HOW DOES THE USE OF SMARTPHONES CHANGE FOR NEW MOTHERS?

A PRE- AND POSTPARTUM, MATCHED-CONTROLLED OBSERVATIONAL DESIGN

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List of Abbreviations

ASD	Autism Spectrum Disorder
DSM	Diagnostic and Statistical Manual of Mental Disorders
EBF	Exclusive Breastfeeding
FB	Facebook
IBQ-R	Revised Infant Behavior Questionnaire Short Form
LGBT	Lesbian, Gay, Bisexual and Transgender
MPPUS-10	Mobile Phone Problem Use Scale – 10 question version
NZ	New Zealand
PDA	Personal Digital Assistant
PSOC-5	Parenting Sense of Competence scale – 5 question version
RBs	Research Buddies
SD	Standard Deviation
SFP	Still Face Paradigm
TBAQ	Toddler Behavior Assessment Questionnaire
TIPS	Technology Interference with Parenting Scale
USA	United States of America
WHO-5	The 5-item World Health Organisation Well-Being Index

Author Attestation

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.

mm

Miriam Aroha McCaleb
29 October, 2020

Works arising from or related to this thesis

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- McCaleb, M., Champion, P., & Schluter, P. J. (2020) The real (?) effect of smartphone use on parenting - a commentary on Modecki et al. (2020). Revision submitted to the *Journal for Child Psychology and Psychiatry* (see Appendix A).
- McCaleb, M. Summary of research for study participants and other interested parties. In draft.

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- McCaleb, M. (2019, November) *Towards Wise Digital Practice* [Presentation]. Puketeraki Community of Learning, Rangiora.
- McCaleb, M. (2019, September). Presentation to Playcentre families from combined North Canterbury Playcentres.
- McCaleb, M. (2019, April). Presentation to “Together Hurunui”, NGO’s, community groups, local government in the Hurunui district.

Online writing relating to this thesis:

- McCaleb, M. (2020, March 8). Screen Free Week in New Zealand: Advocacy and sass. https://www.screenfree.org/screen-free-week-in-new-zealand/

Media articles based on the thesis:

- Dangerfield, E. (2019, April 26). Turn off those screens. *Northern Outlook*, 1.
- Davidson, A. (2019, May 2). Step away from your screens. *North Canterbury News*, 7.

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Abstract

Today's adults are likely to use smartphones, which are pervasive in their abundance and persuasive in their design. Using a smartphone while caring for infants is associated with suboptimal outcomes for the parent/child relationship, and therefore child development. There has been an absence of empirical information about the extent to which mothers' smartphone use reflects an understanding of potential harm, and whether their smartphone perceptions, intentions and behaviours change at the transition to parenthood. To address this question, we used a pre- and post-partum, matched-controlled observational design, in which first time mothers (n=65) and their nominated "research buddies (RB)" (n=29) were surveyed and used a screen-time tracking app (*Moment*) for seven days. Data were gathered during the final trimester of pregnancy, and again at 6-8 weeks postpartum. Pregnant women and RB had mean phone use of 205 and 198 minutes/day (range: 37-562 mins/day, 61-660 minutes/day), respectively. Pregnant women and RB had mean daily phone pickups of 53 and 54 (range: 2-223 pickups/day, 5-142 pickups/day) respectively. After child birth, both groups saw increases in both measures, the new mothers' time on device increase was statistically significant ($p<0.001$), as was the RB pickup increase ($p=0.04$). These measured increases are in contrast to a reduction in both groups' scores on the Mobile Phone Problem Use Scale, 10 question version (MPPUS-10), a self-report scale designed to assess problematic use or overuse of the smartphone. For the new mothers, the average matched MPPUS-10 score reduced by 4 points (95% CI: -7, -1) after the child's birth, a difference that was statistically significant ($p=0.008$). This suggests that women's perceptions of their smartphone differed from their objectively measured use. These findings, along with other results from the survey, reinforce calls by other researchers regarding the need for guidelines for new parents about

limiting smartphone use in the presence of infants. This thesis includes this call for guidelines as part of a suite of recommendations to support new mothers in enjoying the benefits of smartphone use while minimising the potential for harm to the parent/infant relationship, and therefore to child development.

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Appendix A (p143) is a copy of a Commentary submitted to the Journal of Child Psychology and Psychiatry. This was co-authored by thesis supervisors, Patricia Champion and Philip Schluter.

Please detail the nature and extent (%) of contribution by the candidate:

- *The initial conception of the idea for this commentary was Miriam's. She led the writing of the first submission and the attached reviewed version. (90%)*
- *The supervisory team provided advice and revision support, and all saw and approved the final version. (Champion 5%; Schluter 5%)*

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The undersigned certifies that:

- The above statement correctly reflects the nature and extent of the Doctoral candidate's contribution to this co-authored work
- In cases where the candidate was the lead author of the co-authored work he or she wrote the text

Name: *Professor Philip Schluter* Signature:  Date: *22/10/2020*

Chapter One:

INTRODUCTION

1.1 Background

We are in the midst of an unparalleled, ubiquitous social experiment. Mobile technologies, including smartphones, are both pervasive in their abundance and persuasive in their design (Fogg, 2009; Kidron et al., 2018). The societal and individual implications of this rapid change have yet to be fully understood (Gluckman & Allen, 2018), as "consideration of benefits and risks follows, rather than precedes, widespread use" (Beamish et al., 2019, p. 132).

Researchers are working to document the impact of this digital revolution at the societal level, for example, examining the workforce in the face of automation (Smith, 2016) and democratic systems in this era of big data (Bozdag & van den Hoven, 2015; Gray, 2016). Elsewhere, others seek to record the impact of digital transformation on individual and social wellbeing. In this arena, work/life balance (Gadeyne et al., 2018) and interpersonal relationships (McDaniel & Coyne, 2016a; Radesky et al., 2016) are among the topics examined.

Within the examination of modern interpersonal relationships, a phenomenon known as "technoference" emerges (McDaniel, 2013; McDaniel & Coyne, 2016a; McDaniel et al., 2018; McDaniel & Radesky, 2018a, 2018b; Stockdale et al., 2018; Stockdale et al., 2020; Sundqvist et al., 2020; Zimmerle, 2019). This portmanteau speaks to the *interference* of *technology* within relationships, and it could be argued infant neurobiology renders the impact of

technoference as greatest within parent/child relationships. Further: the younger the child, the more this is so (Sergent, 2020).

First described by McDaniel in 2013 as a cause of tension in romantic relationships, technoference is a pattern whereby one person's percieved overuse of technology, for example a smartphone, causes relational disharmony, leading that person to lean deeper into the undemanding comfort of their smartphone. This increased engagement with technology incurs increased relational disharmony and reduced individual wellbeing (McDaniel & Coyne, 2016a) contributing to a continuing cycle. Greater technoference has been associated with poorer perceptions of coparenting quality (McDaniel et al., 2018), and it may be problematic in parent/child relationships (Newsham et al., 2018; Sergent, 2020). Children are more likely to misbehave in the face of their parents' phone use (McDaniel, 2013; McDaniel & Radesky, 2018b) and avoiding such misbehaviour may be a contributing factor in parents' smartphone use in the presence of their children (Newsham et al., 2018; Oduor et al., 2016; Radesky et al., 2014)

For infants, whose optimal development is reliant on a sense of connectedness with their parent (Frosch et al., 2019), it is likely to be a developmental challenge to be raised in a family where the adults are "always connected" to others, online (Williams, 2011, p. 150). The plasticity of infants' brains make the influence of early relationships particularly potent (Phillips & Shonkoff, 2000) as human neurodevelopment occurs in the context of relationship (Cozolino & Walker, 2018; Parsons et al., 2010; Phillips & Shonkoff, 2000). The consistency, attentiveness and degree of attunement with which an adult cares for a baby (Meyer et al., 2013; Schore, 2000; Siegel, 2018) have been shown to implicate physiological and

psychological health outcomes across the baby's lifespan (Johnson & Acabchuk, 2018; Shah & Stewart-Brown, 2018). The importance of early relationships cannot be overstated (Young et al., 2017), as "the development of secure and cooperative relationships are central to the future of the species" (Parsons et al., 2010, p. 220).

In New Zealand, 91% of people of childbearing age (18-34 years) use a smartphone every day (Ministry of Health, 2017; Research New Zealand, 2015), suggesting that it is highly likely that babies born in New Zealand today will be born to parents who use a smartphone. This ubiquitous use brings costs as well as opportunities.

The opportunities include benefits for people's home lives. For example, mobile technologies are perceived to support transnational families in staying connected despite geographical distance (Bacigalupe & Lambe, 2011), limited use of a smartphone may reduce feelings of loneliness in new mothers (Mandai et al., 2018), their use can assist with the management of family activities in real time (Devitt & Roker, 2009), or in emergency situations. Smartphones have been found to help breastfeeding mothers find support about the practice (Alianmoghaddam et al., 2019; Lebron et al., 2020; Tharmaratnam, 2019). Social media is perceived as helping create community for at-home fathers (Ammari & Schoenebeck, 2015) parents of children with special needs (Ammari et al., 2014), and lesbian, gay, bisexual or transgender (LGBT) parents (Blackwell, Hardy, et al., 2016).

Meanwhile, there are acknowledged risks associated with our ever-increasing use of technology. Smartphones create an attentional challenge, as "individuals are 'always elsewhere' "(Wallis, 2010, p. 11) Using a smartphone while parenting has been shown to

distract parents (Blackman, 2015; Golen & Ventura, 2015a; Hiniker et al., 2015), with people of child rearing age (18-33 years) found to check their phones an average of 85 times a day (Andrews et al., 2015). Distracted parents can create risks to child safety, with increased incidences of playground injury (Chatton, 2018; Hiniker et al., 2015) and drowning (Long, 2018; Moran, 2010) attributed to parental distraction by smartphones. Parental distraction poses risks to the formation of secure attachment relationships (Kildare & Middlemiss, 2017; Tomfohrde & Reinke, 2016) and problems with young children's language learning (Reed et al., 2017). Parental distraction by smartphones is also associated with child behaviour problems (McDaniel, 2013; McDaniel & Radesky, 2018b; Radesky et al., 2014). Further, as parents' smartphone use in the presence of their children increases, their reported feelings of connection to their children decreases (Kushlev & Dunn, 2019).

Another challenge to the parent/child relationship is that when a parent is distracted by their smartphone, they are likely to assume a "still face" with blank affect. Lessons from Tronick's seminal Still Face paradigm (SFP) (Tronick et al., 1978) highlight how problematic this can be for an emerging parent/child relationship, and therefore to child development. In the original experiment, mothers in controlled conditions temporarily desisted in their typically responsive interactions with their infants, instead assuming a "still face". The babies' distress and eventual withdrawal are seen as evidence of the importance of interactional reciprocity, which demands caregiver attentiveness and sensitivity. Contemporary researchers find parallels between smartphone use and Tronick's work (Gulyayeva et al., 2016; Khourochvili, 2017; Myruski et al., 2018; Stockdale et al., 2020), as parents interrupted by their phones inadvertently subject their infants to a "still face" periodically throughout a day. This is particularly concerning given that infants have been shown to be sensitive to disruptions in

the flow of natural interactions (Bigelow & Best, 2013) and unpredictable parental signals are associated with negative cognitive outcomes and risk of mental illness for children (Glynn & Baram, 2019). For these reasons and others, parental smartphone use can negatively influence a child's social-emotional functioning (Myruski et al., 2018), with smartphones found to interrupt playtime (Hiniker et al., 2015; Newsham et al., 2018), mealtimes (Radesky et al., 2014) and breastfeeding (Tomfohrde & Reinke, 2016).

As awareness of these risks grows in the research community, so do calls for parent education and/or guidelines to support new parents in limiting their smartphone use in the presence of their babies (Khourochvili, 2017; Kildare & Middlemiss, 2017; Kulakci-Altintas, 2019; Newsham et al., 2018). However, it is unclear the extent to which mothers themselves are aware of the risks that their smartphone use pose to child development, or whether they are using such knowledge to reduce their own smartphone use. A reduction cannot be assumed, particularly as research has shown that new mothers increase their use of Facebook after the birth of their babies (Bartholomew et al., 2012), and elsewhere parents have reported deliberately engaging with their smartphones as an intentional strategy to avoid caring for their children (Oduor et al., 2016).

While maternal smartphone use in the presence of infants is proving to be harmful to the mother/infant relationship and therefore to child development, there is an apparent absence of empirical information about the extent to which mothers' perceptions and behaviours reflect an understanding of those harms. There is an urgent need to gather empirical evidence about whether new mothers' smartphone use perceptions, intentions and behaviour change after the birth of their babies. This is the purpose of this thesis.

1.2 Theoretical Framework

This study will be underpinned by two complementary theories of human development, Bowlby's **Attachment Theory** and Porges' **Polyvagal Theory**. Both theories recognise that a child's relational milieu is the most powerful influence on their development – whether measured via psychosocial, physiological, cognitive, language, or neurodevelopmental outcomes. Also essential in this work is Neuman's **Time Displacement Hypothesis**, which posits that time spent performing one activity (for example: gazing at a smartphone) leaves less time and attentional capacity for other activities (for example: gazing at a baby).

Attachment theory (Bowlby, 1969) offers an explanation for the importance of secure early relationships, and the significance of such a relationship for a person's long term development (Sroufe, 1986; Wilkinson & Marmot, 2003). In terms of human evolution, attachment is seen to be adaptive, as a secure relationship enhances infant safety and survival. The caregiving behaviours that support a secure attachment relationship are described as being part of an *environment of evolutionary adaptedness*: that is, the physical and relational environment under which humans evolved these brains and bodies (Bowlby, 1969). Within the environment of evolutionary adaptedness are a series of caregiving behaviours that are associated with optimal development. These are collectively called the *evolved developmental niche*. These behaviours can be summarised as: extensive breastfeeding, touch, prompt responsiveness, and play (Narvaez, Gleason, et al., 2013). Deviations from these are practices are associated with a range of suboptimal outcomes for psychological and physiological functioning (Narvaez, Gleason, et al., 2013; Narvaez,

Panksepp, et al., 2013; Schore, 2013). The habit of engaging with a smartphone while caring for an infant is an example of a deviation from the evolved developmental niche. This is one way that attachment theory offers a useful framework for understanding the relevance of this study, which aims to quantify the extent to which new parents embrace or avoid smartphones while caring for their new babies.

Meanwhile, the Polyvagal Theory (Porges, 2011), offers a conceptualisation for the biology of attachment (Diamond, 2015; Wagner, 2015). The Polyvagal theory is a biobehavioural explanation for how humans' constant monitoring for cues of risk and safety can be calmed by a loving, soothing relationship, thus regulating both emotional and bodily states. In the Polyvagal theory there are descriptions of the specific neuroanatomical pathways described as *face-to-heart* (Porges, 2015) which emphasise the role of a caregiver's facial expression in fostering a sense of safety in an infant. A calm, safe infant can more readily maintain homeostasis, and parental interaction is a powerful influence on this (Propper & Moore, 2006). An infant whose parent's facial cues communicate safety will likely form social bonds which serve as the prototype for future connected relationships, allowing access to the physiological state associated with learning, growth and restoration into the future (Wilkinson & Marmot, 2003). As previously discussed, the SFP (Tronick et al., 1978) and smartphone users' invocation thereof, provide a worrisome substrate when contemplating the vital importance of *face-to-heart* communication on child development. An infant whose caregiver fails to meet the baby's needs in their quest for safety is at risk of a limited developmental trajectory (Porges, 2015). The Polyvagal theory, with its emphasis on biobehavioural processes, parental responsiveness and the anatomical cues brought about

by parental facial expression as influencers on child wellbeing, will be a useful platform from which to evaluate the relevance of this study.

Also underpinning this work is the Time Displacement Hypothesis (Neuman, 1988), which posits that time engaged in one activity reduces the ability to engage in another. Further, it proposes that the harms associated with technology are directly proportional to exposure. In Neuman's original work, children's reading abilities were studied alongside the time they spent watching television. Subsequently, time spent engaging with screens has been recognised as impacting one's available time for social engagement (Hooghe & Oser, 2015; Putnam, 2000), and this concept is particularly salient when viewed through the lens of parent/infant interaction, given the plasticity of babies' brains (Parsons et al., 2010; Phillips & Shonkoff, 2000).

1.3 Purpose and Structure of the Study

This thesis measures women's smartphone use perceptions, intentions and behaviour before and after their first baby's birth, and compares the pre- and post-natal data. Meanwhile, a matched control group had their smartphone use perceptions, intentions and behaviour measured at equal intervals, without the addition of a baby to their lives. This control group serves to identify temporal changes in behaviours unrelated to the birth of the pregnant women's babies. This data will highlight whether new mothers are reducing their smartphone use, perhaps in deference to their relationships with their babies, or if there is a need for

phone use guidelines and support for parents to reduce their smartphone use in the presence of their infants.

Following a review of the current literature and consideration of specific research questions, this thesis will outline the methodology and methods employed to gather data. The Results chapter contains the statistical analysis of these data. Finally, the Discussion chapter, framed by theoretical underpinnings, will examine the results alongside extant literature. Furthermore, the Discussion will close by drawing conclusions, implications and recommendations.

Chapter Two:

LITERATURE REVIEW

2.1 Introduction to Literature Review

Laypeople and professionals alike are aware that the human experience is changing alongside the enthusiastic adoption of mobile computing and communication technologies. The use of devices such as smartphones has become commonplace, and this ubiquitous use brings costs as well as opportunities.

The opportunities include benefits for people's home lives. For example, mobile technologies are perceived to support transnational families in staying connected despite geographical distance (Bacigalupe & Lambe, 2011), and limited use can reduce new mothers' reported feelings of loneliness (Mandai et al., 2018)

Meanwhile, there are acknowledged risks associated with our ever-increasing use of technology. As new mothers' use of social media site Facebook increases, so do their reported levels of parenting stress (Bartholomew et al., 2012). Overuse of smartphones is associated with decreased sleep and increased depression in university students (Demirci et al., 2015), and within couples, the more frequent the distraction of mobile devices, the lower the reported satisfaction with the relationship – and with life in general (McDaniel, 2013).

Further, there is mounting evidence that parental distraction by smartphones in the presence of infants may be contributing to deleterious outcomes for child development (Atli et al., 2019; Davidovitch et al., 2018; Gunuc & Atli, 2018; Kulakci-Altintas, 2019; McDaniel & Radesky, 2018a; Myruski et al., 2018; Newsham et al., 2018; Reed et al., 2017).

In New Zealand, 91% of people of childbearing age (18-34 years) use a smartphone every day (Ministry of Health, 2017; Research New Zealand, 2015). With infants likely to be born to parents who own and use smartphones, some researchers have called for parental guidelines that support them in limiting their smartphone use in the presence of their babies (Khourochvili, 2017; Kildare & Middlemiss, 2017; Newsham et al., 2018).

However, for such guidelines to be meaningful and effective, they ideally should be informed by a reliable evidence-base. Currently, there is a lack of empirical evidence measuring changes to screen use at the transition to motherhood.

2.2 Objectives

This review sought to examine the previously published, relevant research literature in the area of smartphone use by pregnant women and/or new mothers. Of specific interest is whether new mothers alter their smartphone use after the births of their babies, and if so; how. Also of interest are the implications of maternal smartphone use for the mother/baby relationship and therefore for infant development.

2.3 Method of Literature Review

Selection of Databases

This literature search was undertaken in consultation with the Health Sciences Librarian at the University of Canterbury (Ms. Margaret Paterson). First, the librarian asked to be provided with examples of papers perceived to be important in this research area. The papers were provided following initial reading on the subject of parental smartphone use during infancy. They were a literature review by Kildare and Middlemiss (2017), and research by Myruski et al. (2018). Both are included in this review. This process was in order to select appropriate databases and ensure that our search would include all relevant journals, conference presentations, theses and dissertations. The databases searched extended beyond the realm of those usually associated with Health Sciences in order to include journals with a technological, rather than health, focus.

Databases searched using keywords

The databases in the search and results are listed here, see also Figure 2.1 for a study selection flow chart.

Web of Science journals include science and social sciences journals, as well as conference proceedings. The *Scopus* database included journals from Life Sciences, Social Science, Physical and Health Sciences. Also included was *PsycINFO,* which is a psychology database.

The papers that were hand-selected for inclusion in this review (Ante-Contreras, 2016; Hiniker

et al., 2015; Radesky et al., 2014) appeared in both of the literature reviews that met selection criteria for this chapter.

Keywords

Search terms were selected using terms relevant to three domains (Table 2.1). The search focused on articles using these terms in their titles. Having removed duplicates, an initial screen of abstracts created a pool of possible studies (n=64) which were read in full.

Assessment of Relevance: Inclusion/Exclusion Criteria

For research papers to be considered relevant they had to discuss parental use of smartphones, not only children's use. Papers were also included if they discussed women's smartphone use during pregnancy. If a paper focussed on a different age group, it could be included if it made specific reference to infants.

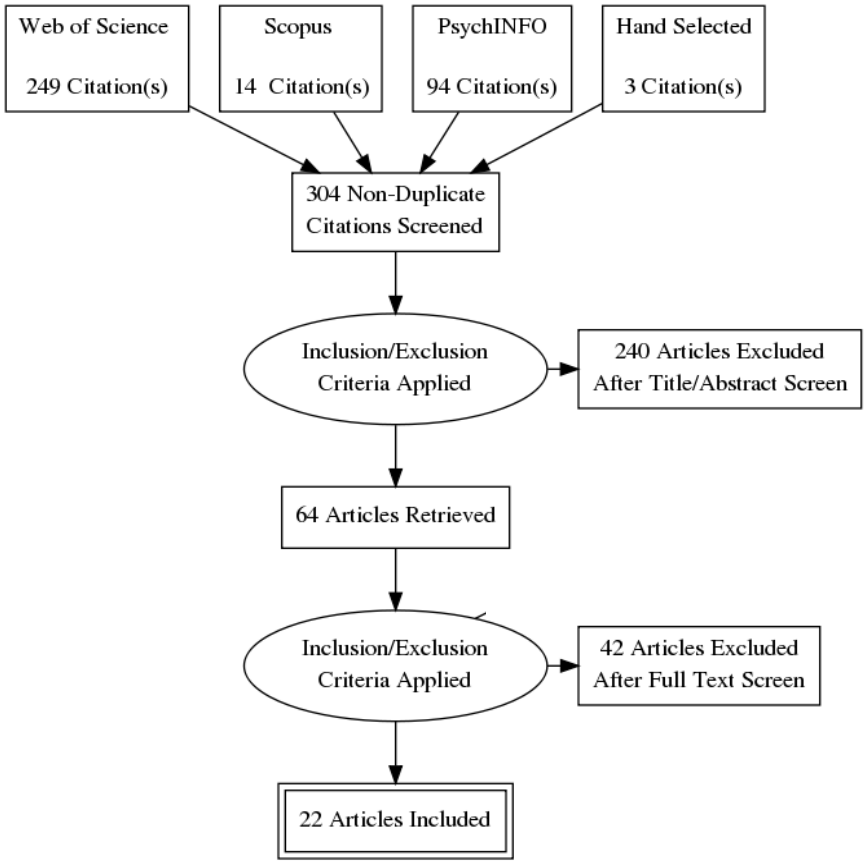
Papers with an mHealth focus were excluded, and this impacted many papers in the initial set of results. mHealth can be defined as "medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants (PDAs), and other wireless devices" (Kay et al., 2011).

The recent nature of smartphone technology meant that specific date ranges were not necessary when formulating this search, so no papers were excluded on the basis of publication date.

Table 2.1
Search Terms for Literature Review

Domain One: technology	Domain Two: Affected person: infant	Domain three: User
Mobile ADJ (phone* or device*) OR cellphone* OR cell phone* OR smartphone* OR smart phone* OR iPad*	(Infan* OR child* OR newborn* OR baby* OR babies*) SAME development OR social-emotional OR socioemotional OR language OR attachment OR interaction* OR behav*	Parent* OR mother* OR maternal* OR pregnan*

Figure 2.1
Literature Review Study Selection Flow Chart



2.4 Search Results

Web of Science returned 249 references, the *Scopus* database returned 14 references and *PsycINFO* returned 94 references. There were 22 papers included in the final review (Table 2.2). This table describes studies that are qualitative in design (n=6), quantitative (n=11), mixed method (n=2) and reviews of literature (n=2). There is one master's thesis and one doctoral dissertation, and studies come from New Zealand, Turkey, the United States of America (USA), Germany, Norway, Australia, Israel, and Japan.

All papers in this review had English language abstracts, and all but one (Johnsen & Glavin, 2017) were published in English. This paper was translated from Norwegian using free web-based translation software, and correspondence with the study's author confirmed the relevance of the included quotations and inferences (Appendix F).

Table 2.2
Summary of Articles Included in Literature Review

Citation	Country	Theory	Aim	Sample Size/ Recruitment	Methodology/ Study type	Key Findings
Alianmoghaddam, Phibbs, & Benn (2019)	New Zealand	Strength of weak ties Landscapes of care	To explore the influence of social media on exclusive breastfeeding practice (EBF)	n=30 women, more than 30 weeks pregnant at time of recruitment Advertisements in public places, breastfeeding social media websites, snowballing	Qualitative. Prenatal questionnaire (demographic info, intention to EBF) Face-to-face interviews 4-6 weeks after birth Monthly audio recorded telephone interviews to six months postpartum OR until giving up EBF	• Mothers need reliable online infant feeding information • Smartphone apps can be a good option for promoting breastfeeding • Information is accessed through weak ties among breastfeeding mothers on Facebook • Breastfeeding advocates should use social media to promote and support EBF
Ante-Contreras (2016)	USA	Attachment theory Ecological theory	Explore how parents use social media while caring for their children, and how this affects parent-child attachment	n=167 parents of children ages 0-4 Recruited via social media sites and snowballing	Quantitative. Online questionnaire Self report of phone use and of attachment styles	• 75% of parents self-reported to using their device at least three times a day for social media when supervising children • 10% stated their

					Masters thesis	child had been hurt when unsupervised while a parent used social media • Statistically significant positive relationship found between having authoritarian parenting style and hours of social media use per day
Asiodu, Waters, Dailey, Lee, & Lyndon (2015)	USA	Life course development theory Black feminist theory	To describe the use of social media during the antepartum and postpartum periods among first-time African American mothers and their support persons	n=14 pregnant African American women and n=8 support persons Flyers in waiting rooms of hospitals, clinics, and community based organisations in the Bay Area of Northern California. Advertisements on social media sites such as	Qualitative. Semistructured interviews, community participant observations, field notes.	• Social media important for disseminating infant feeding information • Future interventions geared toward African American mothers and their support persons should include social media approaches

				Facebook and Craigslist.		
Atli, Gunuc, Kuss, & Baran (2019)	Turkey	Bio-social development theory Family systems theory	To investigate the adaptive behaviours of 18- to 24- month old infants and their parents' use of technology	n=116 parents Convenience sample of 58 volunteer married couples with 18- to 24- month old infants enrolled in Family Health Centres in the Anatolia region of Turkey	Quantitative Questionnaire filled out in Family Health Centre Demographic info, self report tech use, self report of Adaptive Behaviour Assessment System	• Parents' use of technology had an impact on the adaptive behaviours of 18- to 24-month old infants. • Infants whose mothers did not engage in any internet activity have higher adaptive behaviour scores
Beamish, Fisher, & Rowe (2019)	Australia	n/a	Describe, synthesise and evaluate the evidence about parents' mobile device use, caregiving and children's social and emotional development	n=8 papers Systemic review	Systemic literature review Search of databases using keywords and subject headings	• Emerging body of evidence suggests mobile devices are associated with altered attention and responsivity to children by their caregivers and may change caregiver/child interactions. • Evidence precludes questions about causality or

						discussion about impacts on child development
Blackman (2015)	USA	Attachment theory Social learning theory Ecological systems theory Parent Development Theory	Explore parents' screen time and screen distractions on parent-child relationships, including frequency of use and caregiver responsiveness to children during use	n=93 parents and caregivers of children aged between 2 and 18 years of age Recruited in person from New York City public parks, schools and youth sporting events, and snowball sampling	Quantitative Survey (Self reported Screen Time Questionnaire, Parenting Behaviour Importance Questionnaire - Revised), administered in person and via mail PhD Dissertation	• Child screen use increases with parent use • Positive relationship between parental screen time and parental screen distractions • Technologically distracted parents are less responsive to their children • Parents screen time and parental screen distraction are significantly moderated by caregiver education level and income
Davidovitch, Shrem, Golovaty, Assaf, & Koren (2018)	Israel	Hypothesis: Eye contact is fundamental for infants' development, and parent-infant eye contact is impaired when parents are preoccupied by	To document the extent of cellular phone usage by parents during their child's diagnostic developmental assessment. Researchers speculate that, if under these	n=111 parents attending diagnostic developmental sessions for children	Quantitative. Researchers attended the diagnostic meeting and waiting room and observed parent-child interaction, using an app "Stop-Watch" to	• Last 20 years has seen "dramatic increase" in prevalence of autism • "social pollution" may be unrecognised etiological factor • One third of parents used their phone more than 50% of the time while waiting with

		cellphones. Researchers speculate that children with a pre-existing vulnerability to autism may be adversely affected by this pattern of parental behaviour.	stressful circumstances of awaiting their child's crucial assessment the parent is not fully engaged with their child, then in real daily activities this phenomenon is likely much more pronounced.		record how many times parent looked at phone, how many times they used it, and duration of each phone engagement.	their child in waiting area. • Parents' focus and full attention toward cellphones can adversely affect development of joint attention in infants, may be problematic for vulnerable subgroup of infants • More research needed to prove causation, but "it would be reasonable to advise parents to decrease to minimum the usage of cellphones when interacting with their young children".
Guerra-Reyes, Christie, Prabhakar, Harris, & Siek (2016)	USA	n/a	To assess low-income mothers' perceptions of their postpartum information needs, describe their information seeking behaviour, explore their use of mobile technology	n=10 low-income mothers of children aged 48 months and under Convenience sample recruited among clients of community partners	Exploratory, sequential, quantitative-qualitative design	• Establishing breastfeeding and solving breastfeeding problems were central postpartum concerns leading to information seeking • Interviewees reported almost exclusive use of mobile

			to address those needs			phones to access the internet • Websites replace apps as source of information postpartum • Knowledge of page-rank systems and social media will allow health-related organisations to better engage with low-income mothers
Gunuc & Atli (2018)	Turkey	n/a	To investigate the impacts of technology on infants where parents use technological devices for themselves or their infants	n=52 parents Volunteering parents of 18- to 24-month old infants registered in Family Health Centres 9, 10, and 12 of the Ipekyolu district in Turkey	Qualitative. Face-to face, semi-structured interviews.	• Technology has direct and indirect impacts on infants' behaviour and psychology • Parents use technological devices (child's use) during caregiving routines and to entertain them (sometimes so parents can go online)
Harpel (2018)	USA	Attachment theory	To investigate the role of prenatal attachment in the mother's representation of her unborn child	n=117 pregnant women Posts on researcher's FB page, paid ads on	Quantitative. Online surveys – demographic info, questions about use of FB to share	• Social media used during pregnancy for informational and supportive purposes. • Professional

			via social media (specifically Facebook)	FB targeted to pregnancy-related groups, professional organisation listservs.	pregnancy related information, 41 question self report attachment scale.	could use these networks to provide intervention, information and support to pregnant women.
Hefner, Knop, Schmitt, & Vorderer (2019)	Germany	Attachment theory	To test associations between parental mediation of children's phone use, parent's own phone use, and secure parent-child attachment.	n=500 (=both parents and children) Recruitment method unclear. (quota sample survey?)	Computer assisted survey and face to face interviews with children & adolescents (aged 8 – 14 years). Also parent's survey by one of each child's parents. Phone use self-reported	• Children's involvement with mobile phone is higher in children whose parents engage more in restrictive parental mediation • Parents' own problem mobile phone use makes children more vulnerable to problem phone use • 'Attachment Facilitating' parenting has a protective effect on children's problem phone use.
Hiniker et al. (2015)	USA	Socio-technical theory	To understand how adult caregivers use their mobile phones at a playground and to identify adults' perspectives on the	n=466 adult caregivers of children judged to be less than 10 years old.	Mixed methods study Quantitative phone use data (time used for,	• 28% of caregivers feel phone use while supervising children is acceptable as long as child is safe • 44% of parents

			appropriateness of phone use in the context of having children in their care	Seven city locations over 3 month period.	number of times used) Observation of caregiver, field notes taken Semi-structured interviews Asked beliefs and values about phone use	believe phone use should be related to being at playground • 40% of parents would like to decrease their use. • 40% accessed phones when becoming bored
Johnsen & Glavin (2017)	Norway	Attachment theory	To investigate how mothers manage to divide their attention between the use of Smartphones and attending to their children's needs.	n=13 mothers of children aged under 3 years. Mothers recruited from local health clinics – eleven nurses from three health sites asked to recruit.	Qualitative Individual, semi-structured interviews	• Mothers experience challenges in balancing their attention between use of smartphones and being present for child • Increased knowledge and awareness are important so mothers can make intelligent choices while child is awake.
Kildare & Middlemiss (2017)	USA	n/a	To provide an overview of parents' mobile device distractions while caring for	n=27 papers Literature search using key terms	Literature review	• The integration of mobile devices in our day to day lives is complex with many

			their children and the implications of this distraction on parent-child relationships			parenting benefits and complications. • Parents who use their phones during parent-child interactions are less sensitive and responsive both verbally and non-verbally to children's bids for attention
Kulakci-Altintas (2019)	Turkey	Not stated	To determine the use of technological devices among 0-3 year old children and the attitudes and behaviours of their parents for the use of technological devices	n=500 parents of children 0-3 years old Recruited from five family health centres in Zonguldak, Turkey	Quantitative Cross-sectional, descriptive and comparative study	• Nearly half of children using devices 2-5 hours per day • Parents allow children to use devices so they can do housework, silence the child when crying, feed the child, put child to sleep, entertain child and to spend time with other adults • Results reveal the necessity for parents to be informed about health risks for children of long-term use of tech and the need to spend time with children

Lupton (2017)	Australia	Not stated	To investigate womens' experiences of using digital media for pregnancy and parenting, and what media they would like to see developed	n=36 women – either pregnant or with new babies Recruitment via a Sydney-based market research company	Qualitative Focus groups	• Digital media very important to participants • Use apps, social media, content-sharing platforms and online discussion forums to connect with each other & family members, to post images & info about pregnancy/baby, track pregnancy or child development, and to learn about pregnancy, infants and childcare. • Despite frequent use and reliance on digital media, few participants considered implications of sharing personal information about themselves or their children
McDaniel & Radesky (2018)	USA	Not stated	Study aims to investigate longitudinal and bidirectional associations between parent technology use and	n=183 parents with a young child aged 1 year or older, up to 5 year Participants recruited through	Quantitative. Cross-lagged structural equation models of parent technology	• Results suggest bidirectional dynamics in which (a) parents, stressed by their child's difficult behaviour, may withdraw from parent-child interactions with

			child behaviour, and understand whether this is mediated by parenting stress	letters and phone calls to families who were part of a family research database in the northeast of the USA. Announcements also posted to online resources and listservs	interference during parent-child activities, parenting stress, and child externalizing and internalizing behaviour were tested. Tech use self reported.	technology and (b) this higher technology use during parent-child interactions may influence externalizing and withdrawal behaviours over time
Mandai, Kaso, Takahashi, & Nakayama (2018)	Japan	Attachment theory	This study aimed to identify predictors of loneliness in mothers raising children, with special reference to SNS use	n=523 mothers of children under 3 years Participants recruited from mothers taking children for health check-ups in Nagahama City, Japan.	Quantitative. Self-reported questionnaire, cross-sectional study	• Degree of loneliness in mothers raising children associated with smaller social network, lower secure attachment style. • Results suggest U -shaped relationship between time spent on smartphones and loneliness
Myruski et al. (2018)	USA	Not stated	The traditional Still Face Paradigm (SFP) was modified to include mobile device use, mimicking typical disruptions in	n=50 infants 7-23 months old Recruitment method is unreported	Mixed. Parents filled in questionnaires: self-reported mobile use, the Revised Infant	• Patterns of child behaviour during modified SFP mirrored those of the traditional version, with infants showing the most

			parent-infant interactions that may occur in daily life		Behaviour Questionnaire Short Form (IBQ-R) or the Toddler Behaviour Assessment Questionnaire (TBAQ) . Also, researchers observed a modified SFP (three phase: play, SFP, reunion) and coded infant behaviours	distress when mothers were disengaged. • Greater habitual self-reported mobile device use was associated with less infant recovery upon reunion • Findings provide support for the use of this modified paradigm as a framework for understanding the impact of parent's mobile device use on infant social-emotional functioning and parent-infant interactions.
Newsham, Drouin, & McDaniel (2018)	USA	Not stated	To examine problematic mobile phone use, depression, and technology interference among mothers.	n=223 mothers of children aged 1 to 5 years Recruited from Amazon's mTurk, a crowd-sourcing app that is used to recruit participants	Quantitative, self reported. Technology Interference with Parenting Scale (TIPS) – modified. Mobile Problem Use Scale	• "many" mothers (41.9% - 71.8%) reported that technology interfered with parenting activities. • Maternal depression was associated with problematic phone usage, which in turn was associated with

					Center for Epidemiologic Studies Depression Scale short-form	technology interference in parenting. • Public Policy Relevance Statement = highlights potential need for health care screening for maternal problematic mobile phone use alongside traditional maternal depression screens and policy recommendations aimed at parents' and caregivers' own use of media when interacting with children.
Radesky et al. (2014)	USA	Not stated	To describe naturalistic patterns of mobile device use by caregivers and children to generate hypotheses about its effect on caregiver-child interaction	n=55 caregivers of children judged to be 0-10 years old	Quantitative. Observation Field notes	• 40 of 55 caregivers used phones during mealtime • Higher levels of absorption in phone by caregiver associated with less responsivity, change in quality of response to child/ren, more harsh responses • Child's bids for attention/ misbehaviour escalated with parental disengagement

Radesky et al. (2015)	USA	Not Stated	To understand parent views regarding their mobile device use to identify actionable targets of potential intervention	n=35 caregivers of children aged 0 to 8 years old. Recruited via flyers at urban primary care practice, local university, parenting groups, digital tech company, and via snowballing.	Qualitative Interviews with caregivers of young children – individual and small group.	• Participants consistently expressed a high degree of internal tension regarding their own mobile technology use, which centred around 3 themes: Cognitive tensions (eg multitasking), Emotional tensions (eg stress inducing vs. stress reduction), and tensions around the parent-child dyad. • Caregivers of young children describe many internal conflicts regarding their use of mobile technology, which may be windows for intervention.

2.5 Findings of Literature Review

Synthesis of the selected papers revealed primary themes, and this section will collate the various studies according to these themes.

2.5.1 Women's smartphone use pre-motherhood, during pregnancy

Recent research highlights pervasiveness of smartphone use, with Asiodu et al. (2015) reporting that the women in their study all had a smartphone, regardless of educational background, income, or living situation. This idea is expanded in the paper by Alianmoghaddam et al. (2019) with their assertion that those in poorer countries are likely to have a smartphone with access to WiFi, even if they are without running water.

The popularity of pregnancy apps as a means of finding information is discussed by Asiodu et al. (2015), Guerra-Reyes et al. (2016), and elsewhere in a qualitative study by Lupton (2017), in which three quarters of her respondents describe having used one. Lupton also reports that the women she interviewed were already using Facebook prior to pregnancy.

While Blackman (2015) does not specifically mention the change of smartphone use at the transition to parenthood, it is perhaps relevant that she cites various studies into the gender differences of smartphone use between young men and young women. Blackman concludes that women have a more intense attachment to their phones than men do, and that they are more prone to addiction to the device. Although her findings are demographically limited, referring to studies conducted on American college students, Blackman accurately infers that they are "a demographic on the horizon of parenthood" (p44).

2.5.2 Changes in smartphone use for postpartum women

With the birth of babies, the usefulness of pregnancy apps naturally subsides, and many researchers report that instead women begin to use a new variety of apps targeted at new mothers. In her qualitative study, Lupton (2017) found that half of the 36 women in her research used parenting apps, and while some of the women used the apps to find health information, others used them to keep track of infant sleep and feeding patterns. Lupton (2017) also provides some specific examples of changes in women's online habits (for example, 57% of women used websites during pregnancy, 66% used them for parenting). However, due to the nature and design of this study, these findings lack external validity, and it is unclear whether these changes reflect increased time spent on smartphones or increased use of other devices.

In their qualitative study of 13 Norwegian mothers of 3-12 month old infants, Johnsen and Glavin (2017) found that first-time mothers found it especially difficult to alter their already-established smartphone habits as they transitioned into parenthood. Conversely, Asiodu et al. (2015) reported in their study of 14 first-time African American mothers that the new mothers decreased their use of social media, instead spending time interacting with their babies and attending postpartum groups. Unfortunately, the means of measurement for this finding is undisclosed, calling the finding into question. Further, the small sample size and convenience sampling used in both studies may impact the external validity and generalisability of these findings.

Other clues about the possible changes to postnatal phone use might be found in the study by Guerra-Reyes et al. (2016). In their qualitative exploration of the information seeking behaviour of 10 low-income mothers using mobile phones, they specify a change in phone-use behaviour. From a pre-motherhood pattern of longer, continuous use at times that suited themselves, women adapt to a postnatal pattern of "shorter, dispersed periods, the timing or duration of which they did not control" (p18).

2.5.3 Awareness of potential for harm to child development

In a literature review into the impact of parents' mobile device use on parent/child interaction, Kildare and Middlemiss (2017) mention risks to child safety as a result of parental distraction. They go on to acknowledge that parents who use their phones during parent-child interactions are at risk of lower quality parent-child interactions. Having outlined the critical importance of parent-child interactions and their role in setting developmental trajectories for children, their conclusions include the suggestion that the "ultimate goal of future research should be to provide useful and realistic guidelines for parents' mobile device use" (p590).

Subsequently, in a systematic review of literature dealing with parents' device use and the social and emotional development of children, Beamish, Fisher & Rowe (2109) were more cautious about discussing the impact of parents' device use on child development and associated implications. However they do acknowledge that mobile devices "are associated with altered attention and responsivity by their caregivers and may change caregiver/child interactions" (p132), and they amplify the notion that infants require attentive caregivers to meet their physical and psychological developmental needs.

In their quantitative study, Atli et al. (2019) go further in their interpretation of current research when they write “Experts should state the effects of technology on the development of the infant” (p212). Elsewhere, Gunuc and Atli (2018) recommend that parents avoid excessive engagement with technology in front of infants, describing adverse effects on infants’ social relationships as a result.

Work by Blackman (2015) explores the relationship between parental screen time and parental screen distraction. The research concludes that parental screen distraction is an example of an impediment to healthy parent-child interactions, and as such it is a potential source for “maladaptive development in children” (p96).

Meanwhile, in a study involving the technological device attitudes and behaviours of 500 parents in Turkey, Kulakci-Altintas (2019) acknowledges the need to decrease parental use of technological devices and increase interaction between parents and their children. This study was focused on children’s use of technology, and the comprehensive list of deleterious child development outcomes included in the paper were largely due to overuse of technology by children. However, the authors correctly associate parental technology habits with those of their children. This point will be further discussed in 2.4.6 Parent as Technology Role Model.

An earlier paper by Radesky et al. (2016) described qualitative interviews into parental mobile technology use. They found that the challenges of screen use while parenting could not only be thought about in terms of child outcomes, but could also be described in terms of the tensions added to parents’ lives. This phenomenon was summarised in the article’s title,

which refers to “The excitement and exhaustion of parenting while connected”. The researchers go on to describe the pressure parents feel to stay instantly available to their workplace, the obligations they felt in their online lives, and the feeling of information overload. These feelings and pressures are all experienced while parents are simultaneously caring for their children. This study ended by urging clinicians to “ask parents to reflect on their own media use … and whether they carve out unplugged time for themselves or their children”(p700).

Newsham et al. (2018) not only encourage that “future policies should provide a separate category of recommendations to parents and caregivers on *their own* [emphasis added] media use during interactions with their child” (p6) but they explicitly highlight a problem with current practice. They state: “the significant links between depression, mobile phone addiction, and technoference in parenting call into question the practicability of internet-based treatments for mothers”(p6). The illumination of this conundrum is a strength of this paper, which goes undescribed elsewhere.

Davidovitch et al. (2018) studied the smartphone habits of 111 parents of children with a diagnosis of Autism Spectrum Disorder (ASD). Their paper hypothesised that increasing parental phone use may have a role to play in the increasing occurrence of ASD. The researchers observed parents during their child’s assessment with physicians, and also in the waiting room for the assessment. They found that 73 (66%) parents engaged with their phone during the assessment, between one and 20 times. Of 62 observations in the waiting room, 52 (71%) parents used their phones, 1 – 19 times, with 16 (30%) parents using their phones for more than 50% of the time in the waiting room. They also found that the rate of language

and motor delays were twice as common among children of those who used phones during observation periods than among non-users. Davidovitch et al. (2018) acknowledge that their findings deserve further research, even as they state “it would be reasonable to advise parents to decrease to minimum the usage of cellphones when interacting with their young children” (p35).

Their paper also speculates that young children with a pre-existing vulnerability toward ASD would be adversely affected by the “social pollution” (p35) of parental phone use. The authors use ‘social pollution’ as a descriptor for the impact of distraction by phones on relationships – specifically the parent/child relationship. This concept of ‘social pollution’ is certainly recognisable (Ante-Contreras, 2016; Blackman, 2015; Chatton, 2018; Golen & Ventura, 2015b; Gulyayeva et al., 2016; Jake-Schoffman et al., 2017; Khourochvili, 2017; Kushlev & Dunn, 2019; McDaniel & Coyne, 2016b; Myruski et al., 2018; Reed et al., 2017) – but has been as-yet unnamed. Providing a moniker for the concept of ‘social pollution’ could be considered a strength of this work. Another strength of this paper is that it includes a thorough explanation of the value of eye contact for young babies, a phenomenon mentioned elsewhere by Beamish et al. (2019), and further explored in a study of 50 mother/infant pairs by Myruski et al. (2018).

Myruski et al. specifically studied the parallels between the SFP, as described in seminal research by Tronick et al. (1978), and contemporary parents’ use of smartphones in the presence of their infant. The original SFP had mothers cease their usual responsive interactions and instead assume a ‘still face’, with blank affect. Their babies’ distress and

eventual withdrawal is seen as evidence of their need for relational reciprocity, and their awareness of interruptions to the natural flow of interactions.

While others have speculated that maternal technology use may inadvertently mirror the blank affect of the SFP (Gulyayeva et al., 2016; Khourochvili, 2017), Myruski et al. (2018) set out to actively measure the impact of maternal smartphone use using a modified version of the SFP. Their findings include that greater parental device use is associated with less room exploration by infants, less positive affect, and a reduction in the successful repair of interactions following disruptions by smartphones. A limitation of this study was that they relied on parental self-report of smartphone use, and caution is recommended when relying on self-report (David et al., 2018; Lee et al., 2017). This idea will be further explained forthwith.

2.5.4 Reliance on self-report data

None of the studies in this review used an objective measure of screen time (e.g., an app). Some had researchers observe phone use (Davidovitch et al., 2018; Hiniker et al., 2015; Radesky et al., 2014), while all other measurements of phone use in this sample were gained via self-report.

While research suggests some people can be fairly accurate when reporting on some aspects of their phone use, it is also known that people underestimate, and often ignore, their rapid, pervasive checking behaviours when self-reporting (Andrews et al., 2015). These rapid checking behaviours have subsequently been confirmed as an extremely important measure in understanding typical smartphone behaviour (Wilcockson et al., 2018).

Research relying solely on self-report has its usefulness questioned by David et al. (2018), when they call it “unreliable”(p266) and highlight examples of behavioural estimates varying from actual behaviour. In another study, Lee et al. (2017) sought to compare self-report with objectively measured smartphone use. They also conclude that caution is necessary when relying on participant estimates of phone use. It is potentially problematic that the majority of studies in this review are reliant on a measurement tool which is apparently flawed.

2.5.5 Papers Recommending Content for Mothers Without Caveats Acknowledging Risks to Child Development

The majority of new mothers are already online and actively using their smartphones to access health information, whether via apps, social media or websites. It is logical that health professionals would want to ensure that the information available to new mothers (e.g., about breastfeeding) is accurate and relevant.

However, an up-to-date understanding of the risks associated with parental phone use in the presence of infants would surround such information with caveats about these risks, recommending limits for parents’ use when with their infants. An example exists in the form of the Public Policy Relevance Statement in the paper by Newsham et al. (2018). These sorts of caveats are available in other ways, one example is in the work by Johnsen and Glavin (2017) when they write “Increased knowledge and awareness is important so that mothers can make intelligent choices in relation to the use of the Smartphone while the child is awake” (p224).

Perhaps the increased knowledge and awareness sought for new mothers by Johnsen & Glavin (2017) would also be useful for clinicians and researchers. In this literature review, there are repeated incidences of authors recommending the creation of online content for new mothers, without any accompanying caution about the wisdom of limiting the use of smartphones in the presence of their children (Alianmoghaddam et al., 2019; Guerra-Reyes et al., 2016; Harpel, 2018).

Worthy of specific note is the work by Lupton (2017), in which focus groups invited women to discuss how they use digital media in pregnancy and parenting. This study did not specifically advocate content creation, nor provide caution about using smartphones in the presence of infants, but it did highlight other apparent gaps in women's knowledge. Lupton found that the women in her sample were unaware of the commercial rationales of many websites and apps, or of possible data breaches. She writes that the women in her sample were not mindful that "pregnant women, mothers, their foetus and children have *themselves* become valuable commodities that can be exploited by other actors and agencies for profit" (p10). Later, Lupton writes "Nor were women thinking about the future privacy and ethical implications for their children of creating digital profiles about them: in some cases, before they were even born" (p10).

2.5.6 Parent as Technology Role Model

While technology overuse by children is not the focus of this thesis, the risks to children of such overuse are well documented beyond the scope of this literature review (Beyens et al., 2018; Gentile et al., 2017; Vijakkhana et al., 2015; World Health Organization, 2019). It is also well established that parents' use of mobile devices has a positive association to childrens'

own use of such devices (Chang et al., 2018; Cho & Lee, 2017; Hwang et al., 2017; Hwang & Jeong, 2015; Jago et al., 2014; Lauricella et al., 2015; Yamada et al., 2018); an idea which is also explored within the papers of this review.

In a recent paper, Atli et al. (2019) highlight the need for parents to pay attention to their own screen use, because they are role models for their children, and the paper provides numerous examples of the downsides to smartphone overuse by children. They write: "parents need to be conscious about their technology use when they are near their children so they can function as role models for their children" (p197).

In their study into the technological device use of children aged 0-3 years and the device use, attitudes and behaviours of their parents, Kulakci-Altintas (2019) found that 82.4% of the 500 parents in their study used devices (including, but not necessarily, smartphones) in the presence of their young children. The author reinforces the finding that this habit is a significant factor in children, themselves, beginning to use devices. Worth noting here is the fact that screen use by children of this age is discouraged by a range of health promotion agencies (American Academy of Pediatrics, 2016; World Health Organization, 2019).

This idea of parents' device use influencing their children's use is reinforced elsewhere, for example in an opening statement by Radesky et al. (2016), while a study by Gunuc and Atli (2018) highlights how this notion of role modelling is impactful both for children who are allowed to use the technology, as well as for those who are not.

This idea of parents as role models was expanded in research by Hefner et al. (2019), when they urge parents to monitor their own smartphone use, not only to encourage wise use by their older children, but to protect the parent/child attachment relationship. This paper, with its focus on the smartphone habits of 8-14 year olds, is included in this literature review because of the authors' salient observation that "parental mobile phone socialization does not only start when children get their first mobile phone, but rather from the beginning for the parent-child relationship when attachment style starts to evolve"(p98). Work by Blackman (2015) takes an even longer view of this issue, suggesting that the power of role modelling is so impactful that use of mobile technologies by parents may influence the eventual performance of the parental role by those who are currently children.

2.5.7 Ambivalence/Guilt

Multiple researchers capture the mixed feelings that many mothers have about technology use. For example, Johnsen & Glavin (2017) describe this as "the great paradox of technology", that it is "both liberating and captivating at the same time" (p236). The authors use interviews with mothers of babies to describe the tension those women feel when having to choose between being available to their infant or being available to others via their smartphones. Elsewhere, Blackman (2015) captures this tension when she uses the descriptor that smartphones can be "freeing and enslaving at the same time" (p43).

These ambivalent feelings of technology use while parenting is described in a qualitative study by Radesky et al. (2016). Parents use the language of "excitement and exhaustion" (p699), and talk about the "discomfort trying to 'toggle' between work-brain and home-brain, which require different sets of cognitive and emotional skills" (p696). This tension adds a

complicating layer to the acknowledged role of mobile technology as both a stress-inducer and a stress-reduction technique, with mothers describing their phones as “a needed escape from the stresses or boredom of child-rearing”(p697).

In their literature review Kildare & Middlemiss (2017), capture this ambivalence by describing parents’ technology use at various points as “complex and variable”(p588), “positive and negative”(p588), and having “benefits and complications”(p590). They describe families’ “continual struggle for work-life-family balance”(p587) and that “some parents also express feelings of guilt when using their phone around their children regardless of the duration of their use” (p588).

This theme of guilt is also mentioned in the other literature review featured in this sample, with Beamish et al. (2019) saying that, with regard to children’s needs and their own device use, “most parents expressed guilt about not getting the balance right” (p135). Of note is the fact that this literature review identifies its lack of studies documenting the impact of parental technology use on young infants as a limitation.

2.5.8 Social Isolation, Social Support

Social isolation for new mothers is a common challenge identified by multiple authors. The notion of social isolation for new mothers was described in work by Mandai et al. (2018) in terms of loneliness. Their study considered how social network sites and maternal patterns of attachment affect loneliness in 523 mothers raising young children aged 0-3 years. The background to their study described the risks of maternal loneliness for mother and baby. While they found that there may be an “optimal range of smartphone use” (p6) associated

with lower levels of loneliness, they also found that longer smartphone use (2-3 hours, >3 hours per day) was associated with higher levels of loneliness. The authors suggest that there is a U-shaped relationship between time spent on smartphones and loneliness. They also identified teenage mothers as being particularly susceptible to loneliness.

This U-shaped relationship may be an important concept for researchers to consider when discussing new mothers' use of social media to relieve social isolation. At present, there are suggestions in the literature that sending mothers online for support is useful in a variety of circumstances, whether because of geographical isolation (Alianmoghaddam et al., 2019), separation from family offshore (Lupton, 2017), to support breastfeeding (Alianmoghaddam et al., 2019; Asiodu et al., 2015), at the transition to parenthood (Shorey & Ng, 2019), or to support a specific medical need, for example if a baby is born with a cleft lip (Alianmoghaddam et al., 2019).

Conversely, Beamish et al. (2019) found associations between maternal device use and a reduced sense of wellbeing for those mothers, which may support the U-shaped hypothesis for smartphone use and maternal loneliness as proposed by Mandai et al. (2018), as would the previously stated assertion by Newsham et al. (2018) that "the significant links between depression, mobile phone addiction, and technoference in parenting call into question the practicability of internet-based treatments for mothers" (p6).

This assertion is based on the possible negative side effects for mothers. Add in the possible harms of parental technology use in the presence of children on the development of those children in their care (Blackman, 2015; da Mata Gonçalves et al., 2019; Gunuc & Atli, 2018;

Hefner et al., 2019; Kildare & Middlemiss, 2017; McDaniel & Radesky, 2018a; Myruski et al., 2018; Radesky et al., 2016; World Health Organization, 2019), and such internet-based treatments for mothers (Alianmoghaddam et al., 2019; Lupton, 2017) are called into even greater question.

2.5.9 Depression

Newsham et al. (2018) studied problematic phone use, depression, and technology interference in 223 mothers of children aged 1-5 years. Among their findings was an association between maternal depression and problem phone use, and an association between problem phone use and technology interference in parenting. They also identify a factor which may relevant to new mothers when they discuss how "depressed smartphone users spent more time on their devices, which led to them developing problematic use even after their depression had been alleviated" (p6).

Depression is identified as being associated with loneliness in the paper by Mandai et al. (2018), while in their research looking at the SFP and smartphone use, Myruski et al. (2018) found that the infants of depressed mothers show less distress at the non-responsive still-face during smartphone use than the babies of mothers who were not depressed. The blank affect associated with maternal depression may mirror that of a smartphone user, which could put the infants of mothers who are both depressed and overusing smartphones at a greater risk of negative outcomes.

2.5.10 Addiction

The wider literature into smartphone use features an array of perspectives around smartphone overuse, problematic smartphone use, and smartphone addiction (Al-Barashdi, 2015; Bian & Leung, 2015; Cho & Lee, 2017; Eduardo et al., 2012; Kardefelt-Winther et al., 2017; Montag, 2015; Radesky et al., 2016; Sapacz et al., 2016; Zhitomirsky-Geffet, 2016). In the selected literature, smartphone addiction of parents is discussed by Atli et al. (2019), and Blackman (2015), while Kulakci-Altintas (2019) considers addiction in terms of children's smartphone habits.

Respondents in Johnsen & Glavin's (2017) sample talked about how easy it was for the habitual use of smartphones to feel like an addiction. In one example, a mother made the following observation: "I've become addicted, that I automatically just have it in my hand almost without knowing I've picked it up"(p232).

2.5.11 Conscious Screen Use, Conscious Parenting

In their 2019 paper, Atli, Gunuck, Kuss & Baran describe how today's parents have a growing list of responsibilities. The authors suggest that modern parents must add a new skill-set to their parenting abilities, saying "the digital parent is responsible not only for the biological, social and psychological development of the child, but also for appropriate, safe and conscious use of digital technologies" (p197). A suggested goal, they posit, is "Conscious parenting" (p197), which the authors describe as parental awareness of their technology use when they are near their children.

Conscious parenting in this era of digital distraction is shown to be a challenge by other researchers. Guerra-Reyes et al. (2016) found that while women use the internet they are likely to be attempting to multitask, by simultaneously "watching television, nursing their child, or fulfilling other child-care responsibilities" (pS18).

Further, the qualitative study by Radesky et al. (2016), expands upon the challenge represented in those attempts to multitask, stating that "Several mothers specifically described how difficult it is to read and respond to child behaviour when their mind was on their device"(p696). McDaniel & Radesky (2018a) affirm that idea when they acknowledge that parents are "emotionally and cognitively affected by mobile device use in ways that can make it difficult to respond to child behavioural cues" (p210).

In their 2017 work, Johnsen & Glavin add qualitative responses from women describing the challenge to remain conscious in the face of technological distraction "… it becomes like I have more focus on it at times than the child" (p232), and the authors describe how this is a source of tension for the mothers in their study, stating that mothers thought "they could miss the development that happened to the child if they were not conscious" (p233).

Missing out on observing aspects of a baby's development is not the only concern associated with parental distraction by smartphones. With these distractions comes the experience of less meaningful parenting, as described by Blackman (2015), a finding which may reinforce the finding in a study of families with older children (Kushlev & Dunn, 2019), where parental smartphone use was associated with reduced feelings of connection with their children.

2.5.12 Purposes of Maternal Screen Time

This section reviews what the literature reveals of the purposes of maternal screen time, in addition to the social support as discussed in section 2.5.8. According to the literature review by Kildare & Middlemiss (2017), the type of smartphone activity that mothers engage in whilst caring for their infants can impact the extent of their availability or unavailability to their children. For example, talking on the phone might allow for maintaining supervision, whereas typing and swiping might not. Atli et al. (2019) take that idea further, suggesting that "factors including how long, and for what purposes parents use tech[nology] are considered to be important for the development of infants" (p201).

Alianmoghaddam et al. (2019) remind us that electronic information can play a critical role in educating women about aspects of pregnancy, birth, and postpartum life. This idea was previously expressed by Guerra-Reyes et al. (2016) when they specified that low-income postpartum women "rely on their smartphones to find online infant care and self-care health information" (p13). The role of smartphones for finding health information is one that recurs in this literature (Asiodu et al., 2015; Harpel, 2018; Lupton, 2017), although many acknowledge that the health information they find is not always of the highest quality.

Similarly, Alianmoghaddam et al. (2019) used interviews with new mothers to study social media support and exclusive breastfeeding practices. They gave examples of how unhelpful and inaccurate extended family's Skype-based advice can be, and the tension this creates for new mothers. Likewise, in their study of first-time African American mothers and their use of social media to support breastfeeding, Asiodu et al. (2015) found that women rarely questioned whether or not the information they were reading was accurate, and that they

tended to forget the appropriate advice they had learned online. Meanwhile, in her interviews with Australian mothers, Lupton (2017) found that the women appreciated the anonymity of online forums in order to discuss private topics, whether feelings of sadness or the resumption of sexual activity postpartum.

2.5.13 Infant feeding/Caregiving Routines/Family Meals

Maternal smartphone use during bottle or breastfeeding of infants is a practice which has been documented in papers beyond the scope of this review (Golen & Ventura, 2015b; Tomfohrde & Reinke, 2016; Ventura & Teitelbaum, 2017). This is suggested to have negative implications in terms of infant social development, specifically with regard to the role of eye contact in the formation of early attachment relationships (Tomfohrde & Reinke, 2016). Further, it negatively impacts both infant and maternal abilities to regulate food intake, which itself has implications for healthy infant weight gain trajectories.

Another use of smartphones in relation to breastfeeding and infant care is the increasing adoption of apps to keep track of baby's sleep and feeding patterns (Johnsen & Glavin, 2017; Lupton, 2017). Further, women interviewed in the qualitative study by Lupton (2017) expressed their desire for even more technological assistance in caring for their babies. Some interviewees imagined a "wearable device for their infant that would convey data to their smartphone about their breathing rate, sleeping patterns and body temperature: 'like a Fitbit for a baby', as one woman put it" (p7).

Within our review, technology use during infant feeding is mentioned specifically in the review by Kildare & Middlemiss (2017), and in the qualitative interviews of Johnsen & Glavin

(2017) several mothers describe their use of social media while breastfeeding, a habit discussed beyond this review (Tomfohrde & Reinke, 2016).

It may be that there is a link between the habit of mothers distracting themselves during nursing and later use of screens to distract at family mealtimes. This habit is apparently commonplace, referenced by Blackman (2015); Gunuc & Atli (2018); Kildare & Middlemiss (2017), and Atli et al. (2019). Kulakci-Altintas (2019) describes device use during family routines as using "digital pacifiers" (p55), while Newsham et al. (2018) found that problematic phone use by parents had a significant relationship with technoference during mealtimes.

A seminal study examining parental use of digital devices during mealtimes was conducted by Radesky et al. (2014) when they observed 55 caregivers of families in fast food restaurants. They found that 40 of 55 caregivers used phones during restaurant mealtime, and that the caregivers who demonstrated higher levels of absorption in their smartphone also showed less responsivity to children, harsher responses to children, and that their disengagement contributed to children escalating their bids for attention/misbehaviour.

Technology use during caregiving routines is common, but discouraged (Gunuc & Atli, 2018; McDaniel & Radesky, 2018a; Radesky et al., 2016). Atli et al. (2019) suggest that the habit may offer short term gain, but that it contributes to long term problems with development.

2.5.14 Attachment

The concept of attachment is mentioned by a range of authors in this review, from a range of vantage points. Blackman (2015) includes an entire chapter about attachment theory as it relates to the parent/child relationship, and later discusses attachment as a force occurring between a child and a mobile device. This attachment between people and smartphones is also the subject of research beyond the scope of this review, for example in work by Konok et al. (2016).

In her study of Facebook use by 117 pregnant women, Harpel (2018) found that prenatal patterns of attachment to an as-yet unborn child influenced the style and frequency of sharing pregnancy related information to the social networking platform. In a related finding, Hefner et al. (2019) identify that a secure parent/child attachment can serve as a protective factor against children overusing smartphones or similar technologies.

2.5.15 Gap in existing Literature:

Recent research by Atli et al. (2019) highlights the need for a study like this one, saying: “studies regarding the effects of technology on human behaviour should be conducted starting from the birth of the infant (or even during pregnancy). The number of such studies conducted in this field is quite limited and there is a gap in the related literature.” (p148). Such a gap is highlighted by others, for example Johnsen & Glavin (2017), with acknowledgement that further research is required to fully understand the impacts of smartphones on family life, specifically as relates to parent/infant interaction.

The lack of information about the impacts of technology on infants was further emphasised when the systemic review by Beamish et al. (2019) included no studies considering caregivers and young infants, despite search terms that sought to do so. The authors also highlight that using screens for work and leisure has been ubiquitously adopted while the consideration of risks and benefits follow - rather than precede - widespread use.

2.6 Concluding comments and Research Questions:

This literature review highlights how much of the evidence-base relies on small quantitative studies using convenience sampling and self-report measures. Given the rapid changes afoot in the human experience, there is an urgent need to gather robust evidence in order to better understand both the positive and negative impacts of technology on parent/child interactions and on child development.

With this in mind, the overarching primary research objective for this thesis was to understand: How does the use of smartphones change for new mothers? The specific research questions used to inform this primary objective were:

- RQ1 Do women's smartphone use *perceptions* change after the birth of their first child?
- RQ2 Do women's smartphone use *intentions* change after the birth of their first child?
- RQ3 Do women's smartphone use *behaviours* change after the birth of their first child?

Chapter Three:

METHODOLOGY AND METHODS

This chapter describes the approach taken to examine and quantify changes in the use of smartphones by new mothers.

3.1 Study Design

A pre- and post-motherhood, matched-controlled observational design was employed to quantitatively analyse changes in women's intentions and objective measures of smartphone use following the birth of their first child.

3.2 Target population

The target population were women resident in New Zealand, aged 18 years or over. We sought those who were pregnant with their first child, due to deliver in December 2019 or January 2020, and who used a smartphone. All of the pregnant research participants were asked to select a non-pregnant, childless, female friend aged 18 years or over. This group of friends, known as the Research Buddies, formed the matched-control group. In order to meet inclusion criteria, they had to speak English and use a smartphone.

3.3 Setting

As this was an electronic survey, its geographical boundaries extended across all New Zealand.

3.4 Instruments and measures

Surveys investigated participants' smartphone use perceptions, intentions and behaviours, while a screen tracking app provided an objective measure of smartphone use. These objectively measured data were number of minutes per day a phone was in use, as well as the number of times a phone was unlocked (also called phone 'pickups') in a given day. The daily minutes per day was measured by *Moment* as being any time the screen was alight, and added together all incidences of phone use during a day (e.g.; sending a text message, watching an online video, scrolling through social media notifications). The pickups measure could be thought of as being the number of times a person reached for their phone during a day, which might be in response to a notification or to initiate an action. Both measures provide important information, as they speak to different aspects of smartphone use. Table 3.1 contains a summary of the Study tools, both the self-report survey instruments and objective phone-use measures.

Table 3.1. Summary of Study Tools – Self-Report Survey Instruments and Objective Phone-Use Measures.

Objective data	
"Moment" app	The tool selected for the objective smartphone use aspect of this study was an app named "Moment" (Holesh, 2014). It was chosen because it was available for download without cost, across operating systems (ie, both Apple and Android phones), and because it did not demand the latest version of a particular operating system. These were all important aspects of selection, as we wished to ensure the app was accessible to people across socioeconomic strata. Correspondence with the app's developer confirmed that the "export data" function was designed with researchers in mind. "I've talked to probably one hundred teams of researchers who ended up using Moment. There's a data export tool in there specifically for researchers" (K. Holesh, personal communication, July 26, 2018).

	Five days' worth of measuring time spent onscreen and/or two days' worth of pickup data has been found to be adequate for determining typical and/or problematic smartphone use (Wilcockson et al., 2018), and we sought seven days' worth of each.
Subjective data	
Measure of Overall Wellbeing: the WHO-5	The 5-item World Health Organisation Well-Being Index (WHO, 1998) is a short self-reported scale measuring subjective well-being. It has a robust reputation and well documented psychometric properties. One review and psychometric comparison of nine measures of psychological well-being (McDowell, 2010) found the WHO-5 to have Cronbach's alpha scores ranging from 0.82 to 0.95 in populations that include adolescents, the elderly, patients with specific medical and mental health conditions, and the general population. The cited studies took place in Denmark, Germany, and the Netherlands. The WHO-5 has demonstrated reliability and validity in measuring anxiety and depression (Henkel et al., 2003), which are potentially important factors in understanding the lives of new mothers (Shorey et al., 2018), and in understanding the overuse of smartphones (Demirci et al., 2015; Rozgonjuk, 2018). In addition, a more recent systematic review of the literature about the WHO-5 (Topp et al., 2015), included the conclusion that it is a highly useful tool to assess well-being over time and between groups, making it an appropriate choice for this study.
Self-Reported Measure of Phone Use – the MPPUS-10	The Mobile Phone Problem Use Scale (Bianchi & Phillips, 2005) is a self-report tool which has been described as the "gold standard" for measuring problem mobile phone use (Eduardo et al., 2012; Lopez-Fernandez et al., 2014; Yan, 2015). It was adapted by Foerster et al. (2015) to create a ten-item version, the MPPUS-10. Internal consistency of the MPPUS-10 was good, with Cronbach's alpha of 0.85 demonstrated in a study of teenagers in Switzerland. Although this shortened version of the scale was intended for use with adolescents, it has been successfully used with Lebanese adults aged 18-65 years, in that context showing a Cronbach's alpha score of 0.79 (Nahas et al., 2018).
Parenting Sense of Competence, the PSOC-5 (phase two, new mothers only)	The PSOC-5 is a five question version of the Parenting Sense of Competence Scale (Gibaud-Wallston & Wandersman, 1978). In its shortened version, the PSOC-5, a Cronbach's alpha score of 0.8 speaks to the internal consistency of the five question version (Heerman et al., 2017). The questions in the PSOC-5 concern a person's experience of parenting on two dimensions: satisfaction and efficacy. There have been found to be strong positive correlations between PSOC scores and measures of general self-esteem and self-efficacy (Coleman & Karraker, 2000; Wittkowski et al., 2017) This is relevant, because women with low self-esteem are reportedly the population most vulnerable to mobile phone addiction (Bianchi & Phillips, 2005; Eduardo et al., 2012), so as well as speaking to the overall experience

of parenthood, the PSOC-5 may prove a useful means of measuring self-esteem, which is likely to correlate with smartphone overuse.

These questions were available in the second survey in Phase II of the study – when the women were no longer pregnant, but new mothers. The questions were not provided to the Research Buddies during either phase of data collection.

Habits and Attitudes about Smartphones – the Likelihood Scale

No existing tools were found to measure the likelihood that a person would use their phone under various circumstances (for example, during a meal with family, or while supervising at a playground). The responses to these questions may speak to a person's beliefs about the appropriateness of using a smartphone in various settings. Without specific questions, it would not be possible to learn whether the arrival of a baby would change a person's attitude about the appropriateness and likelihood of using a smartphone under particular circumstances (for example, while feeding an infant).

In an attempt to understand the impact of attitudes and knowledge on a person's smartphone use and whether they change after the arrival of a baby, eleven questions were created and added to the survey, having been piloted in October of 2018. They provide an 11 question, 5-point Likert scale for participants to assess their likelihood of using a smartphone under a variety of circumstances.

These questions are part of the Survey in Appendix E.

Knowledge and Perceptions about Child Development and Technology

As with the previous questions dealing with "likelihood", no existing scales were found to assess a person's knowledge of child development; specifically their knowledge about the risks to child development of using a smartphone in the presence of infants.

Eight questions were created and added to the survey, again after a pilot process in October 2018. These questions use a 10-point Likert scale inviting participants to assess whether 8 statements about children and technology are "not true at all", "extremely true", or something in between. These questions are in in Appendix E.

Self-Assessment of Change in Smartphone Use (Phase II only)

Both the new mothers and the research buddies were asked to assess whether they had noticed any overall changes in their smartphone use since the last survey period. If they identified that their overall use had "increased" or "decreased", they were invited to tick a box of preselected reasons (change in work circumstances, the arrival of a baby, having the Moment app loaded) and/or to write in a reason for the change.

Demographics

The first survey ended with a series of questions inviting women to provide information about their demographic profile.

First they were asked to write in the year of their birth, which was intended to verify that everyone was over 18 years old.

Next the women were asked to select their ethnicity. When this survey was piloted, the question about ethnicity provided options in line with the categories featured in the NZ Census of 2018, namely: European, Māori, Pacific Peoples, Asian, Middle Eastern/Latin American/African, Other Ethnicity. That pilot was run as a pen-and-

paper survey, so in the interest of brevity the categories had been consolidated in a way that was believed to be appropriate for the geographical region where the pilot survey took place. Those categories were New Zealand European, Māori, Pasifika, Other (with write-in option).

Those consolidated categories should perhaps have been re-expanded when the survey moved online, instead the abbreviated version was used.

Finally, the survey asked participants to share information about their living arrangement, as a means to try and capture socioeconomic information. The survey asked "Which of these best describes your living arrangement?" and the response options were: I live in a home I own or partly own, I live in a home I rent, I live in the home of family/friends (e.g. boarding), Other (with write-in option).

The second survey repeated the question about living arrangement in order to track any changes thereof.

3.5 Procedure

The original plan for recruitment was to attend antenatal classes in Christchurch and North Canterbury, and invite women to join the study *kanohi ki te kanohi* – face to face. However, discussions with lecturers in midwifery and facilitators of childbirth education revealed that the facilitators of such classes do not welcome outside visitors, whether for commercial or research interests.

In response to this, an alternative recruitment strategy was developed, and in October 2019, a print advertisement was placed in "Kiwi Parent" magazine. See Appendix C for a copy of that advertisement. This advertisement was then formatted for online use and during the final week of October 2019 it was shared via the Facebook pages of Kiwi Parent magazine, the Parents' Centre, the Brainwave Trust, Tots to Teens magazine, OHbaby! magazine, and parent educator Nathan Wallis. In mid-November of 2019, the advertisement was emailed to

pregnant women who had been receiving their antenatal education from Plunket and had identified themselves as being open to receiving such an invitation.

These initial advertisements invited pregnant women aged over 18 years old, with first babies due in December 2019 or January 2020, to email for more information. The women who emailed the principal investigator received a reply email with information about the study, and a link to take the first survey. The survey link included access to a PDF which contained additional information about the study, as per the recommendations of the University of Canterbury Human Ethics Committee. See appendix D for a copy of the information contained in that PDF.

Those who sent an initial email of enquiry but did not reply to the invitation to participate were emailed two more times, being offered two more opportunities to join the study. This process was informed by the Dillman protocol (Hoddinott, 1986) in an attempt to maximise the number of survey responses.

The pregnant women were also asked to identify a Research Buddy, a woman aged 18 years or older, who did not have children. The inclusion of these Buddies in the study was an attempt to match a control group with shared characteristics (such as age or socioeconomic status) to the pregnant women, so that we might control for temporal variations between the new mothers and the RBs over time. These Buddies were emailed with information about the study, and a link to take their first survey. Any Buddies who did not reply were emailed again, being offered two more opportunities to join the study. The final date for recording the survey data of phase one was December 1st 2019.

As they completed the survey, women from both groups were emailed to thank them for having done so. This email of thanks also provided instructions about downloading the *Moment* app and exporting data from the app a week later. In most cases, this email was sent within 24 hours of the survey being completed, although on some occasions the timing of weekends or public holidays may have caused a delay.

Three days after the email of thanks and instruction, a follow-up email was sent in order to check that *Moment* had downloaded without incident, and to offer technical support if necessary. If *Moment* data was not received within a week of that follow-up email, an additional email offered support in the procedure of exporting the data. This proved to be an essential step, as difficulties with exporting data plagued up to half the research participants. It was one of the pregnant women who offered a solution which proved invaluable: taking day-by-day screen shots of the *Moment* app, which provided the required objective screen-time and pickup data.

As the *Moment* data was received, it was logged into an Excel spreadsheet, and the women were emailed again, to thank them for having send their data. This email also asked participants to provide a postal address to enable the mailing of their koha: a grocery voucher. These vouchers were accompanied by a hand-written note of thanks, wishing the pregnant women the best for their forthcoming deliveries, and in all cases outlining the next step of the research process. The final date for collecting *Moment* data was 19 December, 2019, with all koha posted before Christmas of 2019.

The timing of phase two of data collection was dependent upon the timing of the arrival of the babies. In some cases, news of a baby's arrival was shared by the new mothers themselves, in other cases by the Research Buddies. For a third group, no information was offered, and it was necessary to send an email to find whether they may be interested in continuing their involvement in the study. Because most women had spontaneously shared their due dates at the time of their initial enquiry email, it was usually possible to calculate a rough estimate of an appropriate time to send that email.

The second phase of data collection began on January 14th, 2020, with the emailing of the first survey invitations, and the second round of *Moment* data began arriving on January 24th, 2020. The survey remained live until 1 April, 2020; the final *Moment* data arrived on 9th April, 2020.

All survey data was hosted by and securely stored on the University of Canterbury's Qualtrics platform.

3.6 Study Size

A formal power calculation was not undertaken; the sample size selected balanced the pragmatic competing demands of feasibility and practicability against capacity and resources within a Masters research project. With these considerations in mind, a sample size of 30 pregnant women (and 30 elected non-pregnant friends) was arrived at.

This number also had advantageous properties, statistically speaking, as the central limit theorem is frequently invoked at this number whereby the mean distribution can be approximated to Normal. Moreover, a sample of 30 women (together with 30 Research Buddies) allows an opportunity to invite many women to join the study from a variety of settings.

3.7 Statistical Methods

Satistical analyses were completed using (R Version 1.0.153 – © 2009-2017 RStudio, Inc.), and a two-sided p value <0.05 used to determine significance. The presentation results were infomed by the STrenghtening the Reporting of OBservational studies in Epidemiology (STROBE) guidelines for observational studies (www.strobe-statement.org). Matching was used to help control for confounding; the control group ("Buddies") consisted of friends of each participant, and data were collected prior and post participants' transition into motherhood.

Data were reported as mean and standard deviation (SD) for continuous variables, and frequency and percentage (%) for categorical variables. The differences between the subject and control groups were examined using Fishers Exact Test for categorical data and Student's t-test for continuous data. Changes between Phases I and II used techniques that accommodated the data matching (including Student's paired t-test).

3.8 Ethics

This study was completed having gained ethics approval from the University of Canterbury Human Ethics Committee (HEC Ref: HEC 2019/111). All women who enquired about the research or who were invited to be Research Buddies were advised of their right to withdraw at any time, as well as being informed of the proposed process for the study, and the protocols being followed to ensure confidentiality of participants' information and data, as per the approval granted in HEC 2019/111. All participants were invited to request a summary of results upon the study's completion.

Chapter Four

RESULTS

4.1 Recruitment

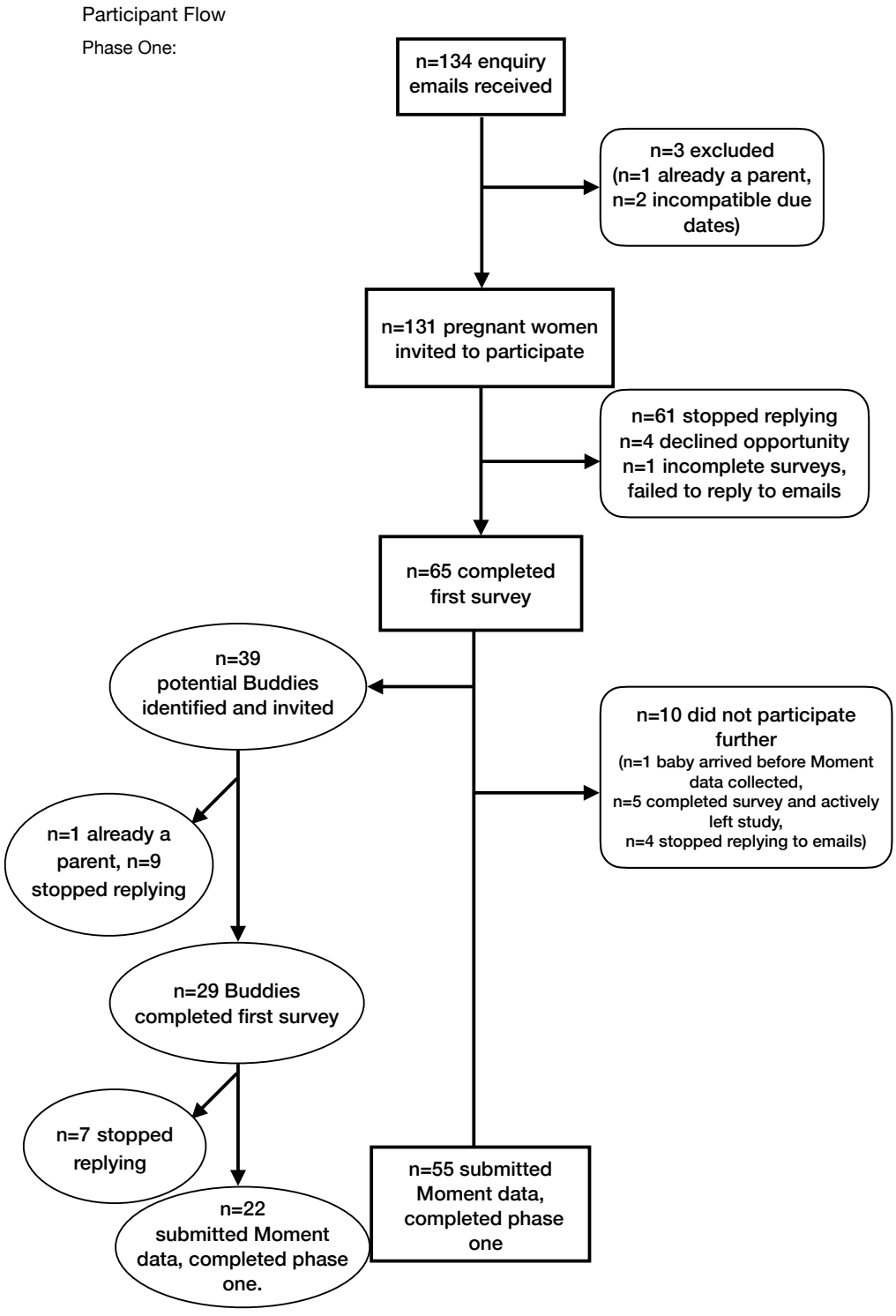
The first phase of the study yielded 134 responses to the recruitment advertisement. However, 3 (2%) respondents were ineligible; with two women having expected delivery dates outside the study time limits, and one already having children. Of the remaining 131 pregnant women who were invited to join the study, 4 (3%) subsequently declined and 61 (46%) failed to respond to either the survey invitation or the two follow up emails. Finally, 1 (2%) further respondent was omitted from the results having submitted a blank survey and not responding to follow up emails, leading to a Phase I sample size of n=65 women. Of these participants, seven days of *Moment* data was provided by 55 (85%) women; see Figure 4.1.

All n=65 participants were also asked to nominate a non-pregnant, childless, female friend aged ≥18 years (known hereafter as Research Buddies), which formed the matched-control group. Overall, n=39 Research Buddies were nominated, of whom n=29 were eligible and participated in the first questionnaire and n=22 provided seven days of *Moment* data (see Figure 4.1)

For Phase II, post-delivery, all n=65 women were re-invited to participate. Of these, n=54 (84%) new mothers completed the second survey and n=50 (78%) submitted *Moment* data. Similarly, all n=29 Research Buddies were re-approached, with 17 (59%) completing the

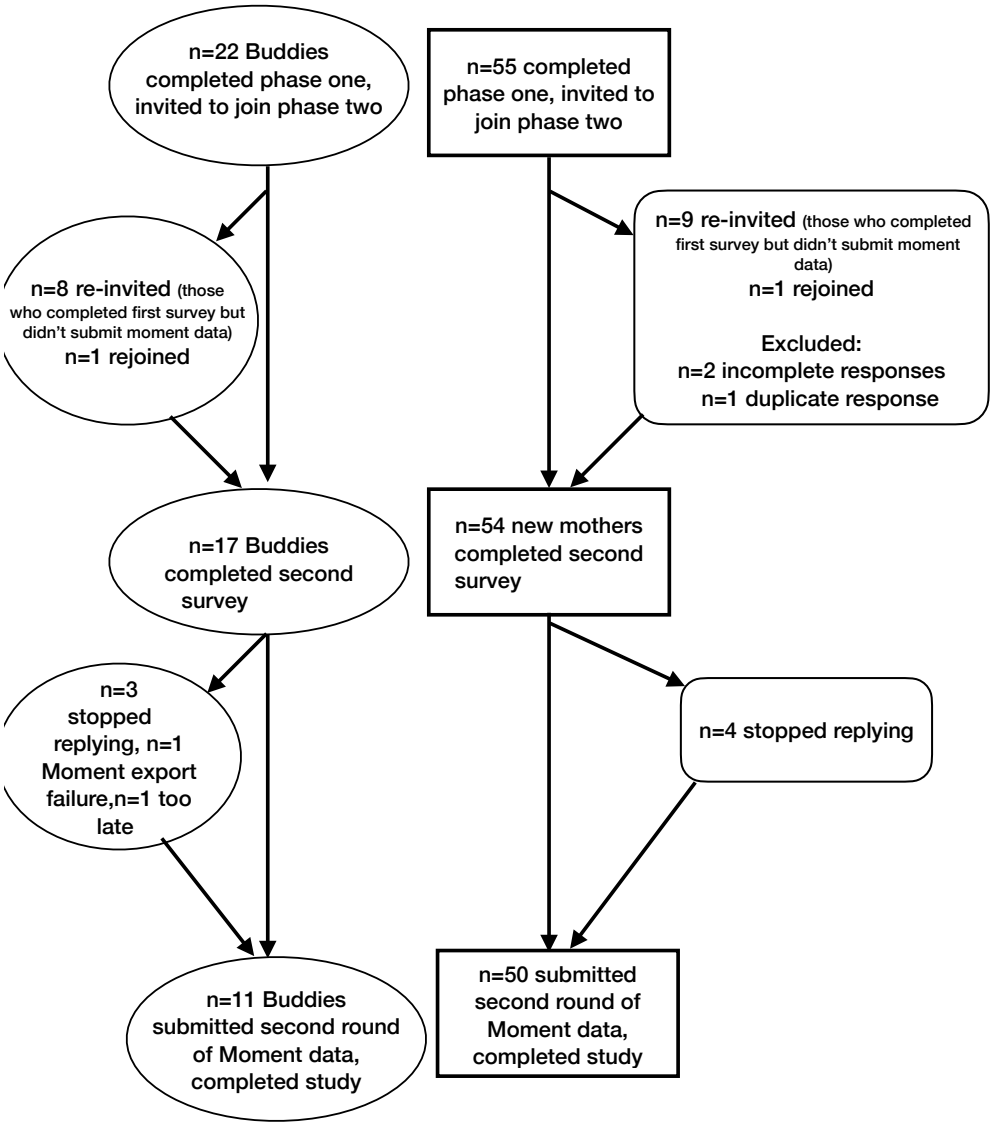
second survey and 11 (38%) providing *Moment* data. Figure 4.1 outlines this process in the form of a Participant Flow Diagram.

Figure 4.1: Participant Flow



Participant Flow

Phase Two:



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4.2 Participant characteristics at baseline

Pregnant Women

At Phase I of the study, there were 65 pregnant women who participated. Table 4.1 presents characteristics of these participants overall, and for those who had a participating Research Buddy.

The majority of the pregnant women were aged between 25 – 34 years, identified as being of New Zealand (NZ) European ethnicity, and most of the Phase I participants lived in homes they owned or partially owned. These patterns were repeated within the subset of pregnant women with matched research buddies, suggesting there was no important difference between those with and without research buddies.

Table 4.1 Participant characteristics at Phase I, for all the pregnant women (n=65), and then for women with a matched buddy and their buddy (n=29)

			Matched pairs			
	All pregnant women		Pregnant women		Buddies	
	n	(%)	n	(%)	n	(%)
*Age (years)**						
20-24	6	(9)	3	(10)	8	(28)
25-29	20	(31)	8	(28)	7	(24)
30-34	29	(44)	14	(48)	10	(34)
35-39	7	(11)	3	(10)	1	(3)
≥40	2	(3)	1	(3)	2	(6)
*Ethnicity***						
NZ European	51	(79)	27	(93)	26	(90)
Māori	4	(7)	0	(0)	1	(3)
Pasifika	2	(3)	0	(0)	0	(0)
Other	12	(19)	2	(7)	4	(14)
Living Arrangements						
Own home	35	(54)	18	(62)	8	(28)
Rent home	21	(32)	8	(28)	10	(34)
Boarding	7	(11)	3	(10)	9	(31)
Other	2	(3)	0	(0)	2	(7)

Notes:
*Participants had indicated via check box at beginning of survey that they were over 18 years and therefore met eligibility criteria. The demographic section at the end of the survey included a write-in option to share year of birth. One participant from the "All pregnant women" section and another of the "Buddies" had, instead, written in a birth location. Those two data points are treated as missing from this category.
**Participants can identify with more than one ethnic group so the percentages may sum to more than 100%.

Research Buddies

Phase I included n=29 Research Buddies. A summary of their characteristics, as well as their matched pregnant women characteristics, is also included in Table 4.1. They were mostly aged 20 – 35 years, generally identified as being of NZ European ethnicity, and appeared more likely than their pregnant counterparts to live in private boarding arrangements.

4.3 Perceptions of Smartphone Use: MPPUS-10

Pregnant Women/New Mothers

The pregnant women who participated in Phase I of the study (n=65) scored, on average, 45.2 on the self-report Mobile Phone Problem Use Scale 10 question version, hereafter known as the MPPUS-10. The range in scores was between 22 and 81 out of a possible 100. A score of 59 or above is said to indicate problem use of the mobile phone (Nahas et al., 2018; Vally & El Hichami, 2019). Using that threshold, n=9 (14%) of the pregnant women had a score that indicated problem use.

At Phase II, post-delivery, n=54 of these women participated and again completed the MPPUS-10. In this phase, the new mothers had an average score of 41.7. The range in scores for this second phase was 21 to 75, with n=4 (7%) of the results indicating problem use, having scored 59 or above.

Comparing Phase I and Phase II results for this group, the average matched MPPUS-10 score reduced by 4 points (95% CI: -7, -1) after the child's birth, a difference that was statistically significant (p=0.008). Table 4.2 includes the mean and standard deviation of MPPUS-10 scores for Phase I and II overall, and for the matched participants and Research Buddies.

The Research Buddies

The Research Buddies who participated in Phase I of the study and completed the MPPUS-10 survey (n=29) scored, on average, 49.1, with range: 21 and 100. Within this Phase, n=6 (20%) of the women scored themselves at 59 or higher, indicating problem use.

At Phase II, n=17 of these women participated and again completed the MPPUS-10. In this phase, the Buddies scored, on average, a score of 47.8, with a range of scores between 27 and 64. For this phase, the number of women scoring 59 or higher was n=2 (12%).

Comparing Phase I and Phase II results, the Research Buddies' matched MPPUS-10 scores reduced by an average of -3.1 (95% CI: -7.6, 1.3), a difference that was not statistically significant (p=0.16); see Table 4.2.

Pregnant Women/New Mothers with a Matched-Control Buddy

When considering the matched pairs of participants and their nominated Research Buddies, there was no significant difference within those pairs in the average MPPUS-10 score between Phase I (n=29, p=0.56) and Phase II (n=16, p=0.24); see Table 4.2.

Table 4.2. Mean and SD of self-reported MPPUS-10 data for all pregnant women, together with those matched to a Research Buddy.

	All pregnant women		Matched Pairs					
			Pregnant women		Buddies		**Difference**	
	mean	(SD)	mean	(SD)	mean	(SD)	mean	(95% CI)
Phase I	45	(12)	47	(13)	49	(17)	-2	(-9, 5)
Phase II	41	(11)	42	(12)	47	(9)	-5	(-14, 4)
Diff (95% CI)	-4	(-7, -1)	-7	(-11, -2)	-3	(-7, 1)		

4.3.1 Perceptions of Smartphone Use: Increased/Decreased

During data collection at Phase I, some women indicated that having *Moment* installed on their personal phones was making them increasingly aware of their smartphone use. Meanwhile, other research participants spontaneously revealed that their smartphones were used for work purposes, and work circumstances were due to change with the arrival of the babies. As a result of these potential confounders, a decision was made to add questions to the second round of surveys. Specifically, Phase II participants were invited to estimate whether their smartphone use had increased, decreased, or 'stayed about the same' since the previous study period. Participants were also invited to choose between suggested reasons for any perceived change in use (namely: change in work circumstances, the arrival of a baby, having installed the *Moment* app or another screen tracking app) and/or to write in a reason for the perceived change.

New Mothers

Of the n=54 new mothers who completed the second survey, 24 (44%) said they noticed an increase in their smartphone use, while 17 (31%) indicated they had decreased their smartphone use, and 13 (24%) perceived that their phone use had stayed about the same. These findings are summarised in Table 4.3.

Some contrast emerges when looking more closely at the new mothers' possible reasons for the perceived changes in smartphone use. For example, 20 (37%) of women cited "the arrival of a baby" as a reason for their perceived *increase* in smartphone use, while 17 (31%) indicated that "the arrival of a baby" was a reason for their perceived *reduction* in use.

Research Buddies

Meanwhile, for the Buddies at Phase II (n=17), 2 (13%) respondents indicated a perceived increase in their use, with another 2 (13%) suggesting that their use had decreased, while the remaining 13 (76%) perceived that their smartphone use had stayed about the same. See Table 4.3.

New Mothers with Matched-Control Buddy

When considering the subset of new mothers with matched Buddies who also completed the survey at Phase II (n=17), 9 (53%) of those women indicated that they perceived an increase in their smartphone use, while 3 (18%) perceived a decrease, and 5 (29%) said that their use had stayed about the same.

With regard to the aforementioned reasons for perceived changes in use, again citing the example of "the arrival of a baby", 8 (47%) of the mothers with matched controls suggested that this was a reason for their perceived increase in smartphone use, while 3 (18%) saw "the arrival of a baby" as a reason for a perceived reduction in use.

Further, the participants' perceptions of changes in smartphone use between the study periods is compared to the objectively measured changes and presented in sections 4.6.1 and 4.6.2.

Table 4.3 Phase II recording of perceived changes in smartphone use between study phases; for all new mothers, together with those matched to a research buddy.

	All new mothers n=54		New mothers with Buddy n=17		Buddies n=17	
	n	(%)	n	(%)	n	(%)
Increased	24	(44)	9	(53)	2	(12)
No change	13	(24)	5	(29)	13	(76)
Decreased	17	(31)	3	(18)	2	(12)

4.4 Intentions for Smartphone Use

4.4.1 'Likelihood' Scale

Pregnant Women/New Mothers

The pregnant women who participated in Phase I of the study (n=65) scored, on average, 35 on the eleven question 'Likelihood' scale. The range in scores was between 21 and 50 out of a possible 55. A score of 55 would indicate that a person was 'highly likely' to use a smartphone across all suggested scenarios. The average score from our participants of 35 may suggest that they perceive themselves to be "likely" to use their phone in various settings.

At Phase II, post-delivery, n=54 of these women participated and again completed the Likelihood scale. In this phase, the new mothers had an average score of 36. The range of scores for this second phase was 25 to 50.

Comparing Phase I and Phase II results for this group, the average matched Likelihood scale score increased by one point (95% CI: -8, 1) after the child's birth, a difference that was not statistically significant (p=0.5). Table 4.4 includes the mean and standard deviation of Likelihood scale scores for Phase I and II overall, and for the matched participants and Research Buddies.

Table 4.4. Mean score and SD of Likelihood scale data for all pregnant women, together with those matched to a research buddy.

	All pregnant women		Matched Pairs					
			Pregnant women		Buddies		**Difference**	
	mean	(SD)	mean	(SD)	mean	(SD)	mean	(95% CI)
Phase I	35	(7)	35	(7)	34	(6)	9	(-2, 4)
Phase II	36	(7)	37	(7)	32	(6)	5	(1, 10)
Diff (95% CI)	1	(-8, 1)	-2	(-2, 3)	-2	(-4, 0)		

The Research Buddies

The Research Buddies who participated in Phase I of the study and completed the Likelihood scale (n=29) scored, on average, 34 out of a possible 55, with range: 23 and 46. At Phase II, seventeen of these women participated and again completed the scale. In this phase, the Buddies scored, on average, a score of 32, with a range of scores between 18 and 43.

Comparing Phase I and Phase II results, the Research Buddies' matched Likelihood scores changed by an average of -2, (95% CI: -4, 0), a difference that was not statistically significant (p=0.08); see Table 4.4.

Pregnant Women/New Mothers with a Matched-Control Buddy

When considering the matched pairs of participants and their nominated Research Buddies, there was no significant difference within those pairs in the average Likelihood scale score at Phase I (n=29, p=0.59). However, there was a statistically significant difference between the participants and Buddies at Phase II (n=17, p=0.02); see Table 4.4.

4.4.2 Intentions for Smartphone Use – Feeding an Infant

The Likelihood scale suggests a range of scenarios and asks participants to rank how likely or unlikely they would be – or think they would be - to use a smartphone under those varying circumstances. One of the questions asked how likely they thought they would be to use a smartphone while feeding an infant.

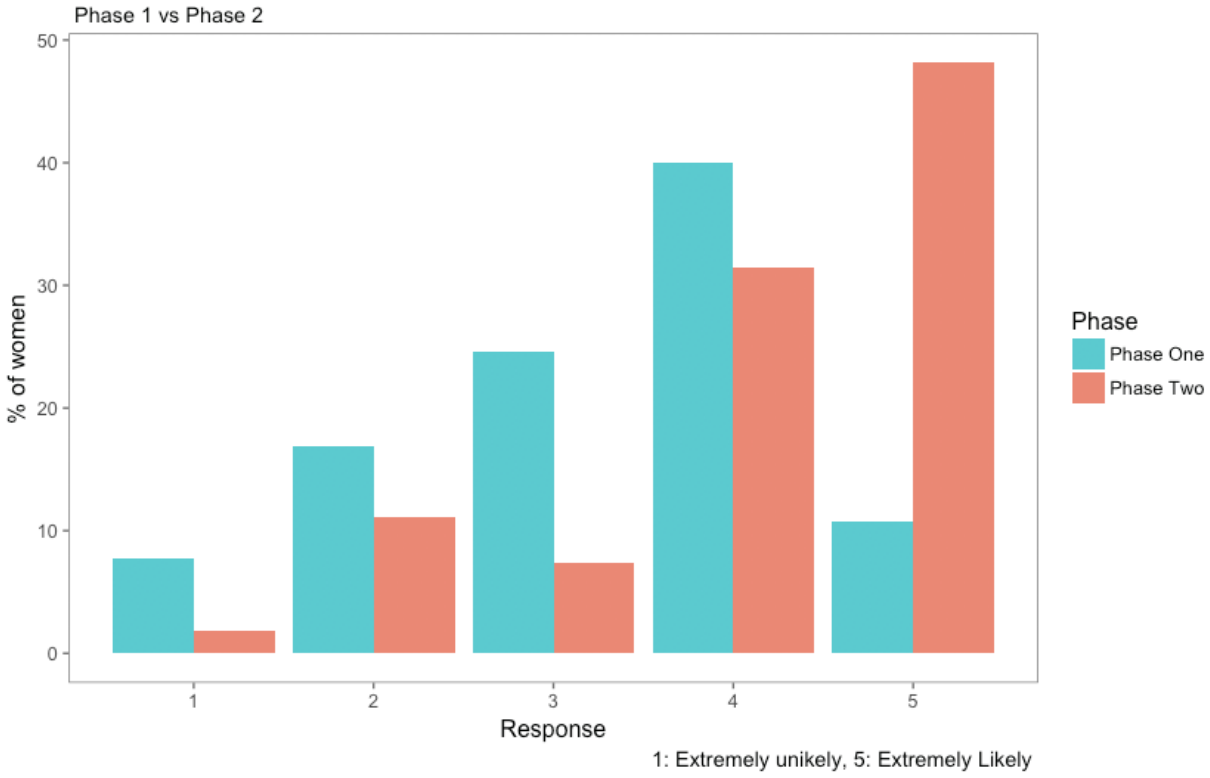
The new mothers – both those with a Buddy and the larger group of mothers - showed a significant difference in their answer to that question between Phase I and Phase II, while the Research Buddies did not.

A comparison using Fisher's exact test for count data was employed to reveal that there were significantly more new mothers who identified with being "Highly likely" to use their phones while feeding an infant in Phase II than there had been in Phase I. This was the case for the whole group of new mothers ($p=0.004$) and for the mothers matched with a Buddy ($p=0.02$). These findings are summarised in Table 4.5, and Figure 4.2 shows the changes in percentages for each category at Phase I and Phase II for the whole group of pregnant women/new mothers.

Table 4.5 Intentions: Likelihood of smartphone use while feeding an infant. Counts and percentages at Phase I and Phase II, for all the pregnant women (n=65 Phase I, n= 55 Phase II), and then for women with a matched buddy and their buddy (n=29 Phase I, n=17 Phase II)

	All pregnant women		Matched Pairs			
			Pregnant women		Buddies	
Intention	Phase I n (%)	Phase II n (%)	Phase I n (%)	Phase II n (%)	Phase I n (%)	Phase II n (%)
Highly unlikely	5 (8)	1 (2)	1 (3)	0 (0)	10 (34)	4 (24)
Unlikely	11 (17)	6 (11)	3 (10)	0 (0)	6 (21)	3 (18)
Neither likely nor unlikely	16 (25)	4 (7)	9 (31)	1 (6)	11 (38)	6 (35)
Likely	26 (40)	17 (31)	13 (45)	4 (24)	2 (7)	3 (18)
Highly likely	7 (11)	26 (48)	3 (10)	12 (71)	0 (0)	1 (6)

Figure 4.2 Intentions: Likelihood Scale at Phase I and Phase II: Percentage of Women in each category: How likely would you be (or do you think you would be) to use a smartphone while feeding an infant?



4.5 Behaviours of Smartphone Use: Moment Data

4.5.1 Time on Device

Pregnant Women/New Mothers

The pregnant women who participated in Phase I of the study and submitted *Moment* data (n=55) spent, on average, 205 minutes/day on their device over the 7-days of recording. The range in average times over the 7-days was between 37 and 562 minutes/day. The most time spent by a participant on their device on any one day was 876 minutes – some 14.6 hours. At Phase II, post-delivery, n=50 of these women participated and submitted *Moment* data. In this phase, the new mothers spent, on average, 253 minutes/day on their device over the 7-days of recording. The range in average times over the 7-days was between 2 and 757 minutes/day. The most time recorded on any one day was 1,046 minutes – some 17.4 hours.

Comparing Phase I and Phase II results, the average daily time on the device increased by 51 minutes/day (95% CI: 22, 79 minutes/day) after the child's birth, a difference that was significant ($p<0.001$). Table 4.6 include the mean and standard deviation of time on the device for Phase I and II overall, and for the matched participants and Research Buddies.

Table 4.6. Mean ($\bar{x}$) and SD of time on the device and pick ups derived from Moment data for all pregnant women, together with those matched to a research buddy.

	All pregnant women		Matched pairs					
			Preg. women		Buddies		Difference	
	$\overline{x}$	(SD)	$\overline{x}$	(SD)	$\overline{x}$	(SD)	$\overline{x}$	(95% CI)
Time on device								
Phase I	205	(121)	227	(135)	198	(159)	29	(-55, 113)
Phase II	253	(149)	251	(149)	211	(96)	40	(-35, 114)
Diff (95% CI)	51	(22, 79)	49	(10, 88)	48	(-20, 115)		
Pick-ups								
Phase I	53	(33)	56	(29)	54	(29)	3	(-16, 22)
Phase II	58	(34)	59	(18)	61	(22)	-2	(-19, 15)
Diff (95% CI)	3	(-9, 15)	4	(-7, 15)	12	(-0.3, 24)		

The Research Buddies

The Research Buddies who participated in Phase I of the study and submitted *Moment* data (n=22) spent, on average, 198 minutes/day on their device over the 7-days of recording. The range in average times over the 7-days was between 61 and 660 minutes/day. The most time spent by a participant on their device on any one day was 912 minutes – some 15.2 hours. At Phase II, n=11 of these women participated and submitted *Moment* data. In this phase, the research Buddies spent, on average, 211 minutes/day on their device over the 7-days of recording. The range in average times over the 7-days was between 63 and 361 minutes/day. The most time recorded on any one day was 512 minutes – some 8.5 hours.

Comparing Phase I and Phase II results, the average daily time on the device increased by 48 minutes/day (95% CI: -20, 115 minutes/day), a difference that was not statistically significant (p=0.15); see Table 4.6

Pregnant Women/New Mothers with a Matched-Control Buddy

When considering the matched pairs between participants and their nominated Research Buddies, there was no significant difference within those pairs in the average time spent on devices at Phase I (n=22, p=0.48) or Phase II (n=11, p=0.27); see Table 4.6.

4.5.2 Pick Ups

Pregnant Women/New Mothers

The pregnant women who participated in Phase I of the study and submitted *Moment* data (n=55) picked up their device, on average, 53 times/day over the 7-days of recording. The range in average pickups over the 7-days was between 2 and 223 times/day. The most pickups of their device by a participant on any one day was 426. At Phase II, post-delivery, n=50 of these women participated and submitted *Moment* data. In this phase, the new mothers picked up their device, on average, 58 times/day over the 7-days of recording. The range in average pickups over the 7-days was between 2 and 202 times/day. The most pickups recorded on any one day was 372 times.

Comparing Phase I and Phase II results, the average daily pickup frequency of the device increased by 3 times/day (95% CI: -9, 15 times/day) after the child's birth, a difference that was not statistically significant (p=0.66). Table 4.6 also includes the mean and standard deviation of device pickup frequencies for Phase I and II overall, and for the matched participants and Research Buddies.

The Research Buddies

The Research Buddies who participated in Phase I of the study and submitted *Moment* data (n=22) picked up their devices, on average, 54 times/day over the 7-days of recording. The range in average device pickup frequencies over the 7-days was between 5 and 142 times/day. The highest device pickup frequency by a participant on any one day was 198 times. At Phase II, n=11 of these women participated and submitted *Moment* data. In this phase, the research Buddies picked up their device, on average, 61 times/day over the 7-days of recording. The range in average pick up frequencies over the 7-days was between 33 and 93 times/day. The highest pick up frequency recorded on any one day was 133 times.

Comparing Phase I and Phase II results, the average daily device pick up frequency increased by 12 times/day (95% CI: -0.3, 24 times/day), a difference that was not statistically significant (p=0.06); see Table 4.6.

Pregnant Women/New Mothers with a Matched-Control Buddy

When considering the matched pairs between participants and their nominated Research Buddies, there was no significant difference within those pairs in the average device pick up frequencies at Phase I (n=22, p=0.77) or Phase II (n=11, p=0.77); see Table 4.6

4.6 Comparing Changes in Smartphone Use Perception with Changes in Smartphone Use Behaviour

Using the MPPUS-10 threshold of ≥59 as an indicator of self-reported potential overuse of the smartphone, it is possible to overlay participants' perceived use of their smartphones atop their *Moment* measures of actual pickups and minutes.

Figure 4.3 is one such summary. The x- axis displays the whole group (n=55) of pregnant women's mean daily pickup tally, the y-axis reveals their mean daily time on device, and the body of the graph uses a colour coded visualisation of their MPPUS-10 score. In this case, the green dots represent women who scored 59 or above, indicating potential problem use. Figure 4.4 shows the same measures for this group of women at Phase II, post-delivery (n=50).

Figure 4.3: Phase I Pregnant Women's MMPUS-10 Scores ≥59 vs. <59 with mean daily time on device and mean daily pickups.

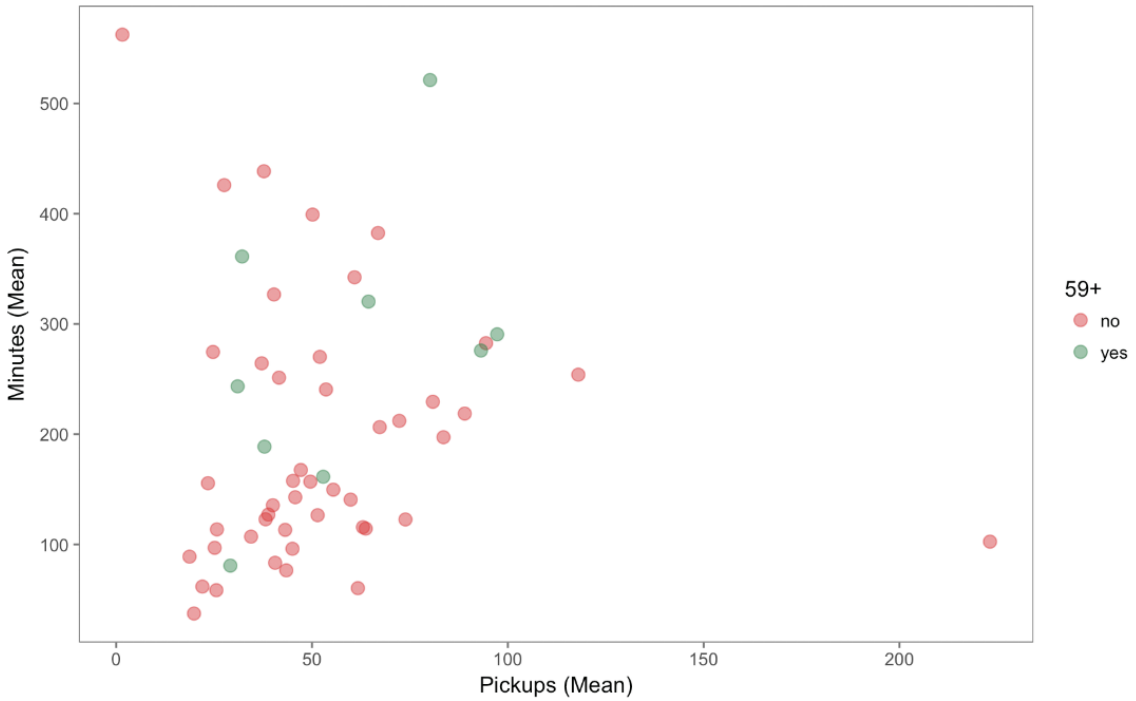
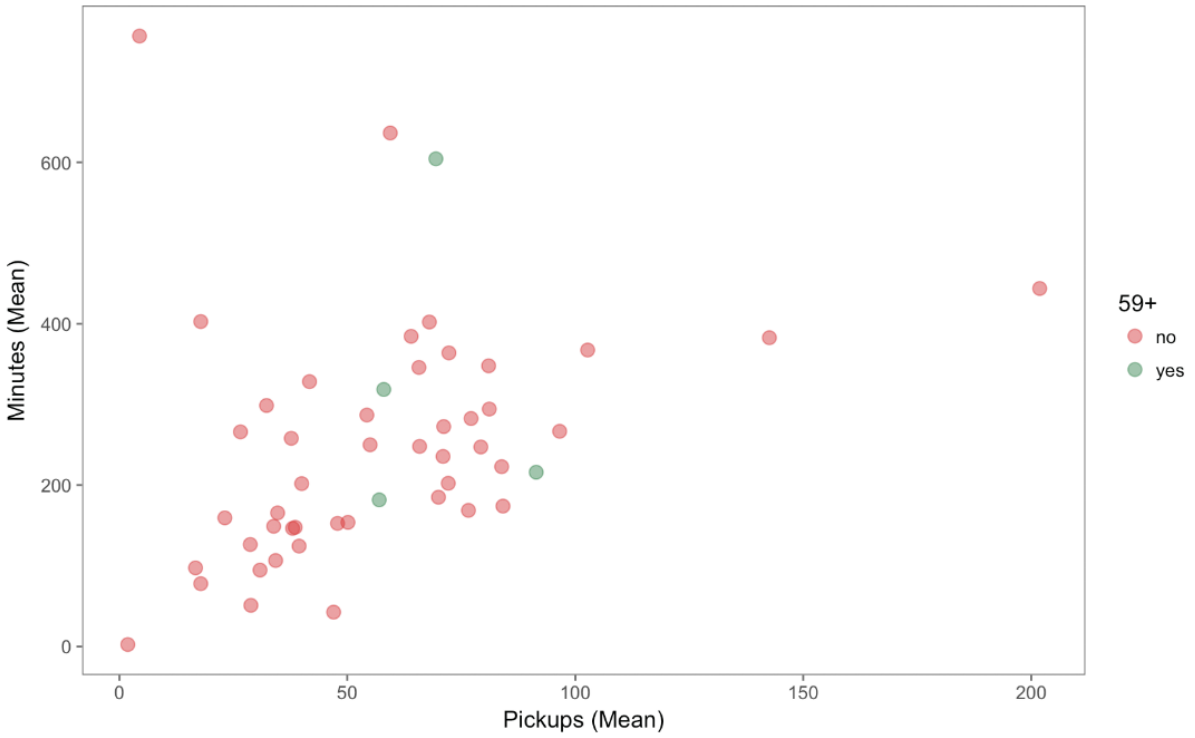


Figure 4.4: Phase II New Mothers' MMPUS-10 Scores ≥59 vs. <59 with mean daily time on device and mean daily pickups.



4.6.1. Comparing Participants' Perceived Changes in Smartphone Use with Measured Changes in Time on Device.

Having identified whether they perceived themselves as having increased, decreased, or kept their smartphone use 'about the same' between data collection Phases, it is possible to compare participants' perceptions to their objectively measured phone use.

The first example examines the whole group of new mothers (n=50) with regard to their perceived changes compared to their measured changes, using the 'time on device' measure. See Table 4.7. This table was populated with the calculation that a variation of ±10% of the original average minutes is "no change". This ±10% tolerance was selected a priori, as it seemed to have appropriate face validity; however it needs validation. Using this definition,

16 (32%) women perceived that they had decreased their use; 8 (50%) of whom had indeed decreased their average minutes per day, while 6 (37%) recorded no objective change and 2 (13%) had, in fact, increased the number of minutes per day. Of the 13 (26%) women who estimated that their phone use had not changed, 3 (23%) had decreased their use, while 2 (15%) recorded no change, and 8 (62%) new mothers increased their time on device.

There were also 21 (42%) research participants who perceived an increase of smartphone use after the birth of their babies. Nineteen (90%) of those women were in concordance while 2 (10%) new mothers instead recorded a decrease in their average minutes on screen per day.

Table 4.7
Perception of change in smartphone use, compared to measured change of smartphone use between phases (Minutes onscreen). Whole group of new mothers, n=50.

	Moment minutes					
	Decrease		No Change		Measured increase	
Perception	n	(%)	n	(%)	n	(%)
Perceived decrease	8	(50)	6	(38)	2	(13)
No perceived change	3	(23)	2	(15)	8	(62)
Perceived increase	2	(10)	0	(0)	19	(90)

4.6.2. Comparing Participants' Perceived Changes in Smartphone Use with Measured Changes in Pickups.

The next example examines the whole group of new mothers (n=50) with regard to their perceived changes compared to their measured changes, using the screen unlock 'pickups' measure. See Table 4.8. Again, a variation of ±10% of the original average number of pickups was recorded as "no change". Sixteen (32%) of the women perceived that they had decreased

their use; 9 (56%) of whom had decreased their average number of pickups per day, while 4 (25%) recorded no objective change and 3 (19%) had increased the number of pickups per day. Of the 13 (26%) women who estimated that their phone use had not changed, 3 (23%) had decreased their use, while 4 (23%) recorded no change, and 6 (46%) new mothers increased their average number of daily pickups.

There were also 21 (42%) research participants who perceived an increase of smartphone use after the birth of their babies. Thirteen (62%) of those women correctly perceived that increase, while 5 (24%) new mothers instead recorded a decrease, and 3 (14%) saw no change in their average number of phone pickups per day.

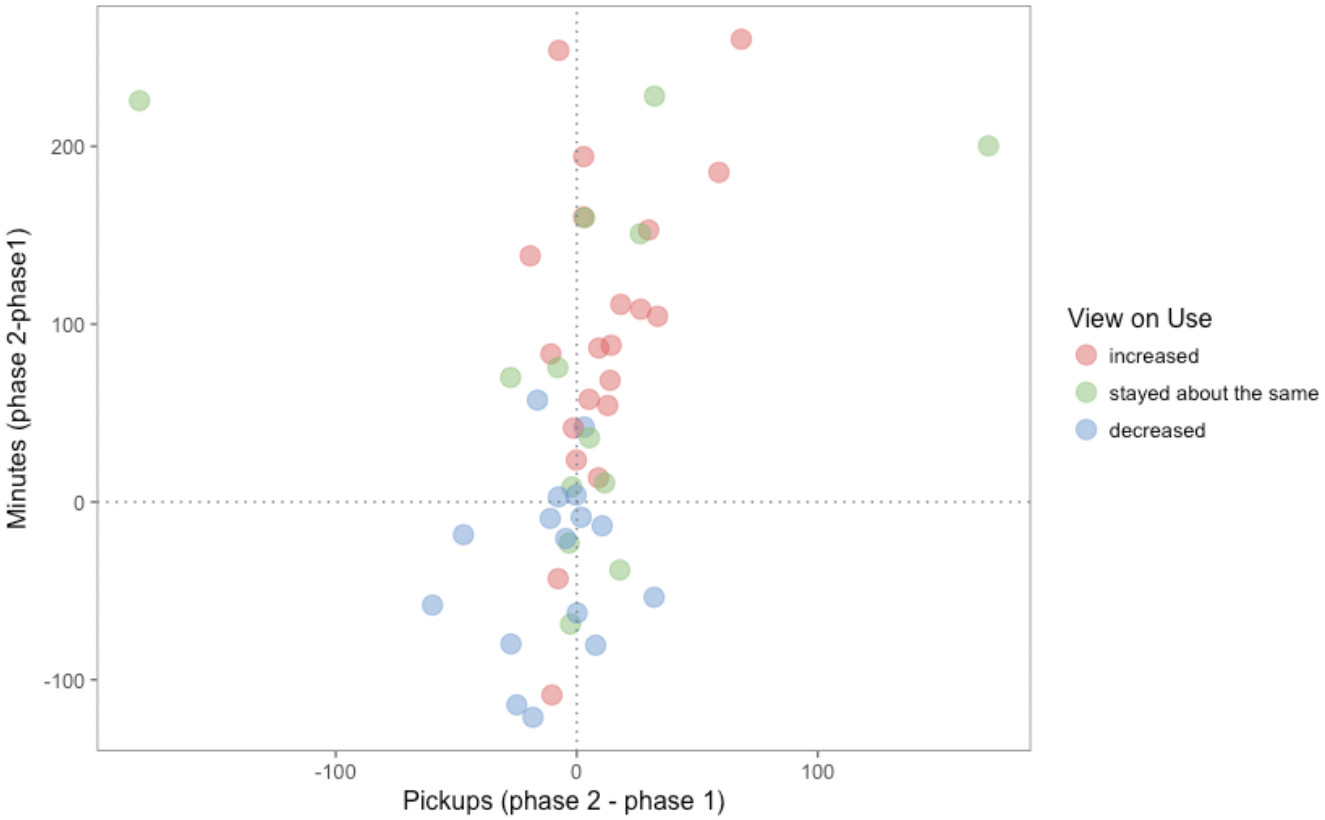
Table 4.8
Perception of change in smartphone use between phases, compared to measured change of smartphone use between phases (Pickups). Whole group of new mothers, n=50.

	Moment Pickups					
	Decrease		No Change		Increase	
Perception	n	(%)	n	(%)	n	(%)
Perceived decrease	9	(56)	4	(25)	3	(19)
No perceived change	3	(23)	4	(31)	6	(46)
Perceived increase	5	(24)	3	(14)	13	(62)

In order to create a visual representation of these perceived and objectively measured changes (Figure 4.5), the variables of phone pickups and time on device are laid along the x and y axes respectively, with increases in minutes or pickups shown as positive or negative attributes depending upon whether they show an increase or a reduction. The participants' perception of changes in their smartphone use is overlaid on these actual measures of

change, using a colour code. Those who perceived their use as having increased are shown in red, those who thought they had reduced their phone use are coloured blue, and the women who perceived their phone use as having stayed 'about the same' are coloured green.

Figure 4.5: Comparing All New Mothers' Perception of Changes in Smartphone Use with Actual Changes in Smartphone Use Behaviour from Phase I to Phase II



Chapter Five:

DISCUSSION

5.1 Introduction to the Discussion Chapter

This chapter will first summarise the study's results with comparison to appropriate literature, then segue into a cautious interpretation of those findings, before explaining the strengths, limitations and generalisability of the study. Finally, this chapter offers a section containing possible clinical implications and suggested recommendations, as informed by the results and theoretical frameworks of this study.

5.2 Key Results

5.2.1 Changes in Smartphone Use *behaviours*

The whole group of new mothers saw a significant increase ($p<0.001$) in their average time on device between phases, from 205 minutes/day (3 hours and 25 minutes per day) during their pregnancies in Phase I, to 253 minutes/day (4 hours and 13 minutes per day) in Phase II, after the birth of their babies. Meanwhile, considering the smaller group of mothers with a matched buddy, there was no significant difference within the pairs in the average time on device at Phase I or Phase II.

Worthy of note is that the average number of minutes onscreen per day for the women in our study (205 in Phase I, 253 at Phase II) was consistent with the average daily finding from

work by Zurcher et al. (2020), whose mean parental minutes per day was 234. Their work provides the only other known published example of objectively measured parental smartphone use. Although the children in that study were older than the newborns in our sample, with a mean age of 3.12 years, the finding suggests that the new mothers in our sample may be described as typical parental phone users.

Meanwhile, there was an apparent increase in the daily average number of times the whole group of new mothers picked up and unlocked their smartphones between phases, though the difference was not significant (p=0.66). As before, when considering the smaller group of matched pairs, there was no significant difference within those pairs at Phase I or Phase II. The participants recorded daily pickup averages of 53 and 58 per day at the respective study phases, while the research participants in the study by Zurcher et al. (2020) averaged 66.8 pickups per day.

These findings represent something of a contradiction. It would seem that women's smartphone use behaviours do change after the birth of their first child; they increase their average daily use. Contra to that interpretation, it suggests that women's smartphone use behaviours changed only as much as their childless counterparts, whose overall use also increased. This may mean that new mothers' use of smartphones could be described as having *not* changed after the birth of their first child.

5.2.2 Changes in Smartphone use *Perceptions*

The MPPUS-10 was our tool for measuring participants' perceived smartphone use. The MPPUS-10 scale has a score of $\geq$59 as the threshold for problem use of the mobile phone

(Nahas et al., 2018; Vally & El Hichami, 2019). The whole group of pregnant women/new mothers in our sample recorded mean scores of 45 in Phase I and 42 in Phase II, a change that was statistically significant ($p=0.008$). The mean scores of these women were higher at both phases than the mean MPPUS-10 score of parents' phone habits in a recent study examining the mealtime behaviour of children with an average age of 5.8 years (Milkovich et al., 2020). The participants in that study had a mean score of 34, suggesting the women in our study viewed their phone use as more problematic. It may be that our New Zealand-based sample of new mothers perceived their phone use differently than the US-based parents in the study by Milkovich et al. (2020) for cultural reasons, or that the ages of the children made a difference to phone-use perception.

With the whole group of new mothers, the significant ($p=0.008$) reduction in the average MPPUS-10 score between study phases, from 45 to 42, could suggest that the new mothers perceive their smartphone use to be less of a problem than they did while they were pregnant. This perception exists despite a significant ($p<0.001$), objectively measured increase in average overall use, from a daily average of 205 minutes/day to 253 minutes/day. This increased tolerance for smartphone use over time may be paralleled elsewhere in the literature (Oviedo-Trespalacios et al., 2019). Given the reasonably rapid rate at which this trend was observed, with a gap between study periods of 8-12 weeks, a continuation of this increased use and apparent comfort with that use could indicate a population whose smartphone habits trend toward overuse; this would be a trend worthy of investigating, particularly given the finding that young women have been shown to be particularly susceptible to developing addictive smartphone behaviour (El-Sayed Desouky & Abu-Zaid, 2020; Van Deursen, 2015).

Conversely, when comparing the subset of new mothers with Research buddies, no significant difference in the average MPPUS-10 score was observed at either phase within those pairs (p=0.56 and 0.24, respectively). This may suggest that having a baby did not impact this smaller group of new mothers' perceptions of their smartphone use, with both Mothers and Buddies seemingly becoming more comfortable with their phone use over time.

With regard to the women's perceptions of whether their smartphone use had increased, decreased, or stayed the same between study periods, there was a significant difference within the matched buddy pairs. The majority of the Research Buddies (76%) perceived that their smartphone use had not changed, although there was a measured increase in phone use for 70% of the buddies. This lack of concordance in estimating phone use is not uncommon (Andrews et al., 2015; Yuan et al., 2019), and supports the inclusion of an objective measurement tool in this study.

Meanwhile, a majority of the new mothers (53%) perceived an increase in their use. Within that subset of new mothers, 90% of the women were in concordance with their perception and they had recorded an increase in the average number of daily minutes on the device, and when using the pickups measure, 62% of were accurate in assessing that their use had increased.

5.2.3 Changes in smartphone use *intentions*

The whole group of new mothers did not seem to have any change in their intentions to use their smartphones between study phases, with no significant difference (p=0.5) recorded.

Their average score on the Likelihood scale at Phase I was 35 (range: 21-50) and at Phase II was 36 (range: 25-50). This suggested that having a baby did not make a difference to our new mothers' intended smartphone use.

This Likelihood scale was created and piloted in 2018, due to an absence of any existing scales to measure the likelihood of using a smartphone in a variety of parenting circumstances. Subsequently, Zurcher et al. (2020) have developed a "Technoference Attitudes and Beliefs" scale, which measures very similar outcomes. They found that increased parental digital media use was associated with more supportive technoference attitudes (i.e., greater likelihood for using the smartphone in the presence of children).

There was one exception to the finding that having a baby did not seem to make a difference to our new mothers' intended smartphone use. That exception lies with the specific question about feeding an infant. The new mothers revealed a significant change in their phone use intentions when they expressed their increased likelihood for using a smartphone while feeding an infant (See Figure 4.2 Intentions: Likelihood Scale at Phase I and Phase II: Percentage of Women in each category: How likely would you be (or do you think you would be) to use a smartphone while feeding an infant?)

This increased likelihood for phone use while feeding would align with the habits observed or reported in other studies (Gomez, 2020; Johnsen & Glavin, 2017). Further, it reinforces a finding from Tomfohrde and Reinke (2016), as 96% of the breastfeeding mothers in their sample used their phones while nursing. This is a habit that extends to the care of bottle fed babies (Golen & Ventura, 2015b). The possible implications of this finding will be further

discussed in section 5.3.3 of this chapter, “Unchanged Intentions for Overall Phone Use Contrasted with Increased Intention to use During Infant Feeding”.

When examining the buddy pairs, there was no significant difference in intentions of use between groups at Phase I ($p=0.59$). However, Phase II showed a significant difference ($p=0.02$), with Buddies indicating they were overall less likely to use their smartphones, with the new mothers more likely to do so. This difference may be explained by the aforementioned point about the significant difference in intentions regarding smartphone use while feeding an infant, recorded at Phase II.

5.2.4 Primary Research Question: How does the use of smartphones change for new mothers?

The present study was designed to determine *how* the use of smartphones changes for new mothers. Our results indicate that there was change, but only when using some of the available measurement tools. Using other rubrics, the use of smartphones did not change for new mothers.

Examples of measured change include the finding that the new mothers viewed their smartphone habits as less problematic than they did during pregnancy. This is in contrast to another measured change: a significant increase ($p<0.001$) in the average daily time on device for the whole group of new mothers. Another indication of change was that the new mothers in our sample demonstrated an increased intention for using their smartphone, led by their significant increase ($p=0.004$) in the likelihood to use their phone while feeding an infant.

With respect to the primary research question, another key interpretation of our results is that the use of smartphones did not change for new mothers. Within buddy pairs, there was no significant difference in either the average time on device or average number of pickups at Phase I or Phase II, suggesting that the arrival of their first child did not change the smartphone use of the women in our sample.

5.3 Interpretation of findings

5.3.1 Increased Objective Measures of Phone Use and Implications for Maternal Wellbeing

The new mothers in our study spent an average of 4 hours and 13 minutes, or 253 minutes, on their smartphones, per day. This finding is consistent with the only other known objective measure of parents' phone use, which recorded 3 hours and 54 minutes, or 234 minutes, per day, in parents of children whose average age was 3.12 years (Yuan et al., 2019).

As previously discussed, the purpose of our participants' phone use is unknown, although Yuan et al. (2019) did acquire such information in their study. They found that task-related apps (e.g., maps, security, weather) were the most used, for a mean of 55 minutes per day. This was followed by social media (49 minutes) , communication apps (e.g., texting, phone calls; 46 minutes per day) and entertainment apps (e.g., YouTube and Netflix; 41 minutes per day).

If these findings are consistent, it could be concluded that there is a need for caution for new mothers' smartphone use, as there is variability in the impact that various uses of a smartphone have on measures of wellbeing (Elhai et al., 2017). For example, Instagram use

has been shown to predict depression and stress (Lowe-Calverley et al., 2019) while elsewhere it has been summarized that “Smartphones can boost or hurt well-being depending on when and how they are used” (Kushlev & Leitao, 2020, p. 77).

Whatever the purpose of the smartphone use by the women in our sample, research shows that for new mothers, more use (2-3 hours, >3 hours per day) is associated with higher levels of loneliness (Mandai et al., 2018). This risk of increased loneliness is true even as people cite loneliness as a reason for their smartphone use (McDaniel, 2019a). The women in our sample had a daily average of 4 hours and 13 minutes per day, while elsewhere Yuan et al. (2019) recorded a daily average of 3 hours 54 minutes, both smartphone averages suggesting a risk of increased loneliness. This being so, caution would be wise when recommending that new mothers use their smartphones - even for accessing social support or parenting information (Alianmoghaddam et al., 2019; Asiodu et al., 2015; Newsham et al., 2018; Tharmaratnam, 2019).

Further, new mothers would not be immune to the documented costs of increased smartphone use, which include a greater risk of eye strain (Golebiowski et al., 2020), headaches (Uttarwar et al., 2020), neck problems (Zhuang et al., 2020), sleep disturbances (Demirci et al., 2015), depression (Alhassan et al., 2018), and anxiety (Lee et al., 2016). Additionally, smartphone use in the presence of others can undermine the well-being benefits usually associated with face-to-face social interactions (Dwyer et al., 2018; Kushlev et al., 2019).

Another probable downside to maternal wellbeing as a result of their smartphone use is mental exhaustion. New mothers may believe in their ability to multitask (Zurcher et al., 2020) although its legitimacy has been questioned (Heffernan, 2011), with some suggesting a more relevant name would be task-switching (Różańska & Gruszka, 2020). Either way, the quick transitions between subjects (switch tasking) or the sustained awareness of multiple subjects (multitasking) have been found to be mentally exhausting (Steege et al., 2015). This tension is recognised in the literature of parental smartphone use, with parents describing "discomfort trying to 'toggle' between work-brain and home-brain, which require different sets of cognitive and emotional skills"(Radesky et al., 2016, p. 696). In the moment-by-moment interactive reciprocity that is represented in care routines, the mothers in our sample could be described as 'toggling' for an average of 4 hours and 13 minutes per day.

Finally, it may be that there are downsides to a mother's neurobiochemistry as a result of the possible distraction by her smartphone. It may be that by missing opportunities to interact with her baby, she is also missing valuable boosts of oxytocin (Young et al., 2017) to her own brain, as well as to her baby's.

Despite these established risks, the new mothers in this study saw their minute onscreen increase between phases. While caution is appropriate when interpreting this finding – for example the acknowledged limitations of such things as the White Noise Baby Sleep app – it is nonetheless the case that the new mothers also increased the number of average daily phone pickups between phases.

It is unknown whether the new mothers in our sample were comfortable with that increased use, or whether it represents an ambivalence worthy of closer scrutiny. The reduced MPPUS-10 scores suggest that the women perceived their phone use as less problematic and were perhaps unperturbed by the increase in use, although this may not be the case. Elsewhere, researchers have documented parental tensions about their phone use (Beamish et al., 2019; Blackman, 2015; Johnsen & Glavin, 2017; Kildare & Middlemiss, 2017; Oduor et al., 2016; Radesky et al., 2016), with 61% of mothers involved in recent research from the United States saying they spend too much time on their mobile phones (Pew Research Center, 2020).

5.3.2 Reduction in Perception of Problematic Use Contrasted with Measured Increase in Use

Results from the MPPUS-10 suggest that both groups of women tended to perceive their smartphone use as being less of a problem at Phase II, even as their measured overall use increased. Possible explanations for this finding are that it indicates less of a responder bias during the second phase of data collection, or that it reflects the increasing use of phone use over time (Oviedo-Trespalacios et al., 2019).

In possible contrast to that previous finding, when women's perceived use was compared to their objectively measured use (see Figure 4.5) was the frequency with which new mothers were able to estimate their changes in use between data collection Phases. They seemed to know what a reduction or an increase "feels" like, with 90% of the new mothers who perceived an increase in their use also recording an increased number of minutes on the device per day. If that trend is transferrable, and women know what it "feels" like to increase their smartphone use, it begs the question: why are new mothers not reducing their smartphone use in deference their relationships with their infants?

There are several possible explanations for this result. The first is that they may not know of the potential harms to child development that are associated with parental screen use in their baby's presence. This conjecture is supported by the observation that, among the new mothers who noticed a change in their phone use between study periods, 37% cited "the arrival of a baby" as a reason for their increase in use. With 90% of those who perceived an increase being in concordance with that assessment, there seems to be a sizeable subset of women viewing the transition to parenthood as a reason for increasing smartphone use, and then doing so. This finding may suggest that information about the potential for harm to the parent-child relationship associated with distraction by smartphones may not be reaching new mothers. This suggestion may be reinforced by the prevalence of papers recommending online content creation for new mothers (Alianmoghaddam et al., 2019; Guerra-Reyes et al., 2016; Harpel, 2018), without the inclusion of calls for caution around new mothers' timing of accessing such information in deference to the babies' need for attentive care.

Whether or not new mothers are aware of the potential of their smartphone habits to interruption the synchrony of their relationships with their new babies, they are seemingly aware of the strength of their ties to their smartphone. For today's new mothers, their smartphones are a likely to be a constant companion: a source of information, communication, productivity and entertainment. In the words of one new mother: "I automatically just have it in my hand almost without knowing I've picked it up" (Johnsen & Glavin, 2017, p. 232). Smartphone use is ubiquitous, and the use thereof is likely reinforced by the new mothers' peers – whether or not they are mothers themselves. The similarity in smartphone habits within buddy pairs is an indication of this. These notions create an

environment where frequent smartphone use is normal, typical behaviour – whether or not it is desirable, healthy behaviour.

Another possible explanation for the increased phone use must be considered, the idea that some people may be addicted to their smartphones (Barnes et al., 2019), including mothers (Song et al., 2019). This idea may hold true for some of the women in our sample. This interpretation of smartphone addiction is not without controversy, as expressed by Bianchi and Phillips (2005), the creators of the Mobile Phone Problem Use Scale (MPPUS), when they acknowledged concern about pathologizing a behaviour that "could indeed be classified as a bad habit" (p49).

Debates continue in the research literature about language, terminology, and concepts of phone use – it is possible to read about addiction, overuse, problem use, excessive use, heavy use, or abuse of smartphones and other technology. Some sidestep the debate by declaring an intention to use "both the terms 'problematic use' and 'addiction' synonymously" (Montag, 2015, p. 435). This may be a useful strategy for scholars concerned with the parent/infant relationship, as the interruptions to relational synchrony associated with parental distraction by smartphones will impact babies, whatever the moniker attached to their parent's use.

Nonetheless, the concept of behavioural addiction is becoming more widely accepted (Al-Barashdi, 2015), perhaps in response to changes in the most recent imprint of the Diagnostic and Statistical Manual of Mental Disorders, also known as the DSM (American Psychiatric Association, 2013). Published in 2013, it included a new category for addiction: "non

substance related disorders", also known as behavioural addiction. At present, gambling is the sole example in the DSM-IV, with internet gaming disorder appearing in the appendix as requiring further study for possible future inclusion (Kardefelt-Winther et al., 2017). While internet gaming is not exactly the same thing as smartphone use, it is acknowledged as being related (Wolniewicz, 2018).

To return to the idea that smartphone addiction may account, at least in part, for the increased use of the mobile phone by the new mothers in our sample, the documented symptoms of addiction may explain the increase. Examples include the notions of tolerance and craving (Billieux et al., 2015) and these are features of addictive disorders that also emerge in discussions of phone use (Elhai et al., 2018). Additionally, "the beeps, buzzes, notifications, and messages may lead to dopamine responses or changes in the brain similar to that found in internet addiction" (McDaniel, 2019a, p. 73).

Just as there are arguments that people can become neurobiologically and behaviourally addicted to the functions of their smartphones, there are suggestions that people can become attached to the devices themselves (Konok et al., 2016), experiencing separation anxiety when away from the smartphone (Nie et al., 2020), even using it as a transition object (Gleiberman, 2020) as a child might use a teddy bear.

5.3.3 Unchanged Intentions for Overall Phone Use Contrasted with Increased Intention to use During Infant Feeding

With the exception of the increased likelihood to use a smartphone while feeding an infant, our study revealed that participants' intentions for smartphone use seem unchanged within

buddy pairs. With regard to the implications of this, a recent paper by Stockdale et al. (2020) used a modified version of the SFP to assess infant reactions to maternal distraction by smartphones. They compared the mothers' reported levels of parenting technoference to the babies' ability to return to baseline affect after the interactive disruption of maternal smartphone use. The study revealed that "Parent beliefs regarding the appropriateness of using media while present with their child was a stronger predictor of infant behavior … than parental reports of their actual technoference behaviors"(p18). This examination of parental beliefs about the appropriateness of media use in the presence of children parallels this study's "Likelihood" scale, and our new mothers' unchanged scores in their Likelihood of using a phone offers a sobering picture into which babies arrive.

The finding about infant feeding and the women's significantly increased likelihood to use their smartphones during this caregiving routine is also sobering. After all, "feeding practices provide a unique window into parent-child relationship health, because from birth, feeding makes up a critical part of parents' daily interactions with young children". (Frosch et al., 2019, p. 7).

A new parent will spend a significant amount of their day engaged with infant feeding, a practice with both "nutritional and social significance" (Ventura et al., 2019, p. 1). The implications of maternal smartphone use during the routine has implications for these domains of the nutritional and the social, and both will now be discussed.

Nutritional Significance of Distracted Infant Feeding Routines:

A distracted caregiver is more likely to misread or disregard infant cues of satiation, which can lead to overfeeding. This is associated with obesity later in that child's life (Golen & Ventura, 2015a) which is itself associated with deleterious health outcomes (Stevens et al., 2017). Conversely, there is evidence to show that infants show healthier weight gain trajectories when their mothers demonstrate greater sensitivity during feeding routines (Ventura et al., 2019). With smartphone use shown to reduce maternal sensitivity (Golen & Ventura, 2015a; Kildare & Middlemiss, 2017), the habit of feeding a baby while using a smartphone has the potential to interfere with healthy weight gain trajectories.

It remains to be seen whether acclimatisation to using devices during infant feeding points to an increased probability for using devices during other mealtime routines. As children age, mealtimes are recognised as an opportunity to foster family closeness (Moser et al., 2016; Nelson, 2019). Technology use during mealtimes has been shown to interfere with such feelings of closeness (Nelson, 2019), contribute to child misbehaviour (Radesky et al., 2014; Sundqvist et al., 2020) and make children less likely to try new foods (Radesky et al., 2015). Further to these reasons, there may be implications of mealtime technology use that travel into adulthood, for example, the "mindless feeding" (Golen & Ventura, 2015a, p. 385) associated with overfeeding during maternal technology use may align with an observed pattern of adults' overeating during mealtime phone use (da Mata Gonçalves et al., 2019).

Social Significance of Distracted Infant Feeding Routines:

Parents or caregivers are likely to bottle or breastfeed their babies 8-12 times a day (Fomon, 1993), and these repeated interactions have potential to offer the infant interactional

reciprocity, which also nurtures socioemotional and cognitive growth (Black & Aboud, 2011). For young babies, the value of those 8-12 caregiving interactions is profound, with the lessons from the Time Displacement Theory (Neuman, 1988) holding greater significance when we consider "the influence that an experience can have on development in a given month changes as a child ages. … Not all intervals of time have equal valence when it comes to the impact of experience" (Hambrick et al., 2019, p. 2).

Feeding routines that are typified by attuned, attentive care will support the formation of secure attachment relationships, itself associated with health across the lifespan. It could be said that the "relational determinants of child outcomes" (Frosch et al., 2019, p. 1) are a key factor in a person's later ability to access the protective benefits of the social determinants of health (Holt-Lunstad et al., 2017; Holt-Lunstad et al., 2010; Wilkinson & Marmot, 2003). Optimal socio-emotional development depends upon synchronous care and timely responses, both of which have been shown to suffer when parents are distracted by their smartphones (Abels et al., 2018; Rothstein, 2018; Vanden Abeele et al., 2020).

If feeding interactions frequently involve maternal smartphone use, as is the intention of the mothers in our sample, it is likely that they will share less eye contact during an otherwise intimate care moment. This was the finding in a study of smartphone use by breastfeeding women (Tomfohrde & Reinke, 2016). Eye contact, or shared gaze, is recognised as being essential for optimal development (Legerstee et al., 2007; Safyer et al., 2020), and disruptions to it are a potential interruption to the formation of secure attachment.

Even before a parent/infant dyad can absorb the benefits of shared eye contact, the neurobiology of the baby demands that they access messages of safety from the parent. The Polyvagal theory offers an explanation for a the specific neuroanatomical pathways described as *face-to-heart* (Porges, 2015) which emphasise the role of a caregiver's facial expression in fostering a sense of safety in an infant. Feeding routines are a naturally occurring opportunity for babies to observe their parent's face, but the still-face of smartphone users, as the mothers in our sample reveal they are "highly likely" to be during feeding routines, may interfere with this (Kildare, 2017; Myruski et al., 2018; Stockdale et al., 2020).

A calm, safe infant can more readily maintain homeostasis, the state representing low levels of neurobiological stress and representing an opportunity for optimal growth (Porges, 2015). Parental interaction is a powerful influence on the maintenance of homeostasis (Davies, 2017; Propper & Moore, 2006). Similarly, an infant whose parent's facial cues communicate safety will likely form social bonds which serve as the prototype for future connected relationships, allowing access to the physiological state associated with learning, growth and restoration into the future (Wilkinson & Marmot, 2003). An infant whose caregiver fails to meet the baby's needs in their quest for safety is at risk of a limited developmental trajectory (Porges, 2015).

Further, distracted feeding interactions are likely to be typified by lower maternal sensitivity (Kildare & Middlemiss, 2017). This would point to a significant effect in lowering mothers' engagement in behaviours that foster cognitive development in their infants (Ventura et al., 2019) and a possible impact to the formation of healthy attachments (Johnson, 2019; McDaniel, 2019a). This latter point "cannot be stressed enough", as it can have a lifelong

impact to an individual's "friendships, romantic relationships, work relationships and productivity, and mental health" (McDaniel, 2019a, p. 76).

The social benefits of attuned care go beyond attachment, socioemotional growth and cognitive development, and include the development of language. Distraction by technology while parenting has been shown to interfere with children's language development (McDaniel, 2019a; Reed et al., 2017) and this points to suboptimal developmental outcomes, even into adulthood (Flensborg-Madsen & Mortensen, 2019).

Infant feeding may have been susceptible to other types of interruption in the past, with the women in a study by Johnsen and Glavin (2017) citing book reading and knitting as examples of activities women undertake while feeding. However other competitors for parental time have been shown to be less immersive than the smartphone (Abels et al., 2018; Johnsen & Glavin, 2017) and this degree of immersion matters for maternal responsiveness (Knitter & Zemp, 2020; Ochoa et al., 2020; Ventura et al., 2019).

Additionally, using an internet-connected device has been shown to interfere with a person's ability to maintain control over their attention (Rosselli & Christopher, 2019; Zurcher et al., 2020). This may be a particular challenge to some parents who perceive infant care, and the requisite 8-12 feeding routines per day (Fomon, 1993), to be boring (Chatton, 2018; Radesky et al., 2016).

Moreover, distraction by devices reduces available cognitive capacity (Barr et al., 2015; Fisher & Keene, 2020; Ward et al., 2017) which may impede a parent's ability to practice "mind-

mindedness" (Meins et al., 2003) during feeding routines. Mind-mindedness can be defined as the ability to understand an infant's mental state (Crucianelli et al., 2019) and is itself a predictor of a child's later social competence (Colonnesi et al., 2019), and a child's development of conscience (Goffin et al., 2020).

If a parent was able to use the 8-12 feeds per day as an opportunity for device-free attunement to their infant, they would likely be more able to practice mind-mindedness, and avoid the potentially harmful state of phone use known as 'absent presence' (Aagard, 2016). In one study involving parents with older children, Blackwell, Gardiner, et al. (2016) report that parents believed they could be more focused on their children when they put their phones away or did not use them during family time. It is unclear whether this belief extends to parents of infants, or whether those parents recognise the value of being focused on their young babies, but both questions deserve closer examination. Keeping feeding routines device free would likely contribute to a parent's feelings of connection to their child (Kushlev & Dunn, 2019), the child's sense of connectedness to them (Frosch et al., 2019), and possibly, both parties' enjoyment of the interaction (Dwyer et al., 2018).

Another way that smartphone use may interfere with the connective intimacy of infant feeding is that it busies mothers' hand(s), meaning those mothers are less able to stroke the skin, cradle the bodies, or envelop the heads of their babies. These seemingly small acts of touch are part of the Evolved Developmental Niche of evolutionarily adaptive behaviours (Narvaez, Gleason, et al., 2013), and this one example of how the intrusion of smartphones into interpersonal relationships can represent an evolutionary mismatch (Li et al., 2020; Sbarra et al., 2019). A baby whose mother is "highly likely" to use her smartphone during

feeding is likely to experience ongoing compromises to receiving their mother's nurturing touch. This may point to suboptimal outcomes for the parent/infant relationship, and therefore to child development (Crucianelli et al., 2019; Glynn & Baram, 2019; Parsons et al., 2010).

It is potentially the case that smartphone use during infant feeding, which is 'highly likely' to be the practice of the mothers in our sample, is depriving babies of the sort of grooming touch that humans, as social mammals, have evolved to expect (Feldman, 2012). This deviation from the behaviours of the Evolved Developmental Niche may interrupt a "vital evolutionary process" (Young et al., 2017, p. 105), one "of fundamental importance for the survival and development of one's own infant, and ultimately … the survival of the species" (Parsons et al., 2010, p. 105).

Further, maternal touch during Still-Face episodes has been shown to help infants manage the stress associated with facial non-responsiveness (Feldman et al., 2010; Safyer et al., 2020). It may be that smartphone use during infant feeding is doubly problematic as it both busies the hands and stills the faces of mothers during 8-12 care routines per day.

The picture emerging from the above analysis is one of intimate care routines being compromised as women negotiate their new role as mothers with smartphone in hand. There is an established link between the importance of responsive infant feeding as a factor in responsive parenting – itself a factor in the formation of secure attachment - and the potential for technology to disrupt those processes. What is striking is that the new mothers in our sample seemed unaware of the potential for harm that exists in repeated, distracted care

routines, and instead indicated that the majority of them would be “highly likely” to use a smartphone while feeding an infant.

5.3.4 Early infancy, early habits and the implications of habituation

This study, with its objective measure of smartphone habits of new mothers, offers a glimpse into one aspect of life during the transition into parenthood, recently described as “one of the sharpest developmental curves in the lifespan” (Young, 2019, p. 1). This phase has long been recognised as a potentially stressful time of life (Belsky, 1986), perhaps due to the novel rigours of infant care, which can make a new parent feel as though they are ‘‘living on the edge of one’s capacities’’ (Martins, 2019, p. 229), but possibly also due to the sudden pivot from “professional self” to “home self”. At work, a woman is likely to have colleagues, performance feedback, perhaps a certain set of technological habits. At home, she may miss those adult relationships (Lee et al., 2019), she might be lacking feedback on the performance of her new role, and it may not be obvious that the technology habits that served her in the workplace may be worthy of review.

This transition into parenthood is also acknowledged as a key opportunity for intervention and education (Spiteri, 2019), while the value of early experiences and early relationships in the lives of infants matters not only in the moment, but across the lifespan of those babies (Zeanah, 2018). These ideas serve as reminder that the parenting habits of early parenthood are likely to hold extensive implications.

Stockdale et al. (2020) highlight how babies as young as 9 months old display behaviours that reveal their adaptation to their mothers’ distraction by their smartphones. The higher the

reported maternal technoference, the greater the attenuating reactions of the babies, suggesting that 9 month old infants learn to adapt to the increased stress of an unpredictably unavailable mother in ways that are consistent with Ambivalent and Disorganised patterns of attachment (Bowlby, 1979; Bretherton, 1992; Lam et al., 2019). Work from Ventura et al. (2019) showed that the babies in their study, who had a mean age of 19.3 weeks, already showed variation in their responsiveness to their mothers, depending upon those mothers' typical smartphone habits.

Elsewhere, researchers find that smartphone habits make smartphone use more pervasive (Oulasvirta et al., 2012; Van Deursen, 2015), and that the smartphone habits we develop during certain phases of our lives can outlive the phase itself. This was the case in work by Newsham et al. (2018), when they found that "depressed smartphone users spent more time on their devices, which led to them developing problematic use even after their depression had been alleviated" (p6).

There are still many unanswered questions about what this may mean in other areas of parents' lives. One such question is whether the smartphone habits adopted during early infancy, when the new mothers in our sample deemed themselves highly likely to use their phones during feeding routines, will lead to increased use while parenting, even after baby's daily routines change.

5.4 Study Strengths and Limitations

The strengths of this research could be considered as strong study design, a sample size that exceeded expectations, the capture of both subjective and objective measures, and the

exploration of an acknowledged gap in contemporary literature. These points will now be expanded.

With regard to the study design, having first-time mothers select a non-pregnant, childless Buddy meant that we could compare changes to smartphone use between groups over time. There was one group who experienced a life-changing event with the arrival of a baby, the other group representing 'business as usual'. The study design meant that the observations about maternal smartphone use were not made in a vacuum, but could be compared to matched phone users who maintained a pre-baby status.

This study benefitted from a sample size that (in some areas) exceeded the goals set during the proposal stage. At that time a sample size of 30 people was selected, and while the number of Buddies didn't reach that target, the number of pregnant women who completed the first survey was n=65 participants, allowing greater statistical power than initially hoped for.

An additional strength of this study was that it went beyond the limitations of self-reported phone use data (David et al., 2018; Lee et al., 2017) and gathered objectively measured data. This is still a rarity in measures of parental smartphone use, with only one other known study using this strategy, with the study by Yuan et al. (2019) being a pilot study to compare parental self-report with so-called passive sensing (i.e. app measurement) of phone use. Similarly, combining the objectively measured phone use data with our subjectively gathered survey information allowed us to compare smartphone users' perceptions of their use with their objectively measured use.

Finally, a strength of this study was its filling of an acknowledged gap in the contemporary literature. Smartphones themselves are a fairly recent phenomenon, meaning that the study thereof is catching up to the ubiquitous use. Researchers had previously identified the lack of studies examining the impact of parental smartphone use during infancy, for example when Atli et al. (2019) wrote: "studies regarding the effects of technology on human behaviour should be conducted starting from the birth of the infant (or even during pregnancy). The number of such studies conducted in this field is quite limited and there is a gap in the related literature." (p148). This gap has been reinforced elsewhere (Beamish et al., 2019; Johnsen & Glavin, 2017) and this work attempts to go some way in addressing it.

Despite these strengths, this study had limitations. They included its reliance on convenience sampling, the difficulty in engaging Research Buddies, challenges with the app *Moment*, the unknown nature of women's purposes for phone use, not being able to determine how much phone use happened in the presence of infants, data collection overlapping with the COVID-19 pandemic, and aspects of self-report measures.

To expand upon those points, our study was limited by its reliance on convenience sampling, which seems to have led to underrepresentation of some groups. This will be expanded upon in section 5.5 Potential External Validity of the Study Results.

Another limitation of this study was the sample size, especially of Research Buddies, in part due to participant attrition throughout both phases of data collection. The projected sample size of 30 participants was exceeded in the group of pregnant women/new mothers, but not

achieved with our Buddy/control group. Further, despite best efforts, only eleven Buddy pairs completed both aspects of data collection in both phases of the study. These pairs may or may not be representative of young New Zealand smartphone users, whether new mothers or not.

Further, a number of users had difficulty with the "export data" function of the app *Moment*, necessitating the emailing of day-by-day screen shots of the user data (ie, minutes of use and number of pickups). For some women, this proved to be too inconvenient or intrusive, leading to study attrition. Other researchers have subsequently found this "export data" aspect of *Moment* to be similarly problematic (McDaniel, 2019b; Yuan et al., 2019). While it is unknown how this may have impacted the study findings, one speculation is that perhaps those who were offput by the emailing of screen shots were less technically proficient, possibly having spent less time on their smartphones. Their inclusion may have pointed to lower mean daily minutes on device than was otherwise recorded.

Another limitation is that we can only speculate on how women were using their phones while they were unlocked. The degree of immersion in the device has been shown to vary between individuals, and not all types of smartphone use are as distracting as others. Thus, different uses impact the degree of parental availability or unavailability (Atli et al., 2019; Kildare & Middlemiss, 2017; Knitter & Zemp, 2020; Lemish et al., 2020; Modecki et al., 2020; Radesky et al., 2016; Ventura et al., 2019). In that vein, research participants sometimes offered unsolicited stories about specifics of their phone use – for example using a map app on a road trip skewed one pregnant woman's daily minutes onscreen, and two new mothers made reference to using a "White Noise Baby Sleep Machine" app, which may have impacted

their onscreen minute tally. Worthy of note is that the Moment app was designed to only record an "awake" screen as time on device (e.g., listening to a podcast with a darkened screen would not count toward daily minutes on the device), so it is unknown which apps would count as minutes onscreen. This limitation may offer reason for a cautious approach in interpreting the new mothers' measured increase in onscreen minutes. Nonetheless, it does not explain the increase in average daily screen unlocks.

Also important to acknowledge is that it is unknown whether all incidences of phone use in Phase II of the study happened in the presence of infants – there is the possibility that new mothers refrained from using their smartphones until their babies were asleep or elsewhere. We do not know the extent to which parent/child interactions were interrupted or mothers were distracted from their infants by their smartphones. This will be an important avenue for future study; to find out what babies are doing while mothers are using their smartphones. As discussed, it would seem that maternal smartphone use during infant feeding is a pervasive habit, but it is unknown the extent to which other routines or interactions are subjected to technoference.

It also deserves to be noted as a possible limitation that the end of our data collection phase coincided with the beginning of a national lockdown in New Zealand due to the COVID-19 pandemic. It is likely that there was increased phone use following the Prime Minister's announcement about the lockdown on March 23rd, 2020, although only three new mothers and two buddies shared Moment data that partially included or followed this date.

The reliance on self-report data within the survey may be viewed as a limitation. While the MPPUS has been accepted as a "gold standard" in reporting problem use of the mobile phone (Eduardo et al., 2012; Lopez-Fernandez et al., 2014; Yan, 2015), a pilot version of this survey run in October 2018 yielded results that questioned the validity of some of the questions therein. With mobile technologies evolving so rapidly, terminologies do not always keep pace. For example, one pilot participant found that the second question of the MPPUS-10 ("When out of range for some time, I become preoccupied with the thought of missing a call") was irrelevant, as she rarely receives phone calls, instead using her smartphone as a tool for texting, accessing social media, or searching the internet.

If this study were to be replicated, a larger and more representative sample would be valuable. Other changes that would benefit the study would include finding a mechanism to capture the extent to which maternal smartphone use is contributing to technoference. Perhaps new mothers are waiting until their babies are asleep or elsewhere before using their smartphones, and therefore their phone habits are not causing them to miss their infants' bids for attention. With the women in our study averaging daily phone use of 253 minutes/day and with newborn care known to be time consuming, this supposition would be logistically challenging and therefore unlikely. This unknown element of maternal smartphone use would be an important addition to understanding the implications thereof.

5.5 Potential External Validity of the Study Results

The findings in this study are potentially generalisable to other populations of young women in New Zealand. The women in our study came from throughout the country, from settings

both rural and urban. Further, the age range of the first-time mothers in our study aligns with the median childbirth age of New Zealanders, which was reported as 30 years old in the 2018 Census (StatsNZ, 2020).

However, the demographic information provided by the first-time mothers and the "buddies" who comprised the control group (Table 4.1) reflects a rather more ethnically homogeneous group than is reflected in the New Zealand population as a whole. For example, census data from 2018 reveal that 70% of New Zealanders identify as NZ European (StatsNZ, 2020), compared to 79% of our whole group of mothers, 93% of our mothers with a matched buddy, and 90% of those buddies. Another example; 16.5% of New Zealanders identify as Māori (StatsNZ, 2020), compared to 7% of the whole group of mothers, 0% of the mothers with a matched buddy, and 3% of the buddies.

The extent to which this impacts the potential generalisability of this study is unknown, as it must be noted that those census data reflect the diversity of New Zealand as a whole, and with the youngest New Zealanders (>18 years) comprising our most diverse population (StatsNZ, 2020), these ethnicity data may not neatly correlate to the specific subset of New Zealanders of childbearing age.

The new mothers' smartphone use as recorded by *Moment* are not unlike those recorded in a study of American parents in work by Yuan et al. (2019). With New Zealand and the USA both fitting the criteria of the oft-studied Western, educated, industrialized, rich and democratic (so-called WEIRD) societies (Bornstein et al., 2017), it may be that the similarity in *Moment* data between these studies reinforces the generalisability of these findings.

5.6 Implications/Recommendations:

5.6.1 Persuasive Technology Design in the lives of today's mothers and their newborns

The new mothers in this study increased their smartphone use by an average of 51 minutes per day after their babies arrived, from a baseline at Phase I of 205 mins to a Phase II total of 253 minutes/day. This increased use ought not represent any kind of failure on the part of a new mother, as it is important to recognise how challenging it may be to resist the distractions of technology in favour of building a relationship with a new baby.

The allure of smartphones is intentional, with use of "sticky design", (Haynes, 2017), "persuasive tech" (Fogg, 2009), and other strategies to increase a user's time on device (Churchill, 2019). Contrast those design goals with the following realities: babies are often demanding, becoming a mother can be overwhelming (Von Mohr et al., 2017), while parenthood has been described as both stressful (Mckenzie & Carter, 2013) and boring (Radesky et al., 2016).

Throughout history, caring for babies has meant meeting their needs for safety, nutrition, attachment, warmth, and comfort. As ever, new parents work to meet those needs as they also teach language, transmit culture, and demonstrate moral behaviour. However, modern parents may find themselves charged with new demands; "it is not enough for parents to just have certain parenting skills. They are supposed to adapt themselves to recent technological developments in the world" (Atli et al., 2019, p. 197)

Evolutionarily, a young human mother would have lived surrounded by a group of kin, providing protection, company, and models of infant care. Today, women raising babies speak of loneliness (Mandai et al., 2018) while designers on the other side of their smartphones work to exploit such psychological vulnerabilities, altering both individual and collective wellbeing (Laufer, 2019).

Considering these factors, it could be described as unreasonable to pit the design might of the technology industry against the willpower of women as they work, one at a time, to create bonds with their babies and thereby maintain our species' Environment of Evolutionary Adaptedness. After all, "It is unreasonable to design services to be compulsive, and then reprimand [people] for being preoccupied with their devices." (Kidron et al., 2018, p. 5). Further, as Hesselberth (2018) writes, the idea that "only mental effort, will power, and self-control" can help a person to use less technology lends itself to "a narrative of personal responsibility and the neoliberalist government it taps into, in which individuals are unapologetically held accountable for their own (mis)use of technology" (p.1998). These examples illustrate how a person's challenges in reducing their use of smartphones can be bigger than that one person.

Thus we consider the rigours of so-called *digital parenting* (Rode, 2009), in which parents might monitor their children's use of technology, acknowledge issues of online privacy, or – as has been the focus of this study – consider the impact of their own use of devices such as smartphones in the presence of their children. An understanding of the power of persuasive technology design leads to a recommendation for a shift in design practices. This will be explored alongside other recommendations in the following section.

5.6.2 Strategies: supporting new mothers to prioritise relationships with their infants, and to enjoy the benefits of their smartphones while minimising the potential for harm

Sbarra et al. (2019) emphasise that "smartphones themselves are neither good nor bad, but how they are used and when they are used can make the instruments for success or agents of failure"(p605). Further, as quoted earlier in this chapter: "Smartphones can boost or hurt well-being depending on when and how they are used" (Kushlev & Leitao, 2020, p. 77). Therefore, it is important to support new mothers in finding strategies that boost their well-being, and avoid hurting the well-being of her baby, of her relationship with her baby, or of the new mother herself.

One strategy may be the development of guidelines that support parental reduction of smartphone use in the presence of children, as called for by other researchers (Khourochvili, 2017; Kildare & Middlemiss, 2017; Newsham et al., 2018). While important, it is unlikely that guidelines alone would be sufficient in creating behaviour change for parents (Kelly & Barker, 2016). Research indicates that behaviour change requires an individual to resolve their personal feelings of ambivalence about a desired change (Manuel & Moyers, 2016). As discussed in the literature review, research into parental use of smartphones is rife with descriptions of ambivalent feelings (Blackman, 2015; Johnsen & Glavin, 2017; Kildare & Middlemiss, 2017; Radesky et al., 2016), offering many potential entry points into supporting change.

The need for strategies beyond guideline development is especially true if new mothers are found to have addictions or attachments to their smartphones: reducing the use thereof would likely be stressful and require additional support. A heavy-handed approach to guidelines could instead create more feelings of anxiety and stress for new parents at the already potentially intense transition to parenthood. This could be counterproductive, as parental overuse of the smartphone is sometimes an attempt to escape from such feelings (McDaniel, 2019a; McDaniel & Radesky, 2018a; Radesky et al., 2016).

Although guidelines are an imperfect solution to the challenge of parental phone use in the presence of infants, they deserve consideration – especially if they urge a rethink of habits during infant feeding. An appropriate recommendation would be that new mothers aim to keep feeding routines as close to phone-free as possible. This will hold benefits for the nutritional aspects of feeding, and also the relational. Further, it is as-yet unknown whether maternal phone use during infant feeding points to increased phone use during mealtimes, later. With device-free family mealtimes being aspirational for a number of reasons (Nelson, 2019), this possible link may be a question worthy of additional study.

Acknowledging the limits of guidelines, education and recommendations, it may be that a whole suite of strategies is necessary. An example would be to support parents in reflecting on their own smartphone use (Zurcher et al., 2020). By paying attention to their habits, parents can immediately start avoiding the ill-effects associated with absent-minded smartphone use.

In one recent study of 3,589 university undergraduates, absent-minded use emerged as a unique positive predictor of negative outcomes (i.e., depression, anxiety, stress, and negative affect) and a unique negative predictor of positive outcomes (i.e., positive affect and flow) (Marty-Dugas & Smilek, 2020). Meanwhile, work by Nowland et al. (2018) specifies benefits when consciously using the internet to enhance existing friendships and/or build new friendships, but those benefits disappear when it is instead used to displace time in offline social interactions. This may be an important finding to share with new mothers, who may find that a quick text exchange to set up a time for sharing coffee with a friend reaps wellbeing benefits comparable in value to the displaced infant connection time taken by that exchange, while aimless scrolling may not.

An associated strategy for encouraging conscious use may involve teaching mindfulness practices, which have been found to reduce smartphone overuse and improve wellbeing outcomes (Verduyn et al., 2021). This finding of the value of mindfulness is reinforced for mothers, with improvement in maternal wellbeing and life satisfaction equating a reduced likelihood of addiction (Song et al., 2019). Elsewhere, the practice of mindfulness techniques in the parenting role have been found to have positive outcomes on measures of a child's attachment to the parents (Medeiros et al., 2016), the stress responses of both mothers and babies (Laurent et al., 2017; Townshend et al., 2016) as well as better attunement by mothers and greater responsiveness by babies (Zeegers et al., 2019).

There are multiple mechanisms for teaching mindfulness to parents, examples include "*Mindful with your baby"* (Potharst et al., 2017), *"FirstPlay Therapy"* (Courtney & Nowakowski-Sims, 2019), and mothers may gain similar skills from the *"Watch, Wait and*

Wonder" programme (Cohen et al., 1999). If mothers' postnatal care included avenues for learning to pay greater attention to their infants, practitioners could highlight the bids that babies routinely make for attention and point out infants' comfort in their mothers' presence. This would have the benefit of activating the production of dopamine and oxytocin in both brains (Atzil et al., 2011; Young et al., 2017), which may reduce mothers' propensity to seek the "rush" of such hormones from their smartphones (Gazzaley & Rosen, 2016; McDaniel, 2019a; Sbarra et al., 2019). Such encouragement of conscious smartphone use and attentive parenting are important, as the results of this study show that new mothers do not appear to be actively reducing their phone use after the birth of their babies.

Another avenue to help parents to reduce their smartphone use would be the use of technology design solutions to more intentionally meet the needs of families (Hiniker, 2017; McDaniel, 2019b; Yuan et al., 2019). If designers were to create tools that supported in-person connection rather than using persuasive design to keep attention on screens (Churchill, 2019; Fogg, 2009) we could seek to avoid the state described as "human downgrading" (Thompson, 2019). Design solutions could share the burden of resisting smartphone overuse in the presence of infants, rather than have that responsibility rest solely on parents' shoulders. However, design solutions alone would be unlikely to solve the problem. A recent study by Monge Roffarello and De Russis (2019) reviewed 42 apps designed to reduce users' onscreen time, analysed >1000 user reviews of such apps, and conducted a three-week-long trial of one such app. The study found that the apps did not promote the formation of new habits. In addition to technology design solutions or mindfulness training around phone use, other ideas worthy of examination include making a "family media plan"

during prenatal visits (Coyne et al., 2020), and providing parents with specific examples of tech-free activities (Zimmerle, 2019).

Elsewhere, lessons from smoking cessation research highlight that mothers have greater success in reducing or stopping smoking during pregnancy or at the transition to parenthood when other family members make similar changes (Bauld et al., 2017; Bottorff et al., 2006). This may also prove to be true in the case of technology, although it is an untested idea at this stage.

This idea of sharing the responsibility for infant wellbeing with a wider family group has an existing model in Aotearoa/New Zealand (Cameron et al., 2013; Jenkins & Harte, 2011). In pre-European times, an extended family of kin and non-kin, known as hapū, would have concerned themselves with the care and wellbeing of babies within the hapū. Contemporary descriptions of infant care suggest that hapū embodied the caregiving behaviours that support adaptation (Jenkins & Harte, 2011), and form the Evolved Developmental Niche (Narvaez, Gleason, et al., 2013), itself a pocket of the Environment of Evolutionary Adaptedness (Schore, 2013). If the lessons from smoking cessation research can be applied here, today's babies would likely benefit from multiple family members committing to a more conscious relationship with their smartphones upon the arrival of a new baby. Babies would arguably do well if families and support networks adopted a hapū approach, with fathers, friends and extended family all limiting smartphone use in their presence.

This notion would be in keeping with the bioecological model of child development (Bronfenbrenner, 1994), which honours the primacy of the parent/child connection even as

it acknowledges the influence of wider family, community and policy on human development and public health (Barclay, 2010). To extend the influence of the bioecological model, policy could aid the wider community in supporting babies in accessing fewer distracted interactions by creating "phone free" public spaces – not unlike the smoke free environments that support community health (Edwards et al., 2008). At time of writing, there is an absence of research investigating the existence of, reaction to, or impact of phone free spaces. Exceptions explore such things as "digital detox" camp for adults (Sutton, 2020), and one paper examining a "phone free" summer camp in the USA (Povilaitis, 2019) found that participants aged between 15 and 17 years reported a positive response to the experience, citing the formation of deeper connections with those they encountered offline. However, while providing examples of people's experiences of shared phone free spaces, these are arguably not phone free *public* spaces, the experience of which remain unexplored.

Future research has many avenues to explore when considering the protection of infants from the potentially deleterious effects of caregiving distracted by smartphones. Researchers could explore the possible efficacy of phone free spaces, along with the role of resolving maternal ambivalence around smartphone use, the value of guidelines for new parents, technological design solutions, mindfulness training for both phone use and infant care, parental evaluation of their own phone use, the prenatal creation of a family media plan, provision of examples of technology-free activities, and wider-family commitments to changing their smartphone use upon the arrival of a baby.

The potential efficacy of these suggestions may be revealed if they were analysed using an exploration of costs versus benefits, including their acceptability to various socio-cultural

groups. Preceding this may be the challenging step of quantifying the possible future health costs associated with doing nothing. That may require calculating whether there are future mental health risks associated with enabling commercially-driven forces to facilitate unfettered parental use of smartphones in the presence of infants. There may be social as well as financial costs associated with this, in which case we might wonder who will bear the burden of those costs.

There are implications here for all those involved with supporting new mothers – whether general practice doctors, practice nurses, midwives, lactation consultants, paediatricians, childbirth educators, or aunties - to provide consistent encouragement for parents to keep interactions with babies as free from smartphone interruptions as possible. This message is especially important with regard to feeding routines.

5.7 Conclusions

The picture that emerges from the above synthesis of results and relevant literature is one that highlights the value of supporting new mothers to prioritise their connections with their new babies, despite the potentially distracting properties of smartphones. The new mothers in our sample saw an increase in their overall use after the arrival of their babies, and report themselves "highly likely" to use a smartphone while feeding an infant. Extant literature suggests these practices may have negative effects on maternal responsiveness, with associated negative implications for the attachment relationship and a host of child development outcomes. Further research is needed to learn how best to support new

mothers in optimising the documented benefits of smartphone use, while minimising the harm to mothers and babies.

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Appendices

Appendix A: Commentary

Revision under consideration by the Journal for Child Psychology and Psychiatry.
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Commentary: The real (?) effect of smartphone use on parenting - a commentary on Modecki et al. (2020)

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A recent publication by Modecki et al. (2020) asserts that "more [smart]phone use was associated with higher parenting quality". This generalistic concluding statement contradicts an increasing corpus of research. The purpose of this commentary is to highlight some of this relevant corpus, and provide some caution to their assertion.

Modecki and colleagues reported on self-reported phone use and relationship warmth data elicited from a cross-sectional convenience sample conducted by the Australian Broadcasting Corporation in August 2017. However, it is widely recognised that considerable care needs to be exercised when relying on participants' self-reported estimates of their phone use, as the psychometric and reliability properties of responses is generally poor (Lee, Ahn, Nguyen, Choi, & Kim, 2017). Furthermore, the attachment scale used by the authors seeks to measure parent attachment to children but not vice versa. These self-report scales leave unanswered questions about the child's lived experience of parental warmth and reciprocated attachment relationships. Caution may be prudent in interpreting these data; attachment relationships are two-sided phenomena and these measurements assess them from one viewpoint only. Further, one person's expression of warmth may not be received as such, observational data would be helpful in interpreting the validity of a parent's assessment of their own warmth.

Their reliance on a convenience sample limits the external validity of the findings, and likely introduces important (yet hidden) non-sampling biases. In accordance with the STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) best practice reporting guidelines (www.strobe-statement.org), a useful addition to the paper would have been the inclusion and stratification of demographic information about the children whose parents were surveyed. Table S2 "Participant Demographics" deals with information about the parents themselves, only alerting us to the range of children's ages (0-18 years) and the mean age of the youngest child living at home (7.86 years). This

omission of detail is crucial. Parenting is a role which varies substantially depending upon the chronological age, developmental stage, and individual needs of those being parented. While Modecki and colleagues seek to describe the "real effect" of smartphones on parenting, the age, stage and needs of the children studied remains largely silent. Thus, the implicit assumption made by these authors is that there is no effect modification between phone use and parenting behaviour over children's differing age, stage and needs.

In addition to the lack of child age stratification, the poor psychometric properties of the primary variables, and questionable external validity of its findings, the study also likely suffers from residual confounding – where additional important confounding factors beyond parent's age, relationship status, education, employment status, and age of youngest child were not considered or collected. Furthermore, the authors use these cross-sectional data to assess whether "smartphone use predict[s] parenting" employing associative techniques rather than, for example, cross-validation methods which utilise both training and test datasets. Cross-validation avoids the optimistic estimates of predictive performance known to exist when the full dataset is used for both model specification and prediction assertions. These methodological issues highlight the need for cautious interpretation of the data.

Modecki and colleagues assert that they reveal the "real effect" of smartphones on parenting, and that "more [smart]phone use was associated with higher parenting quality". Yet, parental distraction by smartphones has, for example, been shown to interfere with parental sensitivity (Beamish, Fisher, & Rowe, 2019), itself a precursor to a secure attachment relationship. Elsewhere, parental smartphone use has been linked to risks to child safety, child behaviour problems (Beamish et al., 2019; Newsham, Drouin, & McDaniel, 2018), a parent's feeling of closeness to their children, and fewer voiced interactions - with implications for children's language learning (Newsham et al., 2018). These and other findings reinforce the need for parental phone use caution.

When Modecki and colleagues assert that "more smartphone use is associated with *better* (not worse) parenting", it begs the question, better for whom? As previously suggested, 'parenting' is not a job description where one-size-fits-all. For example, the neurobiological needs of infants are different to the needs of older children. Infancy is a time unlike any other, with rapid neurological growth and the setting of trajectories across a variety of developmental domains. For babies, parental smartphone use may be especially impactful, as their early relationships implicate brain growth, the complexity with which they learn language, their future relationships, their physical health, their educational outcomes and their development of morality.

As one mechanism for better understanding the impact of parental smartphone use on parent/infant relationships, Myruski and colleagues studied the parallels between the Still Face Paradigm (SFP), as described in seminal research from 1978, and contemporary parents' use of smartphones in the presence of their infant. The original SFP had mothers cease their usual responsive interactions and instead assume a 'still face', with blank affect. Their babies' distress and eventual withdrawal is seen as evidence of their need for relational reciprocity, and their awareness of interruptions to the natural flow of interactions.

Myruski et al. (2018) studied 50 mother and baby pairs; the infants had a mean age of 15.4 months (range: 7.2-23.6 months). The researchers found that while parents were using their phones, they were likely to assume a “still face”. This is potentially problematic, as babies have been shown to be sensitive to disruptions in the flow of natural interactions (Bigelow & Best, 2013) and unpredictable parental signals are associated with negative cognitive outcomes and risk of mental illness for children. This work was limited by their reliance on self-reported patterns of typical phone use, a shortened Reunion phase of the SFP, and variations from the original SFP (in the provision of toys and access to movement for the children in their study).

However, their findings that greater parental device use is associated with less positive affect and a reduction in the successful repair of interactions following disruptions by smartphones were reinforced in a subsequent study by Stockdale et al. (2020). Stockdale and colleagues sought to amend the variations in the SFP test conditions used in Myruski and colleagues’ study by, instead, duplicating the original model. While their work was still reliant on self- reported parental phone use, they found that “Parent beliefs regarding the appropriateness of using media while present with their child was a stronger predictor of infant behavior ... than parental reports of their actual technoference behaviors”(p18). This finding is relevant to our commentary, suggesting as it does that parental *beliefs* about the appropriateness of smartphone use has an influential role on their children, while Modecki and colleagues’ assertion that “more smartphone use is associated with *better* (not worse) parenting” suggests that smartphone use in the presence of their children is, indeed, appropriate. Promotion of Modecki and colleagues’ assertion that increased smartphone use leads to better parenting outcomes may increase parents’ use of their own, perhaps contributing to parental behaviours with documented downsides for the children in their care.

Conversely, recommendations that parents limit smartphone use in their children’s presence may not only serve babies but are likely to support parents themselves. Mothers’ overuse of smartphones has been found to contribute to deleterious outcomes such as increased scores of self-reported loneliness (Mandai, Kaso, Takahashi, & Nakayama, 2018), or symptoms of depression (Newsham et al., 2018). In their work, Newsham et al. (2018) include a Public Policy Relevance Statement, part of which is aimed at encouraging parents to “limit their own use of media when interacting with children”. In addition to the risks to infants and their mothers, levels of parental media use are associated with children’s own levels of media use, later - which are themselves associated with potentially deleterious effects (Beamish et al., 2019).

Perhaps the inclusion of a caveat about the needs of young babies, suggestions for circumstances of when to limit and when to enjoy smartphone use, or a similar Public Policy Relevance Statement would enhance this self-reported study by Modecki et al. As the authors indicate, there is a need to ask nuanced questions about the impacts of our increasingly technologized world. Answering these nuanced questions and asserting an understanding of a “real effect” may warrant objectively gathered data and improved study design.

We agree that addressing nuanced questions will likely require avoiding the "generalized narratives of family risk" as cautioned by the authors, while acknowledging the well documented risks that current literature reveals. These risks deserve closer scrutiny than "generalized narratives" would allow, but the risks are nonetheless real – especially to infants and the developmentally vulnerable – and, we believe, ought to be acknowledged.

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paradigm: Links to maternal behaviors and beliefs regarding technoference. *Infancy, 25*(5), 571-592. https://doi.org/10.1111/infa.12342

Appendix B: HEC Documentation

HUMAN ETHICS COMMITTEE

Secretary, Rebecca Robinson Telephone: +64 03 369 4588, Extn 94588 Email: human-ethics@canterbury.ac.nz

Ref: HEC 2019/111 9 September 2019

Miriam McCaleb
Health Sciences
UNIVERSITY OF CANTERBURY

Dear Miriam

The Human Ethics Committee advises that your research proposal "How Does the Use of Smartphones Change for New Mothers? A Pre- and Post- Motherhood, Matched-Controlled Observational Design" has been considered and approved.

Please note that this approval is subject to the incorporation of the amendments you have provided in your email of 3rd September 2019.

Best wishes for your project.

Yours sincerely

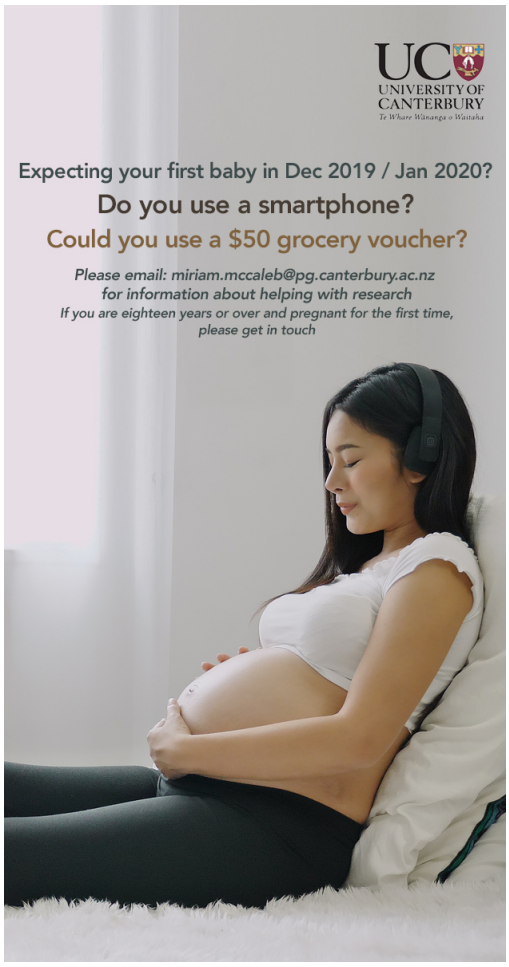
Dr Dean Sutherland

Chair
University of Canterbury Human Ethics Committee

Appendix C:

Recruitment advertisement for print publication:

Formatted for Social Media:



Appendix D:
Consent PDF

School of Health Sciences
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Email: miriam.mccaleb@pg.canterbury.ac.nz

23rd October, 2019
HEC Ref: HEC 2019/111

How does the use of smartphones change for new mothers? Information Sheet for Research Participants.

Kia Ora, hello! Thank you for your interest in joining this study. My name is Miriam McCaleb and I'm a former kindergarten teacher, a mother of two, and I've returned to the University of Canterbury to do some Masters research. I'm interested in how smartphone use changes over time, both with and without a life changing event - in this case, having a baby. We will find out about this by having research participants answer surveys and upload a week's worth of screen-time and pick-up data from their phones. Research participants will be asked to repeat that process after about 12-16 weeks, once Baby is a few weeks old. To thank you for your time, you will receive two $25 grocery vouchers, one after each round of data collection.

You have been invited to take part in this study because you have answered my recruitment advertisement (thank you!). You are eligible to join the study if you are a pregnant mother-to-be, you're expecting your first baby, and you're over 18 years old.

Each pregnant mother-to-be is asked to please nominate a "research buddy", who will also fill in the online surveys and upload phone use data. This research buddy should be female, over 18 years of age, and have no children. If you choose to take part in this study, and your buddy agrees, please let me know their email address when you send back the attached consent form. They will also receive $50 worth of grocery vouchers. The research buddy can email me after Baby has arrived, or you're welcome to do so, and I will know whether/ when to email you about the second phase of surveying and screen time tracking. There will be up to 30 mothers-to-be and 30 friends taking part in the study.

If you choose to take part in this study, you will fill in an online survey and load a free screen-time tracking app onto your phone *(*it's called *"Moment",* see attached info sheet). After a week, you will export the data from the app to my secure email address (the info sheet will show you how). After a gap of 12-16 weeks (once Baby is a few weeks old) you will repeat that process: fill in the online survey and load *Moment,* exporting the data a week later. Please note that the app will only record the number of times your phone was unlocked and the total time it was in use during a day. It doesn't record what apps you've used, whether you're making phone calls or surfing the web, it doesn't record what websites you visit or otherwise record any content. You will receive an email about *Moment* for examples.

The time it will take to fill in the survey will be about 10 minutes each time, and as for *Moment*, it should just take a few minutes to load. After a week, emailing the data and unloading the app (if you

so choose) should take about 5 minutes. After about 12-16 weeks, I will email you and ask that you repeat this process: filling in the online survey and loading the app (if you unloaded it previously), then a week later emailing the data and unloading the app (if you so choose). We ran a pilot version of this study in October of 2018, to iron out any problems with the survey and make sure that it isn't too burdensome.

We know that having a new baby can be a busy and sometimes stressful time for people. Because of this, we have made the survey as short as possible and we chose the least disruptive phone app we could find.

Participation is voluntary, and you may ask for your raw data to be returned to you or destroyed at any point prior to the publication of my thesis. If you withdraw, I will remove information relating to you. Withdrawing will, in no way, affect your usual treatment or care. However, once analysis of raw data starts on 15thJanuary, 2020, it will become increasingly difficult to remove the influence of your data on the results.

The results of the project will be published, but you may be assured of the complete confidentiality of data gathered in this investigation: your identity will not be made public. My primary principle is to manage the data securely to limit the risk of harm caused by unintentional or intentional disclosure of information. Information given by participants will be stored on a secure, password-protected UC-network drive, and the database used for authentication will be separated from that which contains the survey responses.

The *Moment* data will be emailed to my secure UC email address (miriam.mccaleb@pg.canterbury.ac.nz). Confidentiality is important to the researchers and the university. *Moment* and survey data will be securely stored on a University of Canterbury computer using password access. Only my supervisors and I can access the data. In line with New Zealand Privacy Act, the data will be destroyed five years after the thesis has been published.

Please indicate on the online form if you would like to receive a copy of the summary of results of the project.

The project is being carried out as a requirement for the Masters in Health Sciences degree, by me, under the supervision of Professor Philip Schluter and Dr. Patricia Champion, who can be contacted at philip.schluter@canterbury.ac.nz and patriciachampion17@gmail.com. They will be pleased to discuss any concerns you may have about participation in the project.

This project has been reviewed and approved by the University of Canterbury Human Ethics Committee, and participants should address any issues or complaints about the conduct of this research to The Chair, Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human- ethics@canterbury.ac.nz).

If you agree to participate in the study, please complete the online form.

Miriam McCaleb

School of Health Sciences
Telephone: +64 3 369 3523
Email: miriam.mccaleb@pg.canterbury.ac.nz

October 23, 2019

How does the use of smartphones change for new mothers? Consent Form

- ☐ I have been given a full explanation of this project and have had the opportunity to ask questions.
- ☐ I understand what is required of me if I agree to take part in the research.
- ☐ I understand that participation is voluntary and I may withdraw at any time without penalty. Withdrawal of participation will also include the withdrawal of any information I have provided should this remain practically achievable.
- ☐ I understand that any information or opinions I provide will be kept confidential to the researcher and her academic supervisors, and that any published or reported results will not identify the participants. I understand that a thesis is a public document and will be available through the UC Library.
- ☐ I understand that all data collected for the study will be kept in password protected electronic form and will be destroyed after five years.
- ☐ I understand the risks associated with taking part and how they will be managed.
- ☐ I have read and understood the information provided about the *Moment* app, and I am happy to install this on my private smartphone.
- ☐ I understand that I can contact the researcher Miriam McCaleb miriam.mccaleb@pg.canterbury.ac.nz or supervisor Philip Schluter philip.schluter@canterbury.ac.nz for further information. If I have any complaints, I can contact the Chair of the University of Canterbury Human Ethics Committee, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz)

Please fill in the consent section of the online survey, and let's begin!

Miriam McCaleb

Appendix E:
Sample Survey

There were four slightly different versions of this survey: on the following page the New Mother's survey begins.

There was a slightly different survey for Pregnant Women, and the Research Buddies had two versions. More demographic information featured in the Phase I surveys. Only the New Mothers' survey had the questions of the PSOC-5, and the questions about changes in use between study phases only featured in the Phase II studies for both the New Mothers and their Buddies.

The formatting information was not visible to the research participants (eg: Block 5, MPPUS-10, End of Block).

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Block 5

Kia Ora! Congratulations on the arrival of your baby! Welcome to the second phase of data collection. As you might recall, we are interested in how smartphone use changes over time, both with and without a life changing event - in this case, having a baby. We measure this using a brief survey and data from *Moment*, the screen tracking app.

Once you've filled in this survey you will receive an email with repeat instructions about how to load Moment and export the data. After I've received that data I will mail you your second $25 grocery voucher.

Thanks again for your time! I really appreciate it.

Miriam :)

Block 7

I agree to continue with my participation in this research project

- ◯ Yes
- ◯ No

WHO-5

These five questions are about your experience of life in general.
Please indicate for each of the next five statements which is closest to how you have been feeling over *the last two weeks*.

I have felt cheerful and in good spirits

/

- ◯ All of the time
- ◯ Most of the time
- ◯ More than half of the time
- ◯ Less than half of the time
- ◯ Some of the time
- ◯ At no time

I have felt calm and relaxed

- ◯ All of the time
- ◯ Most of the time
- ◯ More than half of the time
- ◯ Less than half of the time
- ◯ Some of the time
- ◯ At no time

I have felt active and vigorous

- ◯ All of the time
- ◯ Most of the time
- ◯ More than half of the time
- ◯ Less than half of the time
- ◯ Some of the time
- ◯ At no time

I woke up feeling fresh and rested

- ◯ All of the time
- ◯ Most of the time
- ◯ More than half of the time
- ◯ Less than half of the time
- ◯ Some of the time
- ◯ At no time

My daily life has been filled with things that interest me

- ◯ All of the time

- ◯ Most of the time
- ◯ More than half of the time
- ◯ Less than half of the time
- ◯ Some of the time
- ◯ At no time

MPPUS-10

These next questions give information about how you use your phone.

For each item, please mark the box which fits best for you from 1 ‘‘Not true at all’’ to 10 ‘‘Extremely true’’

	1 = Not true at all	2	3	4	5	6	7	8	9	10 = Extremely true
I have used my mobile phone to make myself feel better when I was feeling down	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
When out of range for some time, I become preoccupied with the thought of missing a call	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
If I don’t have a mobile phone, my friends would find it hard to get in touch with me	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
I feel anxious if I have not checked for messages or switched on my mobile phone for some time	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
My friends and family complain about my use of the mobile phone	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

	1 = Not true at all	2	3	4	5	6	7	8	9	10 = Extremely true
I find myself engaged on the mobile phone for longer periods of time than intended	○	○	○	○	○	○	○	○	○	○
I am often late for appointments because I'm engaged on the mobile phone when I shouldn't be	○	○	○	○	○	○	○	○	○	○
I find it difficult to switch off my mobile phone	○	○	○	○	○	○	○	○	○	○
I have been told that I spend too much time on my mobile phone	○	○	○	○	○	○	○	○	○	○
I have received mobile phone bills I could not afford to pay	○	○	○	○	○	○	○	○	○	○

How likely?

These next questions are about attitudes and habits around phone use.
How likely would you be – or do you think you would be - to use a smartphone in these circumstances?

	Extremely likely	Somewhat likely	Neither likely nor unlikely	Somewhat unlikely	Extremely unlikely
During a meeting	○	○	○	○	○
During a coffee break	○	○	○	○	○
During playtime with child(ren) at home	○	○	○	○	○
At a party or other social gathering	○	○	○	○	○
While talking with partner/family member	○	○	○	○	○

	Extremely likely	Somewhat likely	Neither likely nor unlikely	Somewhat unlikely	Extremely unlikely
At a wedding, funeral, pōwhiri, or other formal event	◯	◯	◯	◯	◯
When supervising children away from home eg at playground	◯	◯	◯	◯	◯
During a meal with family	◯	◯	◯	◯	◯
While feeding a baby	◯	◯	◯	◯	◯
During time alone	◯	◯	◯	◯	◯
While talking with a colleague	◯	◯	◯	◯	◯

Habits/family

This set of questions are about habits and attitudes about smartphones within families. *Please answer these questions whether or not you are currently a parent.*

For each statement, please mark the box which fits best for you from 1 ‘‘Not true at all’’ to 10 ‘‘Extremely true’’.

	1 = Not true at all	2	3	4	5	6	7	8	9	10 = Extremely true
Babies can’t learn yet, all they need is to be kept warm and fed	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Technology is the future and children should be exposed to it early	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Talking to and cuddling a baby early in life is important as their brains are growing fast	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

	1 = Not true at all	2	3	4	5	6	7	8	9	10 = Extremely true
There is such a thing as too much technology and babies would do better if we limit it around them	○	○	○	○	○	○	○	○	○	○
Babies are born resilient and they will adapt to whatever is happening around them.	○	○	○	○	○	○	○	○	○	○
Parents using smartphones while they are caring for their babies are just doing what's normal these days, it won't hurt a baby	○	○	○	○	○	○	○	○	○	○
Babies are born vulnerable and do best when adults adapt to their needs	○	○	○	○	○	○	○	○	○	○
It would be best for babies if parents waited until babies were asleep or elsewhere before using their smartphones	○	○	○	○	○	○	○	○	○	○

PSOC 5

These questions are about your experience of parenting so far.

For each item, please mark the box which fits best for you from 1 ‘‘Strongly disagree’’ to 6 ‘‘Strongly agree’’

	1 = Strongly disagree	2	3	4	5	6 = Strongly agree

	1 = Strongly disagree	2	3	4	5	6 = Strongly agree
I would make a fine model for a new parent to follow in order to learn what she/he would need to know in order to be a good parent	◯	◯	◯	◯	◯	◯
I meet my own personal expectations for expertise in caring for my children	◯	◯	◯	◯	◯	◯
If anyone can find the answer to what is troubling my children, I am the one	◯	◯	◯	◯	◯	◯
Considering how long I've been a parent, I feel thoroughly familiar with this role	◯	◯	◯	◯	◯	◯
I honestly believe I have all the skills necessary to be a good parent to my children	◯	◯	◯	◯	◯	◯

Block 8

These questions are about whether you have noticed any changes in your own smartphone use ***since our last survey period***.

Since the last survey, my phone use has ...

◯ stayed about the same
◯ increased
◯ decreased

If your phone use has increased or decreased, is this due to ... (please tick all that apply)

☐ changes in work circumstances

	1 = Strongly disagree	2	3	4	5	6 = Strongly agree
I would make a fine model for a new parent to follow in order to learn what she/he would need to know in order to be a good parent	◯	◯	◯	◯	◯	◯
I meet my own personal expectations for expertise in caring for my children	◯	◯	◯	◯	◯	◯
If anyone can find the answer to what is troubling my children, I am the one	◯	◯	◯	◯	◯	◯
Considering how long I've been a parent, I feel thoroughly familiar with this role	◯	◯	◯	◯	◯	◯
I honestly believe I have all the skills necessary to be a good parent to my children	◯	◯	◯	◯	◯	◯

Block 8

These questions are about whether you have noticed any changes in your own smartphone use ***since our last survey period***.

Since the last survey, my phone use has ...

◯ stayed about the same
◯ increased
◯ decreased

If your phone use has increased or decreased, is this due to ... (please tick all that apply)

☐ changes in work circumstances

- [ ] the arrival of a baby
- [ ] having installed the "Moment" app (or other screen time tracking app)
- [ ] [ ] other (please explain)

I am using my phone *in a different way* since our last survey period (for example, shorter phases of screen time, using phone for different functions than at last survey)

- ◯ Yes
- ◯ No
- ◯ Unsure

Demographics

Finally, a quick demographic question.

Which of these best describes your current living arrangement?

- ◯ I live in a home I own or partly own
- ◯ I live in a home I rent
- ◯ I live in the home of family/friends (eg boarding)
- ◯ [ ] Other (please write here)

Appendix F:
Email thread leading to translation of specific paragraphs from paper by Johnsen & Glavin (more recent emails appear first)

Sølvi Johnsen [solvi.johnsen@lyse.net]

Actions

To:
Miriam McCaleb
Inbox

Wednesday, August 21, 2019 6:34 PM

Hi Miriam
How great it is that my paperwork can be used on the other side of the world. This shows that the issues we're dealing with is worldwide😄It seems like you have made the right translation and your paragraphs reflect my work very well.
I will wish you good luck with the rest of your important work, and feel free to contact me again if you need it.

All the best
Sølvi S Johnsen

Miriam McCaleb

Sent Items

Wednesday, August 21, 2019 12:14 PM

Kia Ora Sølvi,

Kjære Sølvi,

I'm back to ask another favour. Your paper was just spot on with regard to the inclusion criteria for my literature review, and I'd love to refer to it in more than one section. Below are three paragraphs that refer to your work, but because I do not speak Norwegian, I have just used online translation software to be able to understand it.

Before my supervisor will allow me to use your important paper (and specifically to quote from it), I need to check whether the English translations in the following paragraphs accurately reflect your original work.

Multiple researchers capture the mixed feelings that many mothers have about technology use. For example, Johnsen & Glavin (2017) describe this as "the great paradox of technology", that it is "both liberating and captivating at the same time" (p236). The authors use interviews with mothers of babies to describe the tension those women feel when having to choose between being available to their infant or being available to others via their smartphones.

And this one:

Respondents in Johnsen & Glavin's (2017) sample talked about how easy it was for the habitual use of smartphones to begin to feel like an addiction, for example, "I've become addicted, that I automatically just have it in my hand almost without knowing I've picked it up" (p232).

And finally:

In their 2017 work, Johnsen & Glavin add qualitative responses from women describing the challenge to remain conscious in the face of technological distraction "… it becomes like I have more focus on it at times than the child"(p232), and the authors describe how this is a source of tension for the mothers in their study, stating that mothers thought "they could miss the development that happened to the child if they were not conscious"(p233).

What do you think, Sølvi? Did the computer do justice to your important work? May I quote you in those words?

THANK YOU!!!

Miriam

Sølvi Johnsen [solvi.johnsen@lyse.net]

Inbox

Monday, July 29, 2019 7:40 PM

Hi Miriam
How great it is that you want to read my article. May I ask in what occasion you need it (just curious😄).

I send you this link and hope that it'll work for you. I'm on vacation at the moment, whitout my Mac. If it's a problem to open it, I'll send it to you next week.

https://cdn.fbsbx.com/v/t59.2708-21/22162775_2029811887036082_3896932241225285632_n.pdf/den_digitale_tidsklemma.pdf?_nc_cat=106&_nc_oc=AQm5_-IjsaG64vfCzQeY33SS1ebapWo0BEzVzCNQRmGSL6AgA9pevbrZYY0tYDkJUWM&_nc_ht=cdn.fbsbx.com&oh=e14ee5558a3e2b9423d49e3956535299&oe=5D415E76&dl=1

All the best, Sølvi S Johnsen

Miriam McCaleb

Actions

To:

solvi.johnsen@lyse.net

Sent Items

Monday, July 29, 2019 12:01 PM

Kia Ora, greetings from New Zealand

I would dearly love a copy of your article. My university's library cannot get me a copy! Can you help? Thank you!

Miriam

Den digitale tidsklemma

Hvordan opplever småbarnsmødre å kunne balansere sin oppmerksomhet mellom bruk av smarttelefon og samtidig være tilstede for barnet?

The digital time-squeeze

How do mothers manage to divide their attention between the use of Smartphones and attending to their children's needs?