourth, implements it successfully. An insensitive response can arise from a deficiency in any of the four stages, which will in turn reflect on the mother-infant relationship.

4.2.10 The Still-Face Paradigm as an observation

The Still-Face Paradigm (SFP) is originally a task developed by Tronick et al. to simulate “the impact of disrupted interactions on infants' behavioural organization” but has been modified by e.g. Myruski et al. (2018), Kildare (2017) and Stockdale et al. (2020) to measure the impact of smartphone interference on parent-infant interactions. A measure to demonstrate the importance of behavioural contingencies such as the mother responding to infant's bids for interaction during dyadic relations as a classic laboratory task, the SFP includes three phases between parent and child: Free Play (FP), Still Face (SF) and Reunion (RU) (Kildare, 2017, p. 2; Stockdale et al., 2020, p. 573). During the Still Phase, the task usually measures an infant's reaction to parents' faces going numb and staring blankly at the child, while not initiating or responding to social cues. The recent studies have modified the Still-Face Paradigm to include maternal distraction with a mobile device, like a smartphone, to measure infants' reactions to parental use and as such give ecologically valid results to the current state

of technoference by smartphone use in parent-infant daily situations (Myruski et al., 2018, p. 2; Stockdale et al., 2020, p. 575). Kildare called this alteration to the Still Phase (SP) the Phone Still Face (PSF)(Kildare, 2017, p. 7). Rather than the parent staring blankly at the child or into the air as with the original SFP, the parent is instructed to use a smartphone or other similar digital device during the Still Phase, or Phone Still Face, of these studies.

Stockdale et al. also used actual smartphones in their modified Still-Face Paradigm study to investigate “influences of developing in a digitally immersive environment” (2020, pp. 578, 589). The results showed a robust “Still-Face effect” as in the original SFP studies. That means that infants displayed increased negative affect, decreased positive affect, increased self-comforting, increased object orientation, and increased escape behaviours during the smartphone distracted phase of the paradigm (2020, p. 588). The parents would not exhibit the expected gaze behaviour or visual attention towards the child, as this was directed towards the smartphone, lowering the parental responsiveness to infant cues. In the study, the infants

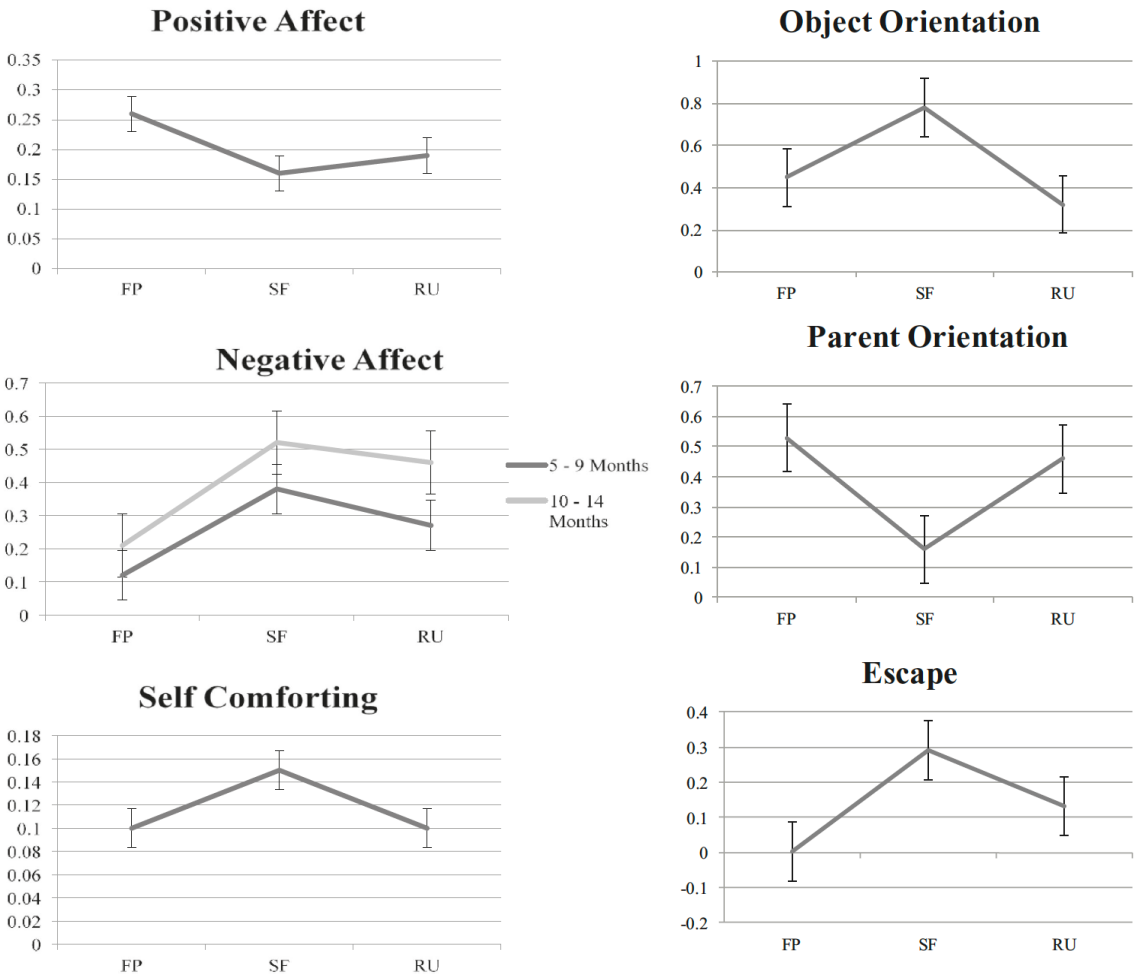


Figure 6. Main effects for different phases of Stockdale et al.'s modified Still-Face Paradigm with smartphones. FP = Free-play phase, SF = Still-Face phase, RU = Reunion phase. Note that the Y-axis is adjusted for each phase (Stockdale et al., 2020, p. 583-584).

also frequently failed to return to baseline during the reunion phase with the parent after the Still Phase. That means that the child had become uneasy or upset and would not calm or soothe properly when the child could resume interaction with their parent and the Still-Face phase of the experiment ended. See Figure 6 for a quick overview of main effects from the study, where SF marks the phase where parents used their mobile device during the parent-child interaction. Stockdale et. al. also stated that it was likely that the disruptive nature of parental technofence would lead children to react to a violation of the social dynamic built up between the child and their parent, that “may lead to increased disorganization in infants’ emotional states” (2020, p. 588). As parents’ heightened beliefs about acceptable mobile device use was also linked to more infant distress, the research suggested that if infants encountered technofence in their parent-child interaction on a habitual basis, they may begin to show blunted emotional responses in ways similar to infants whose caregivers are disengaged because of suffering from depression (p. 589). As such, the study found that infants had difficulties maintaining emotionally regulated states if their parents were “present but emotionally unresponsive” while on the smartphone, and this hindered parent-child interaction and affected child emotionality. Because of the study not being longitudinal the researchers did not conclude with the long-term impact on infants’ social-emotional development.

In Myruski et al.’s study, the aim was similarly to probe the “impact of distracted or unresponsive parents on child socioemotional behaviour”, when parents were using a mobile device (Myruski et al., 2018, pp. 2–3). The parent was given an iPod touch to simulate the mobile device in the parent-child Still-Face Paradigm task. The parent was instructed to interact with the device only, withdraw attention from their infant and become totally unresponsive to their child while permitting the child to continue playing. The iPod touch may simulate smartphone use well, as it has had a touchscreen and WIFI connectivity since its’ release in 2007 and looks quite similar to e.g. an iPhone (iPod touch, in Apple, 2020). Myruski et al. stated that frequent parental use of mobile devices during parent-child interactions could decrease “the quality of the social exchange by limiting opportunities for the in-the-moment emotional feedback essential for emotion regulation development” (2018, p. 2), based on Field’s 1994 article on *The effects of mother’s physical and emotional unavailability on emotion regulation*. Researchers subsequently found that parental mobile device use was associated with “infant social emotional functioning and parent-infant interactions” (Myruski et al., 2018, p. 7) in their study. Infants clearly showed more negative

affect and less positive affect during maternal distraction with a mobile device. Infant engagement with the mother dropped during the maternal distraction phase, while infant social bids towards the mother escalated. The study also found that infants explored the room less and were less engaged in toys after the distracted phase had ended, speculating that this may be a result of the infant being busy trying to reunite with the mother. But contrary to their predictions, maternal self-report on habitual device use did not affect the results of the free play phase except that the infants of habitually frequent smartphone users were less exploratory around the room. Rather it significantly affected the reunion phase in that infants of habitually distracted mothers recovered less after the maternal distraction phase showing less positive affect, less engagement with the mother and less room exploration (2018, p. 7). The study found that the modified Still-Face Paradigm could accurately examine the effects of maternal distraction during device use on infant behaviour and emotion regulation, suggesting further observations in the home or with tracking device use instead of using maternal self-report because of possible social desirability bias.

As mentioned, Kildare also used a modified Still-Face Paradigm in her study to investigate how maternal distraction with smartphone devices affected the infant's emotional and physiological regulation (Kildare, 2017, p. 1). As in the other studies, the infants produced the still-face effect when mothers failed to meet their gaze, ceased to show facial expressions and ceased responding to infants' bids for interaction. Typically, the mother's facial expressions are the "first and most frequent expressions" that infants are introduced to in life, and together with other non-verbal communication make up key components to "sensitive and synchronous mother-infant interactions" (2017, p. 5). A lack of facial expressions and meeting the infant's gaze because of technological distractions can cause the parent to miss infant social cues and bids for attention, as well as show a lack of affect and expressiveness. This has previously been proven to alter infants' socioemotional development and put infants at risk for developing insecure attachment relationships, when mothers have been behaving this way because of depression (Gelfand & Teti, 1990; Pickens & Field, 1993, in Kildare, 2017, p. 6). Kildare also noted that parents are unaware that their "non-responsive, empty facial expressions affect their infants' future bids for attention" (Ekas, Haltigan & Messinger, 2013, in Kildare, 2017, p. 7). Infants were found to decrease looking at their mother and demonstrating positive affect while she was engaging with her phone in the experiment, and increase escape behaviours, self-comforting behaviours, object orientation and demonstrating negative affect in this study too. See Figure 7 for measures of infant's coping behaviours in

the study.

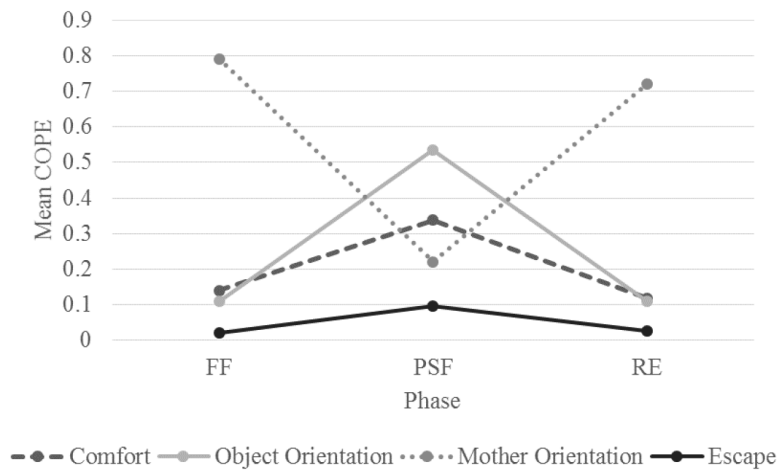


Figure 7. Results from Kildare's Still-Face Paradigm. FF= face-to-face phase, PSF= Phone Still Face phase, RE= reunion phase (Kildare, 2017, p. 22).

As early stress in life has been proven to affect the development of infants' stress response system possibly affecting later physical and emotional functioning (Gunnar, 1998, Haley & Stansbury, 2003; Lupien, McEwen, Gunnar & Heim, 2009; Lomen & Gunnar 2010, in Kildare, 2017, p. 3), Kildare suggested that more research should be put into "exploring the role of eye contact and the typical facial expressions" made while using a phone, and the subsequent infant responses, as well as "maternal sensitivity, maternal responsiveness and dyadic interactions (synchrony)" between the mother and infant (Kildare, 2017, pp. 24–25).

4.2.11 The smartphone as a tool to facilitate parents' sensitivity

Other research had been devoted to investigating whether the smartphone can be used as a tool to facilitate maternal sensitivity rather than distract from the mother-child interaction. Larkin et. al tried to promote "mind-mindedness" to the mothers of infants, through the intervention of a BabyMind application on the mothers' smartphones (Larkin et. al, 2019). The researchers found that intervening in the mother-infant relationship with the use of a smartphone app helped mothers attune with their infant. In their study, the Baby-mind app was used by mothers of infants up to six months of age to describe how the baby was feeling, what the baby was experiencing and for psychological development education of the mother directly correlating with the infant's age (Larkin et al., 2019, p. 3). The app mirrored commonplace parenting social media activities in sharing photos and information about their

baby, but was specifically designed to make the mothers more attuned with their infant, predicting secure caregiver-infant attachment.

Contrary to other studies in this review, the researchers used the smartphone as the solution in forming early parent-child attachment rather than the problem. They found that the intervention group mothers “produced significantly more appropriate mind-related comments and significantly fewer non-attuned mind-related comments than control group mothers”, who had not received the Baby-mind app, during an observed 10 minute free-play session after six months (2019, p. 11). The study also found more frequent users of the app to provide less non-attuned mind-related comments during the observed free-play session, further suggesting that the app was improving the mother-child relationship. Still, the researchers could not rule out that the information given to the mothers initially in their study was a reason for the parents acting more attuned (Larkin et al., 2019, pp. 12–13), but the study highlights a possibility for using apps and the smartphone as a tool in relation to parent-child attachment. A relevant finding was that it must be considered which kind of use the parent has of the smartphone, not only the amount of use, and considered whether this use can possibly make them more informed, less distracted and more attuned to their infant during the rest of the day.

4.2.12 Why parents use smartphones, and excessive smartphone use’s impact on the parent-child relationship

Engaging with technology and social media sites can offer parents, who themselves may or may not suffer from an anxious attachments style to their own parent(s), a form of connection and opportunity to feel a sense of belonging, creating social networks and lifestyles (Courtney & Nowakowski-Sims, 2019, p. 58). Interactive screen time, as opposed to e.g. TV viewing, is “more likely to cause hyperarousal and compulsive use” (p. 59), releasing dopamine rewards when users hear a ding and check their smartphone. As such humans are biologically set up to relate to our devices, often doing so more than 50 times a day (Eadicicco, 2015; Ritvo, 2012, in Courtney & Nowakowski-Sims, 2019, p. 59). But smartphone addiction and excessive use could be detrimental to the parent-child attachment relationship, as too much screen time can interrupt important affective exchanges in the parent-child relationship that are essential for learning social and emotional skills through social interaction and play activities (Courtney & Nowakowski-Sims, 2019, pp. 58–59). Playful interactions such as talking, singing, experiencing touch and having first-play activities between parent and child can be a “major organizer of brain development” according to modern attachment theory, in which “secure attachment relationships are essential for creating a right brain self that can regulate its own

internal states and external relationships” (Schoore and Schoore, 2012, p.44 in Courtney & Nowakowski-Sims, 2019). Also, excessive use of screens leads to a release of cortisol and hyperarousal in the brain, while caring touch and joyful communication releases oxytocin, serotonin and dopamine, referred to by Courtney and Nowakowski-Sims as “feel good neurotransmitters” (2019, p. 61), being “intrinsically healing” for the child.

In Tomfohrde & Reinke’s study, Bartholomew stated that social media use, presumably largely in the form of smartphone use, often increased after becoming a parent (Bartholomew et al., 2012, in Tomfohrde & Reinke, 2016, p. 557). Still, parents who frequently used Facebook were more inclined to answer affirmingly to a statement like “Being a parent is harder than I thought it would be” and reported higher levels of parenting stress than less frequent Facebook users, leading the researchers to assume that Facebook added to parenting stress rather than functioning as a beneficial coping mechanism. New-parent groups or breastfeeding communities on social media could provide “support, community and advice” to new parents and breastfeeding mothers, especially to those without much support, but the researchers highlighted that the mother may not experience emotional ties to the community members all the while she is a member of a group (Tomfohrde & Reinke, 2016, p. 557). Because although being part of such a group with other mothers could be informational and supportive, the participant could have weak relationships to the other participants, not necessarily being friends or even acquaintances outside social media. As such, the effort put into a social media endeavour might not result in more social connectedness and ease of being a parent, but rather be beneficial in answering questions about a specific subject intermittently by more experienced peers and others in the same life stage.

Tomfohrde and Reinke also highlighted technology’s ability to interfere in the parent-child early relationship. According to attachment theory, early eye contact with the parents is an important part of the child’s building of a secure attachment bond, and so, being unresponsive to the child’s “care-eliciting behaviour” can hinder this formation and so possibly interfere with the child’s development (Tomfohrde & Reinke, 2016, pp. 557–558). As breastfeeding can be an important time for mothers to initiate eye contact between the mother and child, the researchers stated that technology such as smartphones could interfere as a barrier in that process, and worst case that this impairment in “eye attention” with attachment figures could lead to more problem behaviours and inner disturbances in the child, like developmental delays or callous unemotional traits later in life. This was previously linked to a lack in eye contact to primary caregivers in a study by Dadds et al. in 2011 (Dadds et al., 2011, in

Tomfohrde & Reinke, 2016, p. 557), highlighting the importance of eye contact and visual responsiveness at the infant and toddler stage for the child's well-being at later stages. It was not possible to definitely conclude that technology such as smartphone social media use directly prevented mothers from having eye contact with their infants while breastfeeding, but the study indicated that the "*opportunity* for eye contact may be disrupted by the surge in technology and social media use" (Tomfohrde & Reinke, 2016, p. 559, author's emphasis). The study found that 96% of the mothers surveyed, used social media while breastfeeding, and as such limited the chance for making eye contact and being responsive to the infant's signals during that time. The prominent reason for social media use while breastfeeding was entertainment with 76%, followed by connecting with friends at 34%, connecting with other breastfeeding mothers at 31% and connecting with other family members at 28%. Several reasons could be chosen at the same time. Still, no measures were used to investigate mother-infant attachment, so the study could not conclude about technofeference's impact on the mother-child relationship. Also, the study only recruited mothers who used social media, and so it was not possible to conclude that mothers using social media on their smartphone were more or less distracted than mothers not using social media on their smartphone, as no control group existed.

Hood et al. found that some parents reported using devices to keep up important family connections regionally and internationally (around 50% of participants), using them for home-schooling and educational apps or searching for ideas of activities to do with their children while isolated during the COVID-19 pandemic (Hood et al., 2021, pp. 10, 12). The devices enabled activities, such as sensory classes with the baby, to continue during lockdown and maintained and strengthened family connections, by for example having family birthdays over Zoom [a software and online video chat and messaging system] (2021, p. 11). In their findings, some participants found device use to help with their isolation and deterred mental state in that it proved to them that other people were out there and experiencing the same things that they were themselves. At the same time, another mother stated that she felt "*very frustrated and overwhelmed with all the messaging from friends ... it stressed me out.*" One mother stated "*I was maybe spending more time on my phone than with him [11 month old], I suppose. If he was happy exploring a room, then I would just be there, but then I'd be on my phone just keeping an eye on him. I suppose I wasn't really interacting with him*" (2021, p. 12). And so, smartphone use caused both parental relief and distractions from interacting with their infants.

4.2.13 Why smartphones and technoference differ from books, magazines or TV

In their observational study of caregivers at Australian playgrounds and food malls, Ewin et al. found that 54 out of 66 caregivers used mobile devices, while none used other forms of entertainment such as books or magazines (Ewin et al., 2021, pp. 2042, 2051). The research stated that “smartphones are used for longer each day than other forms of entertainment such as book reading, and [...] devices may [therefore] be particularly impactful on dyad interactions due to high usage” (2021, p. 2051). The smartphone comes in pocket form, and whether one is engaged in banking, setting up a dentist appointment or just browsing, this minicomputer makes it easy to do so at all times. Inoue et al. found it important to note that high-engagement smartphone use such as watching a video, would prove more distracting than tasks that were less-inhibiting such as checking the screen for time or notifications (Inoue et al., 2021, pp. 508–512). The clear majority of mothers in their study used the phone for less-inhibiting tasks (65%), while only 14% responded to using video features.

4.2.14 Screen time and family-life balance

Some parents gained a new perspective on their family schedule and media habits during the COVID-19 pandemic, reflected in Hood et al.’s study. One parent reflected “*Coronavirus kind of reaffirmed the need for healthy habits and finding a nice balance [...] between the benefits of using screen time, using screens to promote how you live rather than letting screens dictate how you live*” (2021, p. 8). Social media have been found to heighten anxiety because they can make us compare ourselves to others without really knowing the others or their situation (The JED Foundation, n.d.). Promoting how one lives may not provide the whole picture of their life, and can lead to emotional stress for both the promoter and the people seeing the post. Coyne et al.’s study highlighted this kind of stress, as one mother stated “*I’m always doing something, I’m always... either cooking or cleaning or, like anything, and so that’s [referring to feeding time] like my time to go on it because [...] I’m not just gonna go sit on the couch and do nothing and go in my phone*” (2022, p. 4). The mother felt like she should multitask and feed the baby while being on her phone, and did not consider implications on the interaction or bonding taking place.

4.3 Results: Study methodologies

Key findings from the study methodologies were extracted and analysed to investigate the included studies’ methodologies, methodology limitations and risk of bias. In this effort, different characteristics of the studies were arranged into study characteristics, study location

characteristics, sample characteristics and method characteristics and simple frequency counts were conducted in line with the scoping review format (Peters et al., 2020, p. 421). In this section, records will be referred to by the reference number, or “Ref.no.”, in the scoping review’s charting table, see Table 1, column A.

4.3.1 Study characteristics

Of the 32 included records, all included independent studies. 28 records were published as articles in journals, while three were published as part of a theses (ref. no: 4, 14, 15), and one as a book chapter (ref. no: 1). The most common journals for articles in this review were *Nursing and Health Sciences*, with three articles, a journal “focused on the global exchange of knowledge in nursing and health science” (Wiley Online Library, n.d.) and *Computers in Human Behavior*, with three articles, which examines the use of computers from a psychological perspective (ScienceDirect, n.d.). Other journals releasing several articles were *Cyberpsychology, Behaviour and Social Networking*, with two articles, *Early Human Development*, with two articles, *the International Journal of Environmental Research and Public Health*, with two articles and *PLoS ONE*, with two articles. The rest of the publishing journals released one article each, namely: *International Journal of Play Therapy*; *Medical Hypotheses*; *Journal of Child and Family Studies*; *WIREs Cognitive Science*; *Appetite*; *Mobile Media & Communication*; *Health Promotion Journal of Australia*; *Child Development*; *Pediatric Research*; *Journal of Family Communication*; *Developmental Science*; *Academic Pediatrics* and *Journal of Nutrition Education and Behavior*, and *Infancy*. The book chapter (ref. no: 1) was from the book *The talking species: Perspectives on the evolutionary, neuronal and cultural foundations of language* from 2018, and the theses were submitted in partial fulfilment for masters and doctoral degrees, namely Master of Social Work (ref. no: 4), Doctor of Education (ref. no: 14), and Doctor of Philosophy (ref. no: 15). Investigating the study characteristics shows the interdisciplinarity of the research field, as studies were found to investigate this subject from many angles and interest points.

Study location characteristics

The studies were analysed for study location characteristics, to investigate whether the study locations were evenly distributed or focused in the same area. The results found that most records included in this review, 17, originated from the USA. Three studies originated from Australia, and three studies originated from Israel. Two studies originated from the Netherlands, two from Canada and two from Japan. One study originated from Jordan, one from the UK, one from China and one from Croatia. Sweden, Norway and Germany also

produced one article each. The map chart below shows the primary areas of record origination in blue colour, with the darker colour indicating a higher number of studies from the region, see Figure 8. The country of origin is also described for each record in Table 1, see column B.

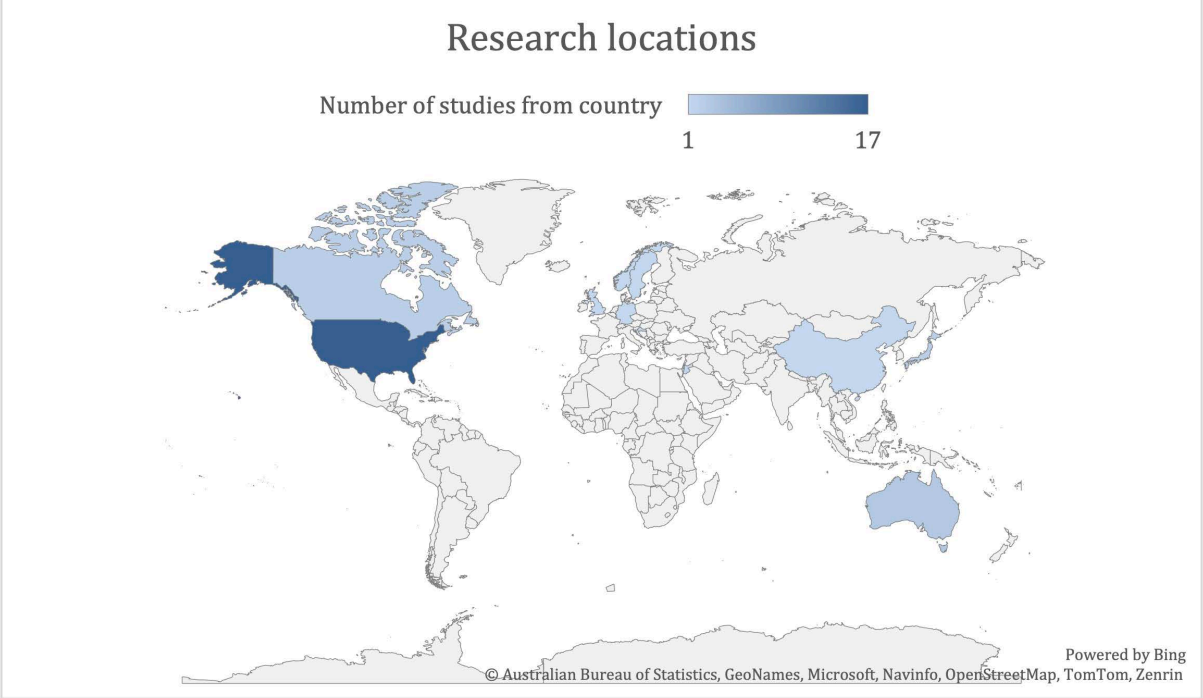


Figure 8. Overview of record origins (research locations) using a map chart.

Studies originated from North America, Europe, Asia and Australia/Oceania. The spread of the research locations indicates that this subject is of research interest in many parts of the developed world. USA had the most studies included in this review, and also has had the highest penetration rates of smartphones in the world with 82.2% in 2021 (*Smartphone Penetration Rates 2021, 2023*). No studies originated from the continents South America, Africa or Antarctica. Antarctica has no permanent human habitation (*Antarctica*, n.d.) and is therefore not expected to perform research on parents and children regarding technology use. South American and African studies could successfully have contributed to the research field and added to the generalizability of the results. According to Statista’s *Smartphone penetration rates 2021*, many developing countries have smartphone penetration rates below 25%, and so the study location characteristics map in Figure 8 can easily be compared to a map over developed countries classified by the United Nations and International Monetary Fund, see Figure 9 below (“Developing Country” 2023). Developed countries are marked in blue, developing countries in orange and least developed countries are marked in red. Grey

colour marks countries with unavailable data from the source. The countries showing the most interest in smartphone related research are thus developed countries with high smartphone penetration rates.

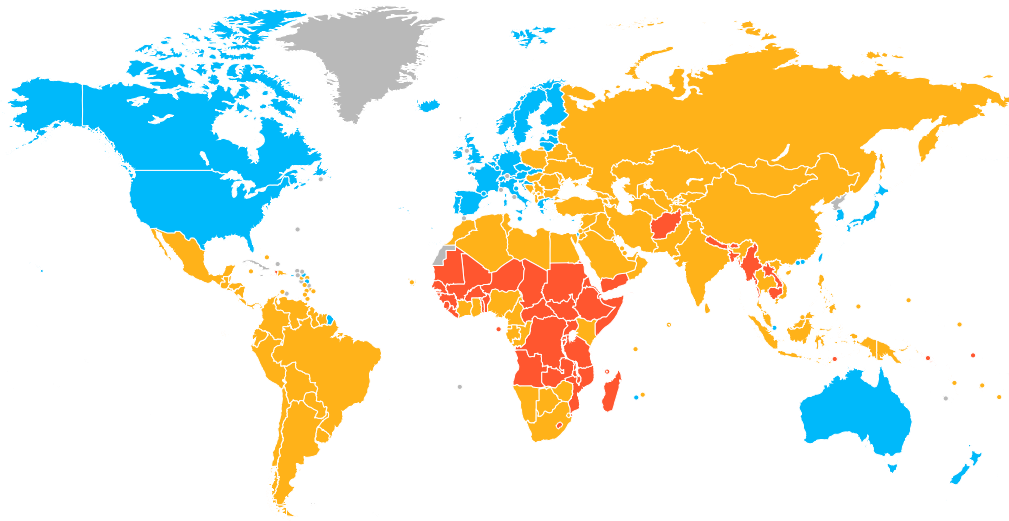


Figure 9. Developed, developing, and least developed countries sorted by the UN and IMF.

Sample characteristics

Sample characteristics were extracted and analysed. Within the studies, the sample sizes varied considerably from 1 parent/caregiver participant (ref. no: 5) to 998 parent/caregiver participants (ref. no: 18), with the total sample size of parent/caregiver participants for this review being 4546 people and the mean parent/caregiver participant count of each study being 146.6 parents/caregivers. 19 studies investigated the parent/caregiver-child dyad (ref. no: 1, 2, 5, 6, 7, 8, 10, 13, 15, 16, 17, 19, 23, 24, 25, 26, 29, 30, 32), with the child participant count then adding up to n=1644 children for this review. 13 of the studies relied on parent/caregiver self-reports and surveys. That means that a large part of the studies did not use unbiased observation of the children to assess their reactions to parental smartphone use. Many studies reported on the child age specifically, while others referred to the child age as “infant” or “up to five years old”, etc. It was therefore not possible to establish the mean age of the child participants in this review. Providing the child’s age would be useful for assessing different research outcomes for different age groups, as e.g. an infant is in a different stage of development than a five year old child. This was therefore found to be a limitation in some of the studies, which can be seen in column G, *Sample*, of Table 1. Some studies regarded children in older age groups than five years old. These were only included in this review if the age group 0-5 years old provided 50% or more of the total sample size, notably ref. no: 8, or

if the study provided novel theoretical models or results, e.g. ref. no: 22.

Method characteristics

Method characteristics were extracted from the included studies to assess study limitations and risk of bias. A large number of studies used qualitative observations as their method, a total of 16 studies (ref. no: 1, 5, 7, 8, 13, 15, 16, 17, 19, 23, 24, 25, 26, 29, 30 and 32). These observations aimed to investigate the potential for the parental smartphone use to affect parental sensitivity and/or responsiveness towards their child (ref. no: 1, 5, 13, 23, 25, 29, 30, 32), parental engagement in socioemotional and cognitive growth fostering” (Ventura & Teitelbaum, 2017, pp. 4–5) (ref. no: 30) or to study the influence of technofence on the interactions between parent/caregiver and child (ref. no: 13, 17, 19, 26). Kildare aimed to particularly observe how infants responded behaviourally and physiologically to maternal screen distraction (ref. no: 15), while Ewin et al. focussed on observing the relationship between caregiver device use and a wide range of attachment behaviours (ref. no: 8). Myruski et al. (ref.no: 23) specifically investigated parental smartphone use’s impact on the child’s development, as well as on infant social-emotional functioning and parent-infant interactions, while Larkin et al. aimed to investigate whether the parent-child attachment relationship could better by the use of a smartphone app, aiding parents in attuning to their child, which they subsequently found to be true (ref. no: 16). Davidovitch et al. (ref. no: 7) also aimed to investigate if parental smartphone use could affect children’s development, distinctly regarding children vulnerable for developmental delays such as autism spectrum diagnoses. Ochoa et al. (2021, p. 621) aimed to observe whether parental device use affected five key components of parent-child interactions that are typically studied in TV-research, namely joint attention, parental and child initiation of interaction, parental sensitivity and responsiveness, parental and child talk and parental and child emotions (ref.no: 25), while finally, Nomkin and Gordon focussed on the decrease of maternal attention towards her infant’s cues due to smartphone use (ref. no: 24). As the qualitative observational studies were performed by objective and qualified researchers and often submitted to randomization techniques (Suresh, 2011), observational results are considered to be generically unbiased. Still, researchers may have put emphasis on the results they expected to find, which can also introduce confirmation bias to the research (Delbosc, 2023).

Even though qualitative observational studies were common, even more studies used quantitative or qualitative surveys as their method, or as part of their method, in a total of 17

studies (ref.no: 1, 2, 3, 4, 6, 10, 12, 13, 15, 18, 20, 21, 22, 23, 24, 31, 32). The most widely used survey used was the fixed survey battery from the Infant Behavior Questionnaire (IBQ, ref. no: 3, 10, 23, 24, 31), followed by the Mother-to-Infant Bonding Scale (MIBS, ref. no: 2, 12, 13, 24) and the Parenting Stress Index (PSI, ref. no: 6, 18, 20, 21). Next, the Smartphone Addiction Scale and the Parent-Child Attachment Q-Sort (AQS) was used in three studies each (ref. no: 1, 2, 24 and ref. no: 4, 6, 18, respectively). Six surveys were located in two of the studies included in this review, namely the Technology Device Interference Scale (TDIS, ref. no: 20, 21), the Maternal Postnatal Attachment Scale (MPAS, ref. no: 3, 10), the Strengths and Difficulties Questionnaire (SDQ, ref. no: 18, 27), the Child Behavioural Checklist (CBCL, ref. no: 20, 21), the Coparenting Relationship Scale (ref. no: 20, 21), and the Centre for Epidemiologic Studies Depression Scale (CES-D, ref. no: 20, 21). Finally, a vast majority of the surveys, n=25, were used sporadically, and only located in one study each that were included in this review. These 25 surveys are as follows; the FOMO scale (ref. no: 1), the Habit Index (regarding technology use habits, ref. no: 1), the General Functioning survey (regarding family functioning, ref. no: 2), the Depression, Anxiety and Stress Scale (DASS-21, regarding maternal mental health, ref. no: 2), the Maternal Distraction Questionnaire (MDQ, ref. no: 3), the Distracted Parenting Survey (ref. no: 4), the Parenting Styles and Dimensions Questionnaire (ref. no: 4) the Early Growth and Development Indicator-Indicator of Parent Child Interaction (IGDI-IPCI, ref. no: 6), the Assessment of Mother-Infant Sensitivity (AMIS, ref. no: 13), The Media and Technology Usage and Attitudes Scale (MTUAS, ref. no: 15), the Phubbing scale (ref. no: 18), the Parent problematic digital technology use survey (ref. no: 21), the Technology Interference in Parenting Scale (TIPS, ref. no: 22), the International Personality Item Pool (IPIP 50, regarding parental emotional stability, ref. no: 22), the Social Competence Scale (regarding parentally conceived child social competence, ref. no: 22), the Distraction in Social Relations and Use of Parent Technology (D.I.S.R.U.P.T., ref. no: 22), the Toddler Behaviour Assessment Questionnaire (TBAQ: ref. no: 23), the Mobile Attachment Scale (MAS, ref. no: 24), the State-Trait Anxiety Inventory (ref. no: 24), The Affect Grid (ref. no: 24), the Comprehensive Assessment of Family Exposure (CAFE) tool (ref. no: 27), the Nursing Child Assessment Parent-Child Interaction Feeding Scale (NCAFS, ref. no: 30), the Infant Feeding Style Questionnaire (ref. no: 31), the Baby Eating Behaviour Questionnaire (ref. no: 31) and the Mini-Maternal Behavior Q-Sort (MBQS, ref. no: 32). As such, large inconsistencies and discrepancies were found in the study methodology characteristics, where studies primarily only used the same study methodology if they were performed by the same researchers, e.g.

Inoue et al.'s studies from 2021 and 2022 (ref. no: 12 and 13), and McDaniel and Radesky's studies from 2018, respectively (ref. no: 20 and 21).

4.4 Summary of results

To summarise, results on theory/conceptual frameworks found that most studies regarded parental sensitivity and/or responsiveness. The second most common conceptual framework was child development, closely followed by attachment theory and parental attention or distraction, as well as what can be considered a subtheme of parental distraction, namely technofeference.

Results of the included studies on the effect of parental smartphone use on the parent-child attachment and/or child development found key findings divided into 14 subthemes based on the analysis of theories and conceptual frameworks used in the studies. These were: The smartphone's intervention in parent-child attachment, from parental sensitivity and responsiveness; Parent-child attachment and mobile devices in an integrated family systems model; Parental technofeference in parent-child interactions; Technofeference and parent emotional stability; Parental phubbing in the parent-child relationship; Parental absorption/immersion; Parent displacement hypothesis; The present-absent paradox; Phone use while feeding infants and toddlers; The Still-Face Paradigm as an observation; The smartphone as a tool to facilitate parents' sensitivity; Why parents use smartphones, and excessive smartphone use's impact on the parent-child relationship; Why smartphones and technofeference differ from books, magazines or TV; Screen time and family life balance. The subthemes were expanded upon to investigate and present the evidence.

Results on study methodologies found large inconsistencies and discrepancies in study methodology within the included records. Key characteristics of the documents included were categorized into study characteristics, study location characteristics, sample characteristics and method characteristics. The results showed that most research originated from developed countries with high smartphone penetration rates. The research came from many different interest points and science disciplines, which were extracted from the publishing journals, book chapter and theses, such as nursing and health, child development, education, technology use and social networking. Qualitative and quantitative surveys were the most common research methods, but the use of survey type differed greatly, and the research method was only found to be similar in studies conducted by the same researchers.

Qualitative observational studies were also common. The participant count varied from one to nearly a thousand participants per study. The total participant count for this review was 6190, whereof 4546 were adults and 1644 were children. As such, most studies, about 73,5% only had participating adults reporting on their experiences and did not include unbiased data about the child. A discussion of the results will now follow.

5 Discussion

This review discovered evidence that parental sensitivity and responsiveness is negatively affected by parental smartphone use depending on the extent and duration of smartphone use, leading to interrupted interactions which negatively affects the parent-child attachment/relationship and child development outcomes long term. This affirms the research from McDaniel's previous review (2019b) which suggests that parental smartphone use has "impacts on parenting sensitivity and behaviors", breaking parental attention and leading to unsuccessful child bids for attention, and to the child's needs not being met (p. 76). This can impact the formation of a secure attachment bond between parent and child, possibly leading to the child developing insecure views of "themselves and relationships, such as friendships, romantic relationships, work relationships and productivity, and mental health" (p. 76). Kildare and Middlemiss's review (2017) previously also found that increased parental smartphone use and reliance on such mobile devices heightened the potential for parents' smartphone use to disrupt parent-child interactions. Parental sensitivity and responsiveness were found to be negatively affected in parent-child interactions, wherein the parents were found to be less verbally and non-verbally responsive towards their children's bids for attention.

Comparably, in Beamish et al.'s review, it was discovered that parental responsivity towards child bids were lowered or completely eradicated because of parental phone use, and that the level of absorption was associated with impaired parental sensitivity. Lower parental sensitivity was associated with greater parental absorption in the device. Knitter and Zemp's review also found that it was the nature of smartphone use that determined whether it was disruptive to the parent-child interaction. This reflects a finding from this review, where e.g. Wolfers et al. found that the duration and not the frequency of phone use was associated with lower maternal sensitivity, making mothers distracted from child signals and resulting in less responsiveness and sensitivity, which are crucial for the formation and maintenance of child attachment (Wolfers et al., 2020, p. 31). Evidence of lowered parental sensitivity and

responsiveness due to smartphone use was established in the studies by Ante Contreras (2016), Davidovitch et al. (2018), Ewin et al. (2021a), Inoue et al. (2022), Jester (2019), Larkin et al. (2019), Ochoa et al. (2021), Vanden Abeele et al. (2020) and Ventura et al. (2019), leading to the cumulative conclusion that parental sensitivity and responsiveness are lowered by parental smartphone use.

Contrarily, the previous reviews by Hood et al., Knitter and Zemp, Beamish et al. and Lippold et al. found parental benefits of smartphone use, allowing parents to e.g. connect with family or other supportive individuals while apart, worry less about their absent children or to manage child-focused activities (Beamish et al., 2019; Hood et al., 2021b; Knitter & Zemp, 2020; Lippold et al., 2022). Parents were thought to gain empathy and develop compassion for their child and themselves, as well as regulate their emotions by using their smartphone. In the current review, Coyne et al.'s study also found that parental smartphone use while feeding their child could help parents cope with feeding challenges and to feel more productive (Coyne et al., 2022, p. 4). In their results, all parents reported that they used media while feeding their child, and most to using their phones. Ewin et al.'s included study (2021) similarly linked parental smartphone use to parental and child benefits, by providing parents with short parenting breaks. This was thought to possibly lead to parents resuming into the interaction more enthusiastically. Alas, the research called attention to that it also might reduce the parent's ability to provide a secure base for the child when needed, which is an important part of parental responsiveness (Ewin et al., 2021, p. 2049).

Both the review by The Norwegian Institute of Public Health by Nøkleby et al. (2022) and the review by Hood et al. (2021b) claimed limited direct and/or speculative evidence, debatable quality or methodological bias in the studies included in their reviews (Nøkleby et al., 2022; Hood et al. 2021b). Hood et al. claimed limited association between duration of parental smartphone use and attachment, while Nøkleby et al. found that parental smartphone use had negative short-term consequence on parents' sensitivity and responsivity, that it elevated the child's stress and negative emotionality, and that it posed negative short-term consequence on parent-child interaction in general. Nøkleby et al.'s findings were in line with the current review's findings from studies using a smartphone modified Still-Face Paradigm (e.g. Stockdale et al, 2020, Myruski et al., 2018, and Kildare, 2017). The current scoping review's methodology and risk of bias section also identified that the inconsistencies in research methodologies may be a reason that the research so far have found scattered or inconclusive results. When the research methods were analysed in depth, it was found that both

quantitative and qualitative surveys were used to answer research questions on this topic, without research observers, creating the possibility for parental social desirability bias. The Infant Behavior Questionnaire, IBQ, followed by the Mother-to-Infant Bonding Scale, MIBS, and the Parenting Stress Index, PSI, were the most commonly used surveys, occurring in up to five of the 32 included studies each. But survey methods were only identical in studies conducted by the same researchers, and so the methods were not confirmed and repeated by other research for comparable results. More commonly though, 25 of the surveys instruments were discovered to only have been used in one of the studies each that were included in this review. That implies that most researchers have tried to enhance on previous study methodologies, or not considered previous study methodologies when deciding on their own study methodology. This can be a reason for inconsistencies in results, as the types of data will alter due to replacing study methodologies, not leading to cumulative and/or comparable results. A methodology complication for longitudinal studies was that the research could not be measured against a control group, due to the omnipresence of the smartphones in developed society. Another reason for inconsistent results can be due to the novelty of the topic and quick expansion of smartphone ownership rates.

5.1 Discussion of study methods, methodology limitations and risk of bias

Study limitations and risk of bias in the included records was afforded an own discussion subheading, as study methodologies proved to be so dissimilar for studies included in this review.

13 studies included in this review has been based on maternal or parental self-report. Coyne et al. (2022) found no longitudinal or cross-sectional associations between attachment security and parent media use during feeding. However, their dataset was based on mothers' self-reporting of their own feelings towards the feeding situation without researchers observing or videotaping the feeding sessions with or without parental awareness. As such it is the mothers' views which constituted the findings of the dataset, and "self-reports [...] may be biased" (Coyne et al., 2022, p. 8) or "affect the validity of the results" (Ewin et al., 2021, p. 2044). The parent(s) may have altered their behaviour due to awareness of the study and the researcher's presence and purpose to fit social norms or be unaware of their own distraction and/or it's effect on the parent-child attachment. Subsequently, Ewin et. al highlights the quality of nonparticipant observational studies (Ewin et. al, 2021, p. 2044).

This can also have skewed the results in Larkin et al.'s study (2019), as the participants were aware of being observed during the free-play session and that the purpose of the app was attuning to their child. The participants may have tried to act according to the social norms that they perceived from the research team. Lv et al. also relied on self-report regarding mother's phubbing behaviours towards her child(ren), but protective factors to the study results was the high participant count of nearly a thousand participants adding generalizability to the results, and the use of several measures to define child emotional difficulties and behavioural problems. The research used the Phubbing Scale, Parent-child Attachment Scale, Parenting Stress Index-Short form and the Strengths and Difficulties Questionnaire to adequately measure mother child attachment and child outcomes of mother's phubbing (Lv et al., 2022, p. 4), adding quality as well as generalizability to their study results. The weakness of the study was that the parent was asked to be the judge of their own distractions towards their infant, and could have been unaware of being unaware. This was also the case in the study by Inoue et al. (2021) where mothers self-reported on bonding with their infant, as well as their subsequent study on smartphone use while breastfeeding (Inoue et al., 2022, p. 227) and in the study by Golen and Ventura (2015). Ventura and Teitelbaum also relied on maternal self-report of their own smartphone use during feeding, and therefore correspondingly hypothesised about potential bias (2017, p. 175).

Parents were also asked about their habitual device use in some of the studies. In Myruski et al.'s study, mothers self-reported on their own mobile device use in frequency per day, and also regarding use in front of firstly, family and secondly, their infant (Myruski et al., 2018, p. 3). Although mothers may have accurately been able to reflect and self-report on such statistics, Vanden Abeele et al. have previously found self-reports of mobile phone usage to be lacking in consistency, and recommended the use of "monitoring technologies and software modified phones" for accurate reporting (Vanden Abeele et al., 2013, p. 228). They stated that "[i]n psychological, sociological, and communication research, information on the valid measurement of mobile phone use is of vital importance in order to make valid claims about the effects of such use" (Boase & Ling, *in press*, in Vanden Abeele et al., 2013, p. 214). They found that "[l]ight users tended to overestimate, while heavy users tended to underestimate their mobile phone use" (p. 213). Valid and well-founded measurements could potentially have provided more reliable time-frames for maternal device use and distractions.

Vanden Abeele et al.'s included study (2020) also found that the results of the study differed when asking permission from the parent(s) pre-observation, in contrast to post-observation.

Parents used their phone less and were more responsive when they knew they were being observed, likely due to social desirability bias (Vanden Abeele et al., 2020, p. 367). This also highlights the importance of doing non-participant studies and using device use tracking apps rather than parental self-reports for ecologically valid results in the future.

One article lacked consistency in reporting of results. In Inoue et al.'s study, the researchers concluded that "no association was found between smartphone use during breastfeeding and poor quality mother-infant interactions" (Inoue et al., 2022, p. 230). This was true with five out of the 13 mothers, but when six out of 13 did not respond to child signals while being on their smartphone, including when the child choked, that attests vividly to poor-quality mother-infant interactions at the time and should be regarded negatively when accounting for the quality of the interaction. These mothers displayed non-simultaneous responses, if there was given a response at all. In the same study, no differences in results were reported on the AMIS, Assessment of Mother-Infant Scale and MIBS, Mother-to-infant Bonding Scale scores. This can attest to a vulnerability in using such scales and maternal self-report. Furthermore, it is also unlikely to expect an immediate change in the mother's perception of the mother-infant bonding after only one feeding with restricted smartphone use in a lab setting. Rather, longitudinal studies seem more appropriate for research on the mother-infant attachment regarding habitual smartphone use.

Some studies lacked variation in participant demographics. For example, in Hood et al.'s study (2021, p. 6), all thirty participants were the mother of the child, although fathers were also invited to participate. The same was the case for Myruski et al.'s study using the modified Still-Face paradigm (2018, p. 3). Inoue et al.'s study also only had mothers as participants, and excluded mothers who experienced mental or physical issues, or postpartum depression. Similarly, in Coyne et al.'s study 2 (2022), 263 participants were mothers and only five were fathers, and this poses a limitation for making conclusions about parents' media use in general.

In Coyne et al.'s study, general ideas were also gathered from a very low participant count from study 1, e.g., "more mother[s] reported using media primarily during the day (n=4), as opposed to night-time feedings (n=2)" (2022, p. 5). These findings were from a total participant count in study 1 of n=76, and so does not constitute a significant finding to base general assumptions on feeding and media habits for future research. The numbers reported in this article were also inconsistent, reporting a participant number of n=19 on another page. If

that was the case, then the “majority of mothers reported using their phone while feeding (n=31)” number is incorrect. And although while having the aim of measuring attachment in their longitudinal study, attachment q-scores were not measured in the first part of the study, only the last. Thus, a change in attachment due to smartphone use cannot be relevantly measured.

The same study further shows the strengths and weaknesses of the method of discussion focus-groups, where participants have a general conversation with each other, observed but not lead by a researcher. A strength could be the relaxed setting and loose conversation type to discuss ideas in a non-judgmental way, but a weakness could be that not all participants in the dataset participate in answering all topics and questions, and some may be too shy or bothered to speak up about intimate details of e.g. nursing while using smartphones, or ashamed to talk about smartphone use that were inconsistent with the other participants’ use. Anonymous research subject to randomization could be considered in this type of research, as the participants would not have to consider the risk of being recognised or “outed”.

In Golen and Ventura’s study (2015, p. 788), the participant demographics were only women (100%), primarily black (70%), had low income (92% had federal assistance) and were overweight (78%) or obese (51%). This reduces participant demographic variations to a point where conclusions cannot regard the general population based on the study’s findings. The study also relied on mothers’ self-report, not researcher observations, and the researchers therefore highlighted that some mothers may have been unaware of being distracted in this study also, or unaware of being unaware. In research this double blindness is referred to as inattention blindness and describes how humans are attentive to what we focus on and expect to see, but can miss out on other things that are right in front of us (Kvalnes, 2017, pp. 29–32). We are also unaware of what we have missed. A participant can therefore be unable to assess their own ability for joint attention, if they were attentive to other things.

Inoue et al.’s study from 2021 also only relied on mothers’ self-report, and no observations (Inoue et al., 2021). This study and the one following (Inoue et al., 2022, p. 226) excluded mothers who were not mentally or physically healthy post-partum, and so the general population was not represented, only the healthy part. Also, mother-infant bonding was measured using a scale that only measures mother’s bonding. Secondly, the sample was also of mothers only, where the mean age was around 36 years old, and this may have skewed the results. Finally, as participants in their study was told to nurse their child wearing eye-

tracking cameras, some may have understood the aim of the study and focused gaze on their child and the feeding interaction to fit social norms, such as the social desirability to be well-functioning and not have high levels of technofence distracting the parent from perceived important parent-child interaction.

The methodology and risk of bias section also highlighted that some studies only recruited mothers that were healthy after conceiving (e.g. Inoue et al., 2021, 2022), and so could have excluded mothers suffering from smartphone addiction or other addiction-related/other mental health diseases that could positively affect the prevalence of smartphone use in mother to infant interaction. Research did not regard whether mothers suffering from e.g. post-partum depression, anxiety or smartphone addiction were more reliant on smartphone use, as a coping strategy or to fill the void of social disconnection and loneliness, and if so, whether this resulted in a poorer connection to their child. This is relevant, because Myruski et al. stated that infants of depressed mothers coped better with the mother becoming non-responsive to social cues in the Still-Face paradigm, explaining this with that depressed mothers could normally be emotionally unresponsive to the child on a habitual basis and that the infant would then be more used to this behavioural pattern and react with less distress (Myruski et al., 2018, p. 2). This also means that children may become more blunted to parental smartphone use when exposed to it frequently. In measures of mothers' physiological responses, mothers also reacted with significantly more heightened stress when being asked to put their phone on silent in a bag, than when their phone was in the bag with notifications on (Nomkin & Gordon, 2021, p. 11). The researchers speculated that it was possible that the "muted condition induced a stress-like response due to a perceived lack of control" (p. 11). In other research settings it has also been established that smartphone use can be a stressor in itself, for example in *The Psychology and Dynamics Behind Social Media Interactions* in which for instance unhealthy attachment to social media, fear of being judged or exposure to inappropriate content were highlighted as stressors for the individual (Demirtepe-Saygili, 2020, pp. 1–2). But as found by Coyne et al. and Ewin et al., social media could also be used as a coping mechanism, source of social support and predictor of well-being for the individual. And so, these subjects invite more in-depth research as to whether the parent felt more calm or more agitated in their relationship to their child due to their smartphone and social media use, and into how this affected the child.

In Tomfohrde & Reinke's study (2016), the survey used only addressed mothers' social media use while breastfeeding, but not the implications for the mother-infant interaction or relationship. The survey was also simplistic in nature, where for example reasons for using social media could only be answered with "entertainment", "catching up on work", "connecting with others" or "other". More categories could have provided a more nuanced picture as to what the mothers were distracted of, and as such, how much absorption or immersion into the content they would have been able to experience. For example, if they were busy making a video call, writing a message, looking through pictures or watching a video. This reflects a finding in Knitter and Zemp's review, which sought after more knowledge on parental user habits and absorption level (Knitter & Zemp, 2020, p. 36) as well as Hood et al. seeking more information on the nature of device use and attachment (Hood et al., 2021b, p. 1617). Although highlighting the need for eye-contact between mother and infant, no questions in Tomfohrde & Reinke's study (2016) were directed at eye contact behaviours or interaction between the mother and infant, and the nuance in reasons for using social media could have provided details as to if the mothers visual attention was elsewhere. In Inoue et al.'s study, eye-tracking cameras were combined with an observational camera, measuring what the parent was potentially seeing on the smartphone, as well as the parent's visual responsiveness to the child and parent-child interaction (Inoue et al., 2022, p. 225), which can be considered an alternative.

6 Conclusions and implications of findings for research

6.1 Conclusions

Through this scoping review, it was found that technoferece through parental smartphone use negatively affects parental sensitivity and responsiveness, which could harm the parent-child attachment relationship and negatively affect the child's developmental outcomes.

The results on the effect of parental smartphone use on parent-child attachment and/or child outcomes found that parents observed with their children in natural settings were more absorbed in smartphone use than in other distractions, and more often showed delayed, blunted or aggressive responses to their children while using their smartphone. Some parents did not respond to child social cues and bids for attention at all, and one was found to be so immersed in smartphone use that she overlooked that her child choked while trying to feed. The child was okay, but it was found that early life stress affects the development of the

infant's stress response system which affects later physical and emotional functioning. Disturbances in the parent-child-attachment relationship can cause disruptions to the child's inner working model. That means that if the child is frequently being ignored or neglected due to parents being distracted with their own things, the child can grow up to not feel safe with others, not rely on others for support, and to ignore others. Technoference was therefore cause to researchers' concern for children's safety, emotional well-being and development.

All studies using a smartphone adapted Still-Face Paradigm showed that children were more distressed when the parent engaged in the smartphone rather than them. This means that the child showed more negative affect, less positive affect, more self-comforting and more escape behaviours when the parent was immersed in smartphone use. Children explored the room less and were less engaged in toys after the parent had been immersed in smartphone use, suggesting a negative impact on the child's sense of comfort and security. Interestingly, children whose parents were habitually more prone to smartphone use or smartphone addiction/problematic phone use seemed more accustomed to being ignored and thus showed blunted responses and reacted less negatively to parental smartphone use.

Parent emotional stability proved to be a mediating factor when encountering technoference in the parent-child interaction. On the other hand, phubbing was found to predict child emotional and behavioural problems, like anxiety, loneliness and acting out, in which a protective factor proved to be that parents were less stressed. One study even found significant correlations between parental smartphone use and child developmental delays, in a situation where children were brought in for assessments regarding autism spectrum diagnoses with their parents. This could be due to parental displacement of time, in which the parent's smartphone use displaces time that should be spent nurturing the child. Excessive parental smartphone use was found to disrupt joint attention, cognitive growth-inducing experiences, parent-child synchrony and the building of a secure attachment with their children. Subsequently, children can be put at a developmental disadvantage if not appropriately scaffolded, interacted with, responded to, and considered with sensitivity.

Finally, the review found that it was the duration and not the frequency of smartphone use that most affected the child's attachment, and so checking the device from time to time was less damaging to the parent-child interaction than being completely immersed in the content over longer time periods. Also, checking the device and putting it away again was found to be less disruptive than passive use such as carrying the smartphone in their hand or leaving it at

arm's length at the table. The smartphone use could even add to the parent's sensitivity towards their children when being used sensitively to frequently keep in contact with friends and relatives, if the parent was still able to show considerate and contingent responses like maintaining eye-contact, responding to children's bids for attention, showing care and affection, and providing support without communicating absent presence. This was especially the case during the COVID-19 pandemic, in which parents and children were able to use the smartphone to video chat with significant others and remain socially connected while having to stay at home, and also when the parent used a smartphone app to enhance their understanding and sensitivity towards their infant.

The results on methodologies used in the studies included in this review found that parental sensitivity and responsiveness, child development and attachment theory were the most common theories/conceptual frameworks investigated regarding the effect of parental smartphone use on the parent-child attachment/relationship and children's developmental outcomes. Parental attention was commonly studied, with references to attention themes such as responsiveness and sensitivity, mutual gaze, joint attention, parent-child synchrony and visual attentiveness. Parental distraction themes towards smartphone use were commonly technoference, phubbing, absorption, immersion, absent presence, problematic phone use and parental screen distraction. Child developmental outcomes were commonly linked to attachment, cognitive growth, emotional and behavioural problems, developmental outcomes and delays, and language acquisition. This review provides a map of existing knowledge, which can lead to new research questions and possibly to useful research outcomes in the future.

A finding of the current scoping review is also that inconsistency of methods; potential for maternal self-report bias to fit social norms; potential for self-report bias when reporting one's own levels of distraction because of inattention blindness; lack of paternal participation in studies and otherwise narrow participant demographics, adds up to a lack of cumulative evidence. There was a large variety in study methods, from differing observation methods to qualitative and quantitative surveys, varying in form and extent. The participant counts from the studies also varied greatly from one, to nearly a thousand participants. And so, although research questions were quite similar, research outcomes often differed and resulted in adverse conclusions or non-comparable results. The implications of these findings for future research will be considered below.

6.2 Implications of the findings for research

Several limitations of studies were found in this review, mostly regarding the research methodology of the studies or the conclusions deduced from the data collected, as discussed. Hence, longitudinal in-home observations with eye-tracking- and situation following cameras combined with public non-participant observations could give a fuller picture of the levels of smartphone related distraction that parents undergo while tending for their infant or toddler, and to the reactions of their child. Observational studies of the child, like the ones conducted using modified Still-face Paradigms, but in natural, non-participant settings, could be a way to enhance the focus on and research outcomes for the child. Longitudinal cause and effect studies, controlling for parent-child attachment from first to perhaps third wave of study longitudinally, and controlling for other distractions as well as parental emotional stability as suggested in Merkaš et al.'s study (2021, p. 199) would be beneficial to the state of the research regarding the effect of parental smartphone use on child development and the parent-child attachment. Because of potentially biased self-reports attempting to fit perceived social norms and the impact on the quality of self-report statements, non-participant observational studies and statistics from the mobile device could add quality and ecologically valid research results to research in the future. Also, parental self-report vs. researcher observations may differ, and so if researchers conducted assessments of the child pre- and post-observation period, the likelihood of social desirability bias from the parent's end would be reduced, especially if the assessments were subjected to randomization processes to hinder researcher confirmation bias. Many studies included mother participants only and reduced participant demographics, so studies researching the paternal role in parental smartphone use, as well as seeking out more variable participant demographics, would also be beneficial to the status of the research and add to the generalizability of the results.

Another aspect for question is if participating in such research endeavours should be compensated, and in case they should, for whom. Most participants so far were mothers with their child. In e.g. Myruski et al.'s case, the mother received a \$50 financial reward for participating while the baby received a t-shirt as compensation (2018, p. 4). As there is no guarantee for where the financial compensation is spent, the compensation could be aimed specifically at strengthening the parent-child relationship and the child's development, to fit the aim of the research being conducted. This reward could include a book or toys initiating shared experiences, pamphlets on parental responsiveness and sensitivity or child development, or the likes. That way, both participants could more likely benefit from the

compensation. Financial rewards could be in form of compensating bus or train tickets, more than the mother's time, as it is in mothers' interests too that such research continues.

7 Supplementary information

7.1 Conflicts of interest

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Appendices for extended summary

Appendices for the master's thesis have been presented in the order of which they appear in the main text of the extended summary (Caulfield, 2020, for reference see reference list for extended summary).

Appendix A Author information pack for Computers in Human Behavior Reports

Appendix B Correspondance letters

Appendix A Author Information Pack for Computers in Human Behavior Reports



COMPUTERS IN HUMAN BEHAVIOR REPORTS

AUTHOR INFORMATION PACK

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Computers in Human Behavior Reports is an open access scholarly journal dedicated to examining human computer interactions and impact of computers on human behavior from diverse interdisciplinary angles. As a companion journal to *Computers in Human Behavior (CHB)*, *CHB Reports* is a forum for both theoretical and practical implications of human-centered computing. It addresses the human aspects in relation to the systems and contexts in which humans perform, operate, communicate, and interact. *CHB Reports* welcomes research articles, review articles, negative results studies, scale validations and replication studies.

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As a minimum, the full URL should be given and the date when the reference was last accessed. Any further information, if known (DOI, author names, dates, reference to a source publication, etc.), should also be given. Web references can be listed separately (e.g., after the reference list) under a different heading if desired, or can be included in the reference list.

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Examples:

Reference to a journal publication:

Van der Geer, J., Hanraads, J. A. J., & Lupton, R. A. (2010). The art of writing a scientific article. *Journal of Scientific Communications*, 163, 51–59. <https://doi.org/10.1016/j.sc.2010.00372>.

Reference to a journal publication with an article number:

Van der Geer, J., Hanraads, J. A. J., & Lupton, R. A. (2018). The art of writing a scientific article. *Heliyon*, 19, Article e00205. <https://doi.org/10.1016/j.heliyon.2018.e00205>.

Reference to a book:

Strunk, W., Jr., & White, E. B. (2000). *The elements of style* (4th ed.). Longman (Chapter 4).

Reference to a chapter in an edited book:

Mettam, G. R., & Adams, L. B. (2009). How to prepare an electronic version of your article. In B. S. Jones, & R. Z. Smith (Eds.), *Introduction to the electronic age* (pp. 281–304). E-Publishing Inc.

Reference to a website:

Powertech Systems. (2015). *Lithium-ion vs lead-acid cost analysis*. Retrieved from <http://www.powertechsystems.eu/home/tech-corner/lithium-ion-vs-lead-acid-cost-analysis/>. Accessed January 6, 2016

Reference to a dataset:

[dataset] Oguro, M., Imahiro, S., Saito, S., & Nakashizuka, T. (2015). *Mortality data for Japanese oak wilt disease and surrounding forest compositions*. Mendeley Data, v1. <https://doi.org/10.17632/xwj98nb39r.1>.

Reference to a conference paper or poster presentation:

Engle, E.K., Cash, T.F., & Jarry, J.L. (2009, November). *The Body Image Behaviours Inventory-3: Development and validation of the Body Image Compulsive Actions and Body Image Avoidance Scales*. Poster session presentation at the meeting of the Association for Behavioural and Cognitive Therapies, New York, NY.

Reference to software:

Coon, E., Berndt, M., Jan, A., Svyatsky, D., Atchley, A., Kikinzon, E., Harp, D., Manzini, G., Shelef, E., Lipnikov, K., Garimella, R., Xu, C., Moulton, D., Karra, S., Painter, S., Jafarov, E., & Molins, S. (2020, March 25). *Advanced Terrestrial Simulator (ATS) v0.88 (Version 0.88)*. Zenodo. <https://doi.org/10.5281/zenodo.3727209>.

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Appendix B Correspondence letters

Wednesday, May 24, 2023 at 17:33:17 Central European Summer Time

Subject: Re: Including a figure from "Coronavirus Changed the Rules..." in my scoping review
Date: Tuesday, 16 May 2023 at 10:51:30 Central European Summer Time
From: rebecca@hood@gmail.com
To: Lone Bjørkmann

Dear Lone,

Thank you for your email and good luck for your research. Yes that is fine to refer to our figure in your Masters thesis.

Thanks,
Rebecca

On 14 May 2023, at 5:01 am, Lone Bjørkmann <lbj036@post.uit.no> wrote:

Dear Rebecca Hood,

I am reaching out to you regarding your article *"Coronavirus Changed the Rules on Everything": Parent Perspectives on How the COVID-19 Pandemic Influenced Family Routines, Relationships and Technology Use in Families with Infants*.

My name is Lone Bjørkmann and I am a student of media and documentation at the Faculty of Humanities, Social Sciences and Education at UiT The Arctic University of Norway. For my master's thesis, I have written a scoping review that aims to map key concepts for understanding and investigating how the parent-child attachment relationship and child development can be affected by parental smartphone use, when children are aged 0-5 years old.

I was hoping to include a figure from your article, Figure 1, and was wondering if that is alright? This figure provided a significant finding for my review, in that it provided a model for understanding parental smartphone use in the parent-child relationship based on attachment theory and family systems theory. I would like to include the figure if you think that's okay, naturally with reference to your article. The master's thesis will be published online on the university's open science archive, *UiT Munin*, in June. Follow this link if you want to discover Munin. <https://munin.uit.no/>

Hoping for a timely reply.

All the best and kind regards,
Lone Bjørkmann
Alta, Norway

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Correspondence letter regarding figure from Hood et al.'s article (2021a).

Corresponding author Rebecca Hood.

Wednesday, May 24, 2023 at 17:33:37 Central European Summer Time

Subject: Re: Including a figure from "Parent Distraction with Technology..." in a scoping review
Date: Monday, 22 May 2023 at 00:24:11 Central European Summer Time
From: Marina Merkaš
To: Lone Bjørkmann

Dear Lone,
Sorry for replying so late. You can use it; I'm glad that it will help and that you found it important.
Good luck with writing! Let me know when you defend your thesis!
Best
Marina

izv. prof. dr. sc. Marina Merkaš
Odjel za psihologiju

Hrvatsko katoličko sveučilište
Ilica 242
HR-10000 Zagreb
Telefon: + 385 (0) 1 370 66 47
Faks: + 385 (0) 1 370 66 01
www.unicath.hr

From: Lone Bjørkmann <lbj036@post.uit.no>
Sent: Sunday, May 14, 2023 7:07 PM
To: Marina Merkaš <marina.merkas@unicath.hr>
Subject: Including a figure from "Parent Distraction with Technology..." in a scoping review

Dear Marina Merkaš,
I am reaching out to you regarding your article *Parent Distraction with Technology and Child Social Competence during the COVID-19 Pandemic: The Role of Parental Emotional Stability*.

My name is Lone Bjørkmann and I am a student of media and documentation science at the Faculty of Humanities, Social Sciences and Education at UiT The Arctic University of Norway. For my master's thesis, I have written a scoping review that aims to map key concepts for understanding and investigating how the parent-child attachment relationship and child development can be affected by parental smartphone use, when children are aged 0-5 years old.

I was hoping to include a figure from your article, Figure 1, and was wondering if that is alright? This figure provided a significant finding for my review, in that it provided a model for understanding the effect of parental emotional stability on parental technoference and child social competence. I would like to include the figure if you think that's okay, naturally with reference to your article. The master's thesis will be published online on the university's open science archive, UiT Munin, in June. Follow this link if you want to discover Munin. <https://munin.uit.no/>

Hoping for a timely reply.
All the best and kind regards,
Lone Bjørkmann
UiT The Arctic University of Norway
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Correspondence letter regarding figure from Merkaš et al.'s article (2021).

Corresponding author Marina Merkaš.

Wednesday, May 24, 2023 at 17:34:07 Central European Summer Time

Subject: Including a figure from "The Effect of Mother Phubbing..." in a scoping review
Date: Sunday, 14 May 2023 at 19:14:50 Central European Summer Time
From: Lone Bjørkmann
To: chensq@gzhu.edu.cn

Dear Suiqing Chen,

I am reaching out to you regarding your article *The Effect of Mother Phubbing on Young Children's Emotional and Behavioral Problems: A Moderated Mediation Model of Mother-Child Attachment and Parenting Stress*, where you are listed for correspondence purposes.

My name is Lone Bjørkmann and I am a student of media and documentation science at the Faculty of Humanities, Social Sciences and Education at UiT The Arctic University of Norway. For my master's thesis, I have written a scoping review that aims to map key concepts for understanding and investigating how the parent-child attachment relationship and child development can be affected by parental smartphone use, when children are aged 0-5 years old.

I was hoping to include a figure from your article, Figure 1, and was wondering if that is alright? This figure provided a significant finding for my review, in that it provided a model to explore the mechanisms by which maternal phubbing interacts with children's emotional and behavioural problems. I would like to include the figure if you think that's okay, naturally with reference to your article. The master's thesis will be published online on the university's open science archive, UiT Munin, in June. Follow this link if you want to discover Munin. <https://munin.uit.no/>

Hoping for a timely reply.

All the best and kind regards,
Lone Bjørkmann
UiT The Arctic University of Norway

Page 1 of 1

Correspondence letter regarding figure from Lv et al.'s article (2022).

Corresponding author Suiqing Chen.

Wednesday, May 24, 2023 at 17:34:25 Central European Summer Time

Subject: Including figures from "Infants' response to a mobile..." in a scoping review
Date: Sunday, 14 May 2023 at 19:20:33 Central European Summer Time
From: Lone Bjørkmann
To: lstockdale@byu.edu

Dear Laura Stockdale,

I am reaching out to you regarding your article *Infants' response to a mobile phone modified still-face paradigm: Links to maternal behaviors and beliefs regarding technoference*, where you are listed for correspondence purposes. First of all, thank you for a great article!

My name is Lone Bjørkmann and I am a student of media and documentation science at the Faculty of Humanities, Social Sciences and Education at UiT The Arctic University of Norway. For my master's thesis, I have written a scoping review that aims to map key concepts for understanding and investigating how the parent-child attachment relationship and child development can be affected by parental smartphone use, when children are aged 0-5 years old.

I was hoping to include two figures from your article, Figure 1 and 2, and was wondering if that is alright? These figures provided a significant finding for my review, in that they visualized the infants' responses to the Still-face Phase. I would like to include the figures if you think that's okay, naturally with reference to your article. The master's thesis will be published online on the university's open science archive, UiT Munin, in June. Follow this link if you want to discover Munin. <https://munin.uit.no/>

Hoping for a timely reply.

All the best and kind regards,
Lone Bjørkmann
UiT The Arctic University of Norway

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Correspondence letter regarding figures from Stockdale et al.'s article (2020).

Corresponding author Laura Stockdale.

Wednesday, May 24, 2023 at 17:34:43 Central European Summer Time

Subject: Including a figure from "Infants' Perceptions of Mothers' Phone Use..." in a scoping review
Date: Sunday, 14 May 2023 at 19:29:36 Central European Summer Time
From: Lone Bjørkmann
To: Cory.Kildare@gmail.com

Dear Cory Kildare,

I am reaching out to you regarding your doctoral dissertation *Infants' Perceptions of Mothers' Phone Use: Is Mothers' Phone Use Generating the Still Face Effect?*.

My name is Lone Bjørkmann and I am a student of media and documentation science at the Faculty of Humanities, Social Sciences and Education at UiT The Arctic University of Norway. For my master's thesis, I have written a scoping review that aims to map key concepts for understanding and investigating how the parent-child attachment relationship and child development can be affected by parental smartphone use, when children are aged 0-5 years old.

First of all, thank you for such an interesting dissertation! I was hoping to include two figures from your article, "Figure 4. COPE behaviors by phase...", and was wondering if that is alright? This figure provided a significant finding for my review, in that it visualizes the infants' responses to the phone still face phase. I would like to include the figure if you think that's okay, naturally with reference to your dissertation. The master's thesis will be published online on the university's open science archive, UiT Munin, in June. Follow this link if you want to discover Munin. <https://munin.uit.no/>

Hoping for a timely reply.

All the best and kind regards,
Lone Bjørkmann
UiT The Arctic University of Norway

Page 1 of 1

Correspondence letter regarding figure from Kildare's dissertation (2017).

Corresponding author Cory Kildare.

Appendices for scoping review

Review appendices have been numbered using roman numerals in the order by which they appear in the body of the scoping review text (Peters et al., 2020, p. 445, for reference see scoping review reference list).

Additional file I Search strategy.

Additional file II Screening questions, eligibility criteria and data charting.

Additional file III PRISMA-ScR-Fillable-Checklist.

Additional file IIII Sources excluded following full text review.

Additional file I Search strategy

Search strategy and information sources

To guarantee a comprehensive search for studies, two online databases were pilot searched for records relevant to the research question. First, a search in the academic database Web of Science retrieved 104 results. Secondly the health-related database PubMed was consulted, as attachment was a primary health-related topic. This revealed 35 results. The search strategy was to prioritize the technology or technology-related terms to parents and attachment, and the effect this would have on parent, child or parent-child relationship and attachment. The search terms started as "social media" "influence" but were adjusted to "child*" "detachment" "excessive" "parent* media use" "social media" "child maltreatment*" and then finally to "smartphone, parent*, attachment" with the accompanying terms listed below. The adjustment was made to ensure relevant result entries were found. The final search retrieved 851 results, whereof 262 results were from Web of Science, 82 results were from PubMed and 507 results were from the OVID database including Embase Classic+Embase, Ovid MEDLINE(R) and APA PsycInfo.

Search terms

These search terms were used for the following databases:

Web of Science

TS=(("smartphone*" OR "mobile device*" OR "technolog*" OR "media" OR "phubbing" OR "technoferece" OR "absor*" OR "immers*") AND ("parent*" OR "child*" OR "infant*" OR "baby") AND ("attach*") AND ("detach*" OR "connect*" OR "distract*" OR "attenti*" OR "sensitiv*"))

262 results on 12.12.2022 for years 01.01.2005-12.12.2022

PubMed.gov:

("smartphone*[Title/Abstract] OR "mobile device*[Title/Abstract] OR "technolog*[Title/Abstract] OR "media"[Title/Abstract] OR "phubbing"[Title/Abstract] OR "technoferece"[Title/Abstract] OR "absor*[Title/Abstract] OR "immers*[Title/Abstract]) AND ("parent*[Title/Abstract] OR "child*[Title/Abstract] OR "infant*[Title/Abstract]

OR "baby"[Title/Abstract]) AND ("attach*"[Title/Abstract]) AND ("detach*"[Title/Abstract] OR "connect*"[Title/Abstract] OR "distract*"[Title/Abstract] OR "attention"[Title/Abstract] OR "sensitivity"[Title/Abstract]) Filters: from 2005/1/1 - 2022/12/12

Reported n = 82 results on 12.12.2022 for years 01.01.2005-12.12.2022

Embase Classic+Embase <1947 to 2022 Week 49>

Ovid MEDLINE(R) <1996 to December Week 2 2022>

APA PsycInfo <2002 to December Week 1 2022>

((smartphone* or mobile device* or technolog* or media or phubbing or technoference or absor* or immers*) and (parent* or child* or infant* or baby) and attach* and (detach* or connect* or distract* or attenti* or sensitiv*)).mp. [mp=ti, ab, hw, tn, ot, dm, mf, dv, kf, fx, dq, bt, nm, ox, px, rx, an, ui, sy, tc, id, tm] n = 640

limit to yr="2005 -Current" n = 555

remove duplicates n = 507

Reported n = 507 results on 15.12.2022 for years 01.01.2005-15.12.2022

Total search results: 262+82+507= n = 851

Records after duplicates removed: n = 669

Titles and abstracts of records screened: n = 669

Full-text articles accessed for eligibility: n = 60

Full text articles excluded on criteria: n = 46

1 Not parent-child attachment, bond or relationship context: n = 6

2 Not relating to parental smartphone/mobile device use: n = 21

3 Not appropriate population age group (child): n = 5

4 Not peer reviewed and published: n = 0

5 Not an empirical study: n = 5

5.1 Reviews: n = 7

(Of these, eligible reviews were included in the introduction)

6 Not English language: n = 1

7 Not published before 2005: n = 0

8 Additional duplicate found: n = 1

Full-text articles after exclusion: n = 14

Records added by snowballing the in-text references and literature lists: n = 18

Studies included in qualitative synthesis: n = 32

Additional file II Screening questions, eligibility criteria and data charting

Eligibility criteria
<p>Inclusion criteria</p> <ul style="list-style-type: none"> • Are published from 01.01.2005 because of the emergence of the smartphone at that time. • Investigates the relationship / bond / attachment between parent/primary caregiver and their child aged 0-5 years. • Media use includes mobile phones and smartphones and whatever content they include (apps, social media, texting, newspapers, music players, banking, weather forecasts, etc.) • Investigates different types of parental distraction regarding mobile phone/smartphone use, and parent-child reactions/consequences to/of this use. • Includes qualitative or quantitative empirical studies • Is written in English
<p>Exclusion criteria</p> <ul style="list-style-type: none"> • Does not focus on child media use. • Does not focus on relationship to siblings, grandparents or other close relatives or caregivers than caregivers in the primary parental role. • Does not research distraction from cassette players, CD-players, TV, VHS, Internet streaming, large tablets or console games, iPods, MP3-players, discmans, etc. • Does not include studies where the smartphone was used as an aid for medical reasons or vulnerable groups dependent on the media use. • Does not research the smartphone use's individual influence on parent or child health such as smartphone addiction, anxiety, depression, autism spectrum diagnoses or attention deficit hyperactivity disorder (ADHD) without the parent-child interaction aspect. • No research published before 2005 is included.

- Not written in English.

Title/abstract screening

Yes/maybe --> Full text screening.

No --> exclude

- Is the study empirical?
- Does the study/review report on parent/primary caregiver – child relationship/attachment/bond?
- Does the study/review report on parental media use from mobile phones/smartphones?
- Is the study peer-reviewed and published?

Full text screening for inclusion and exclusion

- Does the study report on child ages 0-5 years?

Data charting

To answer the research questions, the extraction fields in the data chart focused on author and year of publication; purpose of study/review; theory/conceptual framework; type of data (method); sample; variables of interest; measure of relationship quality and key findings relating to the research objectives. These extraction fields built upon the extraction fields in previous scoping and systematic reviews regarding parent-child attachment and parental technology use, specifically on the reviews by Kildare & Middlemiss (2017) and Hessel & Dworkin (2018) For these references, see the article’s reference list.

See the final data chart below.

Ref. no.	Country of origin	Reference	Purpose	Theory/conceptual framework	Type of data (method)	Sample	Variables of interest	Measure of relationship quality	Key findings

Additional file III PRISMA-ScR-Fillable-Checklist

Follows on the next page.

Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
TITLE			
Title	1	Identify the report as a scoping review.	Title page
ABSTRACT			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	1
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	3
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	7
METHODS			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	8
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	9
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	9
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	Additional file I, Additional file II
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	9, Additional file II
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	11, Additional file II
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	12
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	N/A

Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	30
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SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
RESULTS			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	11
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	13
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	N/A
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	13
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	30
DISCUSSION			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	59
Limitations	20	Discuss the limitations of the scoping review process.	68
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	63
FUNDING			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	73

JBI = Joanna Briggs Institute; PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.

* Where sources of evidence (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.

† A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with information sources (see first footnote).

‡ The frameworks by Arksey and O'Malley (6) and Levac and colleagues (7) and the JBI guidance (4, 5) refer to the process of data extraction in a scoping review as data charting.

§ The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document). From: Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Ann Intern Med.* 2018;169:467–473. doi: 10.7326/M18-0850.



Additional file III Sources excluded following full text review

60 records were accessed in full-text for eligibility according to the inclusion and exclusion criteria. The primary reasons for exclusion have been listed below, and the complete reference plus it's primary reason for exclusion is cited in the table.

Full-text articles accessed for eligibility: n = 60

Full text articles excluded on criteria: n = 46

- 1 Not parent-child attachment, bond or relationship context: n = 6
- 2 Not relating to parental smartphone/mobile device use: n = 21
- 3 Not appropriate population age group (child): n = 5
- 4 Not peer reviewed and published: n = 0
- 5 Not an empirical study: n = 5
 - 5.1 Reviews: n = 7
 - (Of these, eligible reviews were included in the introduction)
- 6 Not English language: n = 1
- 7 Not published before 2005: n = 0
- 8 Additional duplicate found: n = 1

Full-text articles after exclusion: n = 14

Number (out of 46 excluded records in total)	Reference	Primary reason for exclusion
1	Ariyanto, A.A. [Ed], Muluk, H. [Ed], Newcombe, P. [Ed], Piercy, F.P. [Ed], Poerwandari, E.K. [Ed], Suradijono, S.H.R. [Ed], 2018. Diversity in unity: Perspectives from psychology and behavioral sciences. Diversity in unity: Perspectives from psychology and behavioral sciences.	2 Not relating to parental smartphone/mobile device use
2	Armstrong, L., Huh, Y., 2021. Longing to Connect: Could Social Robots Improve Social Bonding, Attachment, and Communication Among Children with Autism and Their Parents?, in: Li, H., Ge, S., Wu, Y., Wykowska, A., He, H., Liu, X., Li, D., PerezOsorio, J. (Eds.), Ewha Womans University. Presented at the SOCIAL ROBOTICS, ICSR	2 Not relating to parental smartphone/mobile device use

Number (out of 46 excluded records in total)	Reference	Primary reason for exclusion
	2021, pp. 650–659. https://doi.org/10.1007/978-3-030-90525-5_57	
3	Baggett, K., Davis, B., Sheeber, L., Miller, K., Leve, C., Mosley, E., Landry, S., Feil, E., 2021. Optimizing Social-Emotional-Communication Development in Infants of Mothers With Depression: Protocol for a Randomized Controlled Trial of a Mobile Intervention Targeting Depression and Responsive Parenting. JMIR RESEARCH PROTOCOLS 10. https://doi.org/10.2196/31072	5 Not an empirical study
4	Beamish, N., Fisher, J., Rowe, H., 2019. Parents' use of mobile computing devices, caregiving and the social and emotional development of children: a systematic review of the evidence. Australas Psychiatry 27, 132–143. https://doi.org/10.1177/1039856218789764	5.1 Review
5	Bonassi L., Beretta G., Nastasi G., Giuntini N., Andreol A., Pravettoni G., Peccatori F.A., Cassani C., Smorti M., Ponti L., Ionio C., Bozicevic L., 2021. The quality of mother-infant interaction in a sample of mothers with a previous cancer diagnosis and their 4 months infants. Tumori, National Congress of Italian Association of Medical Oncology, AIOM 2021. Virtual. 107, 158–159. https://doi.org/10.1177/03008916211041664	2 Not relating to parental smartphone/mobile device use
6	Bozicevic, L., Ponti, L., Smorti, M., Pravettoni, G., Peccatori, F.A., Cassani, C., Nastasi, G., Sarchi, V., Bonassi, L., 2022. Psychological Well-Being, Prenatal Attachment, and Quality of Early Mother-Infant Interaction: A Pilot Study With a Sample of Mothers With or Without Cancer History. Front Psychol 13, 913482. https://doi.org/10.3389/fpsyg.2022.913482	2 Not relating to parental smartphone/mobile device use
7	Braune-Krickau, K., Schneebeli, L., Pehlke-Milde, J., Gemperle, M., Koch, R., von Wyl, A., 2021. Smartphones in the nursery: Parental smartphone use and parental sensitivity and responsiveness within parent-child interaction in early childhood (0-5 years): A scoping review. Infant Ment Health J 42, 161–175. https://doi.org/10.1002/imhj.21908	5.1 Review
8	Bucur, C., Ciolan, L., Petrescu, A., 2018. NOWADAYS PARENT - BETWEEN CHALLENGES OF PRESENT TIME AND BUILDING THE FUTURE, in: Chova, L., Martinez, A.,	2 Not relating to parental

Number (out of 46 excluded records in total)	Reference	Primary reason for exclusion
	Torres, I. (Eds.), University of Bucharest. Presented at the EDULEARN18: 10TH INTERNATIONAL CONFERENCE ON EDUCATION AND NEW LEARNING TECHNOLOGIES, pp. 10001–10008.	smartphone/mobile device use
9	Dyzel, V., Dekkers-Verbon, P., Toeters, M., Sterkenburg, P., 2021. For happy children with a visual or visual-and-intellectual disability: Efficacy research to promote sensitive caregiving with the Barti-mat. BRITISH JOURNAL OF VISUAL IMPAIRMENT. https://doi.org/10.1177/02646196211047733	2 Not relating to parental smartphone/mobile device use
10	Eslinger, P.J., Anders, S., Ballarini, T., Boutros, S., Krach, S., Mayer, A.V., Moll, J., Newton, T.L., Schroeter, M.L., de Oliveira-Souza, R., Raber, J., Sullivan, G.B., Swain, J.E., Lowe, L., Zahn, R., 2021. The neuroscience of social feelings: mechanisms of adaptive social functioning. Neuroscience & Biobehavioral Reviews 128, 592–620. https://doi.org/10.1016/j.neubiorev.2021.05.028	2 Not relating to parental smartphone/mobile device use
11	Gleeson, D.M., Craswell, A., Jones, C.M., 2019. Women’s use of social networking sites related to childbearing: An integrative review. Women Birth 32, 294–302. https://doi.org/10.1016/j.wombi.2018.10.010	5.1 Review
12	Griffin, C.R., 2012. No more away: techno-attachments and the relational future. Am J Psychoanal 72, 65–75. https://doi.org/10.1057/ajp.2011.48	5 Not an empirical study
13	He, Q., Zhao, B., Wei, H., Huang, F., 2022. The relationship between parental phubbing and learning burnout of elementary and secondary school students: The mediating roles of parent-child attachment and ego depletion. FRONTIERS IN PSYCHOLOGY 13. https://doi.org/10.3389/fpsyg.2022.963492	3 Not appropriate population age group (child)
14	Hood, R., Zabatiero, J., Zubrick, S.R., Silva, D., Straker, L., 2021. The association of mobile touch screen device use with parent-child attachment: a systematic review. Ergonomics 64, 1606–1622. https://doi.org/10.1080/00140139.2021.1948617	5.1 Review
15	Jia, Y., Cheng, G., Zhang, D., Ta, N., Xia, M., Ding, F., 2017. Attachment avoidance is significantly related to attentional preference for infant faces: Evidence from eye movement data.	2 Not relating to parental

Number (out of 46 excluded records in total)	Reference	Primary reason for exclusion
	Frontiers in Psychology 8. https://doi.org/10.3389/fpsyg.2017.00085	smartphone/mobile device use
16	John A., A.S., M., Halliburton A.L., 2012. Looking beyond maternal sensitivity: Mother-child correlates of attachment security among children with intellectual disabilities in urban India. <i>J. Autism Dev. Disord.</i> 42, 2335–2345. https://doi.org/10.1007/s10803-012-1479-y	2 Not relating to parental smartphone/mobile device use
17	Julal, F.S., 2018. Holding the baby: Using the Leiden Infant Simulator Sensitivity Assessment to examine attachment theory's sensitivity hypothesis. <i>Psychology Learning & Teaching</i> 17, 229–241. https://doi.org/10.1177/1475725718766280	2 Not relating to parental smartphone/mobile device use
18	Kammermeier, M., Duran Perez, L., König, L., Paulus, M., 2020. Attachment security and attention to facial emotional expressions in preschoolers: An eye-tracking study. <i>Br J Dev Psychol</i> 38, 167–185. https://doi.org/10.1111/bjdp.12313	2 Not relating to parental smartphone/mobile device use
19	Kildare, C.A., Middlemiss, W., 2017. Impact of parents mobile device use on parent-child interaction: A literature review. <i>Computers in Human Behavior</i> 75, 579–593. https://doi.org/10.1016/j.chb.2017.06.003	5.1 Review
20	Kim, A.R., Kim, S.-Y., Yun, J.E., 2020. Attachment and relationship-based interventions for families during neonatal intensive care hospitalization: a study protocol for a systematic review and meta-analysis. <i>Syst Rev</i> 9, 61. https://doi.org/10.1186/s13643-020-01331-8	5 Not an empirical study
21	Knitter, B., Zemp, M., 2020. Digital Family Life: A Systematic Review of the Impact of Parental Smartphone Use on Parent-Child Interactions. <i>Digit Psych</i> 1, 29–43. https://doi.org/10.24989/dp.v1i1.1809	5.1 Review
22	Kosenko, Y., Suprun, M., Boryak, O., Korol, O., 2021. DIGITAL TECHNOLOGIES AS A TOOL TO FORM ABSTRACT CONCEPTS OF SCHOOLCHILDREN WITH MENTAL DEVELOPMENT DISORDER. <i>INFORMATION TECHNOLOGIES AND LEARNING TOOLS</i> 85, 42–61. https://doi.org/10.33407/itlt.v85i5.4415	6 Not English language

Number (out of 46 excluded records in total)	Reference	Primary reason for exclusion
23	Kryukova T., Ekimchik O., Tikhomirova E., Umanskaya I., 2022. Phubbing as a Mobile Phone Addiction. J. Behav. Addict., 7th International Conference on Behavioral Addictions, ICBA. Nottingham United Kingdom. 11, 23. https://doi.org/10.1556/2006.2022.00700	1 Not parent-child attachment, bond or relationship context
24	LaFrance, M., 2011. We, lonely robots. <i>PsycCRITIQUES, Contemporary Psychology</i> 56, No-Specified. https://doi.org/10.1037/a0026395	5 Not an empirical study
25	Leach, P., 2018. Fifty years of childhood. Transforming infant wellbeing: Research, policy and practice for the first 1001 critical days. 3–10.	2 Not relating to parental smartphone/mobile device use
26	Lee, G., Kim, S., 2022. Relationship between Mother's emotional intelligence, negative parenting behaviour, Preschooler's attachment instability, and smart device overdependence. <i>BMC Public Health</i> 22, 752. https://doi.org/10.1186/s12889-022-13171-3	2 Not relating to parental smartphone/mobile device use
27	Lee, R., Skinner, A., Bornstein, M.H., Radford, A.N., Campbell, A., Graham, K., Pearson, R.M., 2017. Through babies' eyes: Practical and theoretical considerations of using wearable technology to measure parent–infant behaviour from the mothers' and infants' view points. <i>Infant Behavior and Development</i> 47, 62–71. https://doi.org/10.1016/j.infbeh.2017.02.006	2 Not relating to parental smartphone/mobile device use
28	Leung J., Doyle J., Hamilton J., 2019. Using technology to promote parent child attachment through a cultural lens. <i>Women Birth, ACM 2019 National Conference - Power, Passion and Politics</i> . Canberra Australia. 32, S26. https://doi.org/10.1016/j.wombi.2019.07.224	5 Not an empirical study
29	Lin, C., Sabanovic, S., Dombrowski, L., Miller, A., Brady, E., MacDorman, K., 2021. Parental Acceptance of Children's Storytelling Robots: A Projection of the Uncanny Valley of AI. <i>FRONTIERS IN ROBOTICS AND AI</i> 8. https://doi.org/10.3389/frobt.2021.579993	2 Not relating to parental smartphone/mobile device use
30	Mackay, L.J., Komanchuk, J., Hayden, K.A., Letourneau, N., 2022. Impacts of parental technoference on parent-child relationships and child health and developmental outcomes: a	5.1 Review

Number (out of 46 excluded records in total)	Reference	Primary reason for exclusion
	scoping review protocol. Syst. Rev. 11, 45. https://doi.org/10.1186/s13643-022-01918-3	
31	Melumad, S., 2018. The distinct psychology of smartphone usage. Dissertation Abstracts International Section A: Humanities and Social Sciences, Dissertation Abstracts International 78, No-Specified.	1 Not parent-child attachment, bond or relationship context
32	Modecki, K.L., Low-Choy, S., Uink, B.N., Vernon, L., Correia, H., Andrews, K., 2020. Tuning into the real effect of smartphone use on parenting: A multiverse analysis. Journal of Child Psychology and Psychiatry, Child Psychology & Psychiatry & Allied Disciplines 61, 855–865. https://doi.org/10.1111/jcpp.13282	3 Not appropriate population age group (child)
33	Nekoui, Y., Roig, E., 2022. Children and the Mediated City. Place Attachment Development Using Augmented Reality in Urban Spaces. INTERACTION DESIGN AND ARCHITECTURES 144–157.	1 Not parent-child attachment, bond or relationship context
34	Nelson, C.A. [Ed], Luciana, M. [Ed], 2008. Handbook of developmental cognitive neuroscience., Developmental cognitive neuroscience. Boston Review, Cambridge, MA, US.	2 Not relating to parental smartphone/mobile device use
35	Norgate, S.H. [Ed], Cooper, C.L. [Ed], 2020. Flexible work: Designing our healthier future lives. Flexible work: Designing our healthier future lives., Current issues in work and organizational psychology. https://doi.org/10.4324/9780429326585	1 Not parent-child attachment, bond or relationship context
36	Numata-Uematsu, Y., Yokoyama, H., Sato, H., Endo, W., Uematsu, M., Nara, C., Kure, S., 2018. Attachment Disorder and Early Media Exposure: Neurobehavioral symptoms mimicking autism spectrum disorder. J Med Invest 65, 280–282. https://doi.org/10.2152/jmi.65.280	2 Not relating to parental smartphone/mobile device use
37	Oades-Sese, G., Cahill, A., Allen, J., Rubic, W., Mahmood, N., 2021. Effectiveness of Sesame Workshop’s Little Children, Big Challenges: A digital media SEL intervention for preschool classrooms. PSYCHOLOGY IN THE SCHOOLS 58, 2041–2067. https://doi.org/10.1002/pits.22574	1 Not parent-child attachment, bond or relationship context

Number (out of 46 excluded records in total)	Reference	Primary reason for exclusion
38	Oliveira P., Stevens E., Barge L., Comyn J., Langley K., Ramchandani P., Wright B., Woolgar M., Kennedy E., Byford S., Shearer J., Scott S., Barlow J., Glaser D., Senior R., Fonagy P., Fearon P., 2022. A modified video-feedback intervention for carers of foster children aged 6 years and under with reactive attachment disorder: a feasibility study and pilot RCT. <i>Health Technol. Assess.</i> 26, v–96. https://doi.org/10.3310/SLIZ1119	2 Not relating to parental smartphone/mobile device use
39	Palen, L., Hughes, A., 2007. When home base is not a place: parents' use of mobile telephones. <i>Pers Ubiquit Comput</i> 11, 339–348. https://doi.org/10.1007/s00779-006-0078-3	1 Not parent-child attachment, bond or relationship context
40	Roeters, A., van Houdt, K., 2019. Parent–Child Activities, Paid Work Interference, and Child Mental Health. <i>Family Relations</i> 68, 232–245. https://doi.org/10.1111/fare.12355	3 Not appropriate population age group (child)
41	Saltzman, J.A., MUSAAD, S., Bost, K.K., McBride, B.A., Fiese, B.H., 2019. Associations between father availability, mealtime distractions and routines, and maternal feeding responsiveness: An observational study. <i>Journal of Family Psychology</i> 33, 465–475. https://doi.org/10.1037/fam0000519	2 Not relating to parental smartphone/mobile device use
42	Schein, S.S., Roben, C.K.P., Costello, A.H., Dozier, M., 2022. Assessing Changes in Parent Sensitivity in Telehealth and Hybrid Implementation of Attachment and Biobehavioral Catch-Up During the COVID-19 Pandemic. <i>Child Maltreat</i> 10775595211072516. https://doi.org/10.1177/10775595211072516	2 Not relating to parental smartphone/mobile device use
43	Technology's impact on the parent-infant attachment relationship: Intervening through FirstPlay® therapy. [WWW Document], n.d. URL https://psycnet-apa-org.mime.uit.no/fulltext/2018-59973-001.html (accessed 12.21.22).	8 Additional duplicate found
44	Wang, X., Qiao, Y., Li, W., Lei, L., 2022. Parental Phubbing and Children's Social Withdrawal and Aggression: A Moderated Mediation Model of Parenting Behaviors and Parents' Gender. <i>J. Interpers. Violence</i> 37, NP19395–NP19419. https://doi.org/10.1177/08862605211042807	3 Not appropriate population age group (child)

Number (out of 46 excluded records in total)	Reference	Primary reason for exclusion
45	Wright, B., Barry, M., Hughes, E., Trépel, D., Ali, S., Allgar, V., Cottrill, L., Duffy, S., Fell, J., Glanville, J., Glaser, D., Hackney, L., Manea, L., McMillan, D., Palmer, S., Prior, V., Whitton, C., Perry, A., Gilbody, S., 2015. Clinical effectiveness and cost-effectiveness of parenting interventions for children with severe attachment problems: a systematic review and meta-analysis. <i>Health Technol Assess</i> 19, vii–xxviii, 1–347. https://doi.org/10.3310/hta19520	2 Not relating to parental smartphone/mobile device use
46	Zayia, D., Parris, L., McDaniel, B., Braswell, G., Zimmerman, C., 2021. Social learning in the digital age: Associations between technoference, mother-child attachment, and child social skills. <i>Journal of School Psychology</i> 87, 64–81. https://doi.org/10.1016/j.jsp.2021.06.002	3 Not appropriate population age group (child)

