## Maintaining Momentum in Infant Mental Health Research During COVID-19: Adapting Observational Assessments

Stephanie Tesson (D, 1,2 BPsych (Hons I), Dianne Swinsburg, 1,3 BPsych (Hons I), MCLINPsych, and Nadine A. Kasparian 1,4,5 BA Psych (Hons I), MAPS, PhD

<sup>1</sup>Heart Centre for Children, The Sydney Children's Hospitals Network, <sup>2</sup>School of Psychology, The University of Sydney, <sup>3</sup>Discipline of Paediatrics, School of Women's and Children's Health, UNSW Medicine, The University of New South Wales, <sup>4</sup>Cincinnati Children's Center for Heart Disease and Mental Health, Heart Institute and the Division of Behavioral Medicine & Clinical Psychology, Cincinnati Children's Hospital, and <sup>5</sup>Department of Pediatrics, University of Cincinnati College of Medicine

All correspondence concerning this article should be addressed to Nadine Kasparian, BA Psych (Hons I), MAPS, PhD, Cincinnati Children's Center for Heart Disease and Mental Health, Cincinnati Children's Hospital, 3333 Burnet Avenue (MLC 7039), Cincinnati, OH 45229, USA. E-mail: nadine.kasparian@cchmc.org

Received 23 October 2020; revisions received 17 February 2021; accepted 18 February 2021

#### **Abstract**

Understanding the potential effects of the COVID-19 pandemic on the developing parent-infant relationship is a priority, especially for medically-fragile infants and their caregivers who face distinct challenges and stressors. Observational assessments can provide important insights into parent-child behaviors and relational risk; however, stay-at-home directives and physical distancing measures associated with COVID-19 have significantly limited opportunities for in-person observational parent-infant assessment. To maintain momentum in our research program during the pandemic, we rapidly pivoted to remote, technology-assisted parent-infant observational assessments. In this commentary, we offer a series of strategies and recommendations to assist researchers in adapting observational parent-infant paradigms. We also discuss the benefits, challenges, and limitations of distance-delivered assessments, and offer considerations for clinical service provision and future research during and post the COVID-19 pandemic.

**Key words**: COVID-19; infancy and early childhood; infant mental health; parent-child relationship; psychological functioning; parenting; research design and methodology.

The severe acute respiratory syndrome coronavirus 2 pandemic has brought about widespread medical, economic, social, and psychological challenges. Obstetric care has undergone major changes, and many pregnant women have experienced unanticipated alterations in antenatal care, as well as restrictions on the presence of loved ones during labor and childbirth, and ongoing infection control measures (Bartick, 2020; Choi et al., 2020). Parents of infants with serious illness, such as congenital heart disease (CHD),

have additionally faced changes to pediatric care, and for hospitalized infants, unusually restrictive visitation policies (Duff et al., 2020; Murray & Swanson, 2020). Although well-intended to prevent the spread of the novel coronavirus disease 2019 (COVID-19), these changes carry an emotional toll. Psychological reactions reported during the pandemic by women in the perinatal period include hyperarousal, sleep disturbances, sadness and grief, as well as depression, traumatic stress, and general- and pregnancy-specific anxiety

(Boekhorst et al., 2020; Davenport et al., 2020; Rajkumar, 2020). Concerns have also been raised regarding potential consequences of the COVID-19 pandemic for parent–child relationships (Chu et al., 2020; Tscherning et al., 2020).

## Implications of the COVID-19 Pandemic for Parent-Infant Relationships

Exposure to highly stressful or traumatic experiences can have far-reaching consequences for parents and their children. Research on historical community-wide traumatic events and natural disasters, including the 9/11 terrorist attacks, Ebola epidemic, hurricane Katrina, and the Wenchuan earthquake in China, have linked such exposures to adverse pregnancy and birth outcomes (Harville et al., 2010), greater maternal psychological disturbance and family dysfunction (Cao et al., 2013; McDermott & Cobham, 2012), and negative parenting practices, such as greater hostility, withdrawal, overprotection, and child maltreatment (Kelley et al., 2010; McFarlane, 1987). Parent-child relationships can also potentiate or "buffer" children from psychological distress and behavioral problems during periods of adversity (Cobham et al., 2016), and the COVID-19 pandemic is likely to be no exception (Fong & Iarocci, 2020; Marchetti et al., 2020). Expectant and new mothers are at heightened risk of psychological morbidity, social isolation, domestic violence, job loss, and financial insecurity; all factors that may compromise parenting confidence and place parent-child relationships at risk (Campbell, 2020; Nicola et al., 2020; Perez et al., 2020; Rajkumar, 2020), especially in the context of pre-existing maternal psychological disorder, a history of trauma or adverse childhood experiences, low social support, or threats to the health of one's infant (Perez et al., 2020; Valenzuela et al., 2020). During the COVID-19 pandemic, parents of hospitalized infants also face distinct challenges to parent-infant bonding and interaction, including periods of separation, restricted visitation, heightened health-related fears, and prolonged mask use limiting facial visualization, and relational communication (Duff et al., 2020; Green et al., 2021; Murray & Swanson, 2020; Tscherning et al., 2020). In contrast, it is also possible that some families may experience various upsides to the pandemic, including greater adoption of work-from-home arrangements, more family focused time, and a greater sense of community connectedness.

Early research examining the relational consequences of COVID-19 has reported mixed findings. Several studies have found adverse effects, including higher rates of traumatic childbirth, mother–infant bonding difficulties (Mayopoulos et al., 2021; Oskovi-Kaplan et al., 2020), parenting stress and caregiver burden

(Hiraoka & Tomoda, 2020; Russell et al., 2020), and family conflict (Russell et al., 2020). Other studies, however, have reported benefits of the pandemic, including closer family connection, enhanced communication, greater emotional expressiveness (Günther—Bel et al., 2020), and closer parent—child bonds (Chu et al., 2020). These early studies converge on significant relational effects of COVID-19; yet, none have utilized an observational measure to examine parent—infant dyadic interaction, highlighting a significant knowledge gap.

# Importance of Observational Infant Mental Health Assessment

Decades of naturalistic and experimental research using observational methods to assess the parent-infant relationship, including the Strange Situation Paradigm and the Child-Adult Relationship Experimental (CARE)-Index, have advanced our understanding of the foundational importance of child attachment relationships (Ainsworth & Bell, 1970; Aspland & Gardner, 2003; Beebe & Lachmann, 2013; Fonagy et al., 1991; Kelly et al., 2005; Lotzin et al., 2015; Madigan et al., 2006; Ranson & Urichuk, 2008; Stern, 2018; Tronick & Beeghly, 2011; Van Ijzendoorn et al., 1999). Extensive meta-analytic evidence has demonstrated robust associations between early parent-child attachments and a range of outcomes across childhood, adolescence, and adulthood, including internalizing and externalizing behaviors (e.g., anxiety, depression, aggression; Madigan et al., 2013, 2016; Spruit et al., 2020), neurodevelopmental, self-regulatory, and attentional capacities (Pallini et al., 2018, 2019), socio-emotional development and peer relations (Cooke et al., 2016; Pallini et al., 2014), as well as physical health (Ranson & Urichuk, 2008). Direct observation is considered the gold-standard for assessing parent-child behavior and can be used to identify relational risk as well as to inform clinical intervention (Lotzin et al., 2015). Despite this, research during the COVID-19 pandemic to date has focused exclusively on self-report and qualitative assessments of parent-child bonding and interaction, predominantly from parents' perspective. Although providing important insights into caregivers' subjective experiences, these methodologies are prone to socially desirable responding and recall bias, and correlate poorly with the findings of observational assessments (Hendriks et al., 2018; Lotzin et al., 2015). Yet, the challenges to in-person observational assessments during the pandemic have been extensive (Gruber et al., 2020), including stay-at-home and quarantine orders, the need for physical distancing, use of personal protective equipment (PPE; e.g., masks, gloves, goggles), greater parenting demands, family stress and disrupted

routines, and in medical settings, cancelation or delay of assessments due to significant changes to hospital visitation policies. Many of these challenges also apply more broadly to other research methodologies, as well as to clinical care (Izmailova et al., 2020; Junior Bokolo, 2020; Remtulla, 2020).

### Need for Adaptations to Observational Assessment Methods in Response to COVID-19

Calls have accordingly been made for research efforts to adapt existing observational paradigms (Stiles-Shields et al., 2020). Yet, to date, specific strategies and recommendations for doing so have been lacking. Clinical services have responded to restrictions to inperson care by developing various remote, technology-assisted adaptations, including electronic monitoring of clinical trials (Izmailova et al., 2020) and telehealth and telemedicine services (Junior Bokolo, 2020). Remote or technology-assisted, distance-delivery also provides a promising solution to the challenges of new and ongoing observational assessment with pediatric populations during the COVID-19 pandemic and beyond.

Our research laboratories at the Heart Centre for Children in Sydney, Australia and Cincinnati Children's Center for Heart Disease and Mental Health in the United States have experienced these challenges firsthand. We routinely conduct observational assessments of parent-infant interaction and attachment using a range of paradigms, including a naturalistic play-based method called the CARE-Index (Crittenden, 2010). Caregivers and their infants with heart disease (aged 6 and 12 months) are invited to participate in the CARE-Index alongside, or in addition, to scheduled hospital appointments. Mothers are instructed to play with their infant "as you normally would" for 3 min and this interaction is filmed by a trained member of our research lab in accordance with the published protocol (Crittenden, 2010). Trained, reliable coders then use a validated framework to evaluate: (a) patterns in maternal and infant interaction, and (b) levels of "risk to the relationship." Maternal behavior is assessed according to three dimensions (sensitivity, control, and unresponsiveness), and infant behavior is coded according to four dimensions (cooperative, compulsive, difficult, passive; Crittenden, 2010). During coding, attention is focused on seven aspects of behavior: facial expression, verbalizations, body contact, emotional expression, pacing of turns, control of the activity, and developmental appropriateness of the play. Mother-infant dyads are also assigned an overall score, categorized as sensitive (scores of 11–14), adequate (7–10), inept (5-6), or high-risk (0-4), with clinical intervention

indicated for dyads categorized as "inept" or "high-risk" (Crittenden, 2010).

Our efforts to administer the CARE-Index were hampered; however, when stay-at-home orders were mandated and institutions ceased in-person research activities for an undefined period to manage COVID-19 infection risks. To maintain momentum and overcome barriers to observational assessment of parentinfant interaction, we needed to develop a feasible alternative to our usual lab-based implementation method. Capitalizing on available technologies, we developed a standardized protocol for distancedelivered parent-infant observational assessments (Institutional Review Board [IRB] approval: 11/ CHW/112). Consenting parents are offered two options during the initial scheduling call; (a) virtually administered, distance-delivered or, if community and hospital COVID-19 restrictions allow, (b) in-person participation in the CARE-Index. Mothers preferring virtual administration are guided through our new standardized protocol. This involves nominating a trusted individual, and time and date to film the 3min play-based activity, as well as reviewing procedural instructions, and problem solving any potential challenges to assessment completion (e.g., sibling care arrangements). Verbal instructions are supplemented by emailed written materials and visual aids to facilitate appropriate camera positioning, movement, and angles. Parents are asked to transfer the film to the researchers using WhatsApp, a confidential, widely downloaded and easy-to-use app (Opperman & van Vuuren, 2018). Because the CARE-Index procedure involves free-play, it can be delivered in various settings (e.g., clinical, research laboratories, home) without diminishing validity (Crittenden, 2010). In addition to the CARE-Index, participants are also invited to complete a questionnaire, including a brief set of COVID-19 related items measuring exposure and stress responses to the pandemic, as part of our broader research.

Returned videos and questionnaire responses are rapidly reviewed by the research team for risk and recording quality. Parent-infant dyads experiencing relational difficulties or reporting elevated distress are offered timely and appropriate referral to perinatal mental health services, social services, domestic violence organizations, or their primary care doctor, as indicated. The Heart Centre for Children also has a well-established state-wide, integrated clinical psychology service dedicated to childhood heart disease. We provide evidence-based care for patients and families across the continuum of care (Kasparian et al., 2016) and during the COVID-19 pandemic we leveraged telehealth technologies to offer virtually administered psychology appointments and psychotherapeutic interventions.

Table I. Potential Benefits and Limitations of Virtually Administered Parent-Infant Observational Assessments

	Benefits	Limitations and Challenges
For Researchers	<ul> <li>Enables continuation of existing studies and initiation of new research to determine the consequences of COVID-19 (and other stressful or traumatic community-based events) on parent—child relationships</li> <li>Increased sample representativeness due to greater accessibility for regional, rural and remote families, participants with mobility challenges, busy families, and those unable to complete an assessment alongside medical appointments due to infant tiredness or distress</li> <li>Removes need for use of PPE (e.g., masks, gloves, goggles) during a pandemic</li> <li>Researcher safety protected</li> <li>Ease of administration</li> </ul>	<ul> <li>Some families may not have access to the required technology (e.g., data-enabled smart phone)</li> <li>Some parents may feel more comfortable and relaxed, or may refilm the interaction, potentially positively skewing the results</li> <li>Need for multiple reminders for some families</li> </ul>
For Participants	<ul> <li>Reduced time and cost related to travel, parking, and time off work</li> <li>Fewer physical barriers to participation (e.g., mobility issues)</li> <li>Greater convenience and flexibility in terms of scheduling</li> <li>Offers choice (caregivers can select remote or hospital-based assessment, depending on preference and COVID-19 restrictions)</li> <li>Greater flexibility in terms of adjusting the research activity around infant feeding, sleeping, and settling routines</li> <li>Removes need for use of PPE (e.g., masks, gloves, goggles) during a pandemic</li> <li>Participant safety protected</li> <li>Ease of administration</li> </ul>	<ul> <li>Caregiver is responsible for organizing a time for the interaction to be filmed, potentially increasing participant burden</li> <li>Possible technological difficulties (e.g., recording equipment, sending video to research team)</li> <li>Filming and scheduling difficulties (e.g., finding a quiet space and a trusted individual to film, managing sibling during filming)</li> </ul>

### Acceptability and Feasibility of Virtually Administered Parent–Infant Observational Assessments

Our experience of virtually administered, distancedelivered parent-infant observational assessment, instigated in response to COVID-19, has been overwhelmingly positive (see Table I for a summary of potential advantages and limitations). In terms of implementation feasibility, the total time from protocol, materials, and procedures development to implementation with mothers and their infants with CHD was 9 weeks, including IRB review and approval. At the time of writing, we have been using this new, distancedelivered methodology for 6 months, with ongoing use planned throughout 2021. High acceptability is evidenced by excellent participant uptake rates as well as anecdotal reports. When compared with the same period in 2019 (June-December 2019, prepandemic), we have recovered at least 94% of the data we would have otherwise lost due to COVID-19 restrictions and stay-at-home orders (June–December 2020).

Anecdotally, participating mothers have described numerous advantages of distance-delivered assessment, including flexible scheduling to suit both mother and baby's needs, greater choice regarding filming time and location, reduced time and travel costs, and less disruption to work commitments. Participants have also commented on the simplicity of the new, distance-delivered procedure, with spontaneously offered quotes indicating "The instructions are all clear" and "It seems straightforward enough." Participant and researcher safety is also protected without the need for PPE which interferes with facial recognition and affective cues during parent-infant observational assessments (Green et al., 2021). Many of these advantages parallel those of other telehealth services, including enhanced safety, accessibility, and convenience (Izmailova et al., 2020; Junior Bokolo, 2020; Remtulla, 2020).

Notwithstanding the COVID-19 pandemic, distance-delivered observational assessments may confer additional advantages over in-person, hospital-, or

lab-based implementation. For example, parents can determine their infant's readiness to play and adjust the activity around sleeping, feeding, and settling routines. Within the hospital environment, following medical appointments, infants are often tired, hungry, unsettled, or distressed, limiting or precluding engagement in research activities. Distance-delivery also helps overcome the "tyranny of distance" endemic to the Australian research context, as well as many other settings. By improving accessibility for families living in regional, rural or remote locations, and those with mobility challenges making in-person attendance difficult or impossible, the reach of infant mental health research is broadened and potential disparities in participation may be lessened. This approach may thus reduce selection bias as well as missing data.

### Limitations of Distance-Delivered Approaches to Observational Infant Mental Health Assessment

Several potential limitations of this new approach warrant consideration (Table I). Distance-delivery of the CARE-Index was possible as this paradigm assesses free play between parent and infant. More structured observational parent-infant assessment paradigms (e.g., the Strange Situation Paradigm) may not be amenable to adaptation. Participation may also be limited by lack of access to the required technologies, potentially contributing to sampling bias; however, in our experience this has not been an issue, with ~91% of the Australian adult population owning a data-enabled smartphone (Deloitte, Technological difficulties may nonetheless arise and require troubleshooting. Another potential issue is that distance-delivery shifts greater burden to families who are responsible for organizing a convenient time for filming, although this is balanced against reduced travel time and cost. To address this challenge, researchers may need to make multiple reminder calls to support filming for some families.

Without researcher presence, caregivers may feel more relaxed and comfortable, or may choose to refilm the video in an attempt to capture their "best" interaction. Although it is conceivable this may positively skew results, individuals trained in the CARE-Index method are taught to identify subtle, finegrained behavioral indicators of relational risk, making the procedure robust to refilming (Crittenden, 2005, 2010). For example, one theoretical tenet is that smiles do not necessarily express pleasure or affection but may hide parental hostility or infant displeasure, depending on the interpersonal meaning or function of the behavior, which may be overlooked by an untrained observer (Crittenden, 2005, Crittenden & DiLalla, 1988). Moreover, in our experience over the past 6 months, several mothers have explicitly stated they sent their first filming attempt and raised queries regarding camera angles and movement rather than concerns about the interaction (e.g., "Let me know if we need a better angle"). Nonetheless, we are yet to comprehensively examine the validity of technology-enabled, distance-delivered CARE-Index assessment, representing an important goal for future research.

# Recommendations for Future Research and Clinical Practice

In Table II, we offer a series of recommendations to assist researchers in developing and implementing technology-based distance-delivered parent-infant observational assessments. During the set-up phase, IRB approval is essential and should be applied for as early as possible to minimize disruption to existing studies and facilitate timely initiation of new research. All adaptations should be carefully and comprehensively protocolized, and tailored training is strongly recommended (via videoconferencing during the pandemic) to ensure uniform delivery across research team members. Development of clear and simple visual aids, verbal scripts, and written filming instructions is also strongly recommended to support participant engagement. Visual aids should include simple guidance regarding appropriate camera positioning, filming angles, and movement.

During the early stages of implementation, teams should be prepared for rapid-cycle problem-solving to quickly address any issues that occur (e.g., scheduling or filming difficulties). In our experience, this has included developing strategies to assist caregivers with identifying specific dates and times to film the play interaction, as well as supporting caregivers to find a trusted adult to film the interaction (e.g., a partner, grandparent, or friend), troubleshooting to minimize disruptions (e.g., filming during sibling naptimes or child care, turning off electronic devices), and arranging to check-in just before the interaction to troubleshoot any challenges that arise. Offering both remote or in-person administration is also recommended, depending on current COVID-19 restrictions, to maximize participant convenience and safety, and respect families' preferences and comfort levels. If the assessment must take place in-person, researchers can consider the use of clear masks to allow for visualization of facial expressions and affective cues (Green et al., 2021).

Data security is another key concern and it is important to consider the best available methods for protecting participant confidentiality and safety whilst minimizing participant burden. For example, our team asks participants to return videos using WhatsApp, which utilizes end-to-end encryption to ensure data privacy (Opperman & van Vuuren, 2018). Returned

**Table II.** Potential Challenges, Solutions, and Recommendations for Adapting Parent–Infant Observational Assessment Paradigms for Distance-Delivery During the COVID-19 Pandemic

Potential Challenge Strategies, Solutions and Recommendations	
Set-up	Apply for IRB approval early to minimize disruption to existing studies and facilitate
Protocol adaptation	<ul> <li>timely initiation of new studies</li> <li>Clear and careful documentation of all adaptations to the protocol should be made to facilitate comparison of in-person and distance-delivery procedures and results, as well as to support collaboration across groups, and assist future validation work</li> <li>Develop visual aids, verbal scripts, and written filming instructions for families. Visual aids should include guidance on filming and camera positioning, angles, and movement to capture desired aspects of interaction (e.g., face-to-face interaction, emotional expression, verbalizations), with a <i>Do's and Don'ts</i> section to assist participants when carrying out assessments</li> </ul>
Researcher training	<ul> <li>Tailored training and ongoing supervision should be provided either in-person or via videoconferencing, to ensure uniform implementation across research team</li> </ul>
Scheduling	<ul> <li>Wherever possible, schedule the assessment on a specific date and time, and set up a reminder or check-in call with participants, to facilitate efficient communication and follow-up, and support assessment completion</li> <li>Create a plan with participants to minimize potential disruptions (e.g., schedule during sibling naptime, turn off electronic devices)</li> <li>Be flexible—accommodate changes in families' schedules, offer opportunities to complete the assessment at home or in-person, depending on current COVID-19 policies and</li> </ul>
Filming	<ul> <li>Participants' needs and preferences</li> <li>Schedule the assessment when a parent or trusted individual is available for filming.</li> <li>Assess if additional considerations are required to support participation (e.g., a single parent may use a tripod if it is difficult to find someone to film the interaction, provide equipment for families who are experiencing financial hardship and do not otherwise have the resources to participate).</li> <li>Provide visual aids, and verbal and written filming instructions on appropriate camera positioning, angles, and movement.</li> <li>Offer reminder or check-in calls with participants to reiterate instructions and support assessment completion.</li> <li>Consider use of clear masks if the assessment must take place in-person to protect participant and researcher safety and allow for visualization of facial expressions and affective</li> </ul>
Data security	<ul> <li>Use a secure file transfer method for videos to protect participant safety, confidentiality, and privacy</li> <li>Consider convenience and ease of use of chosen system for busy families</li> <li>Ensure a secure, password-protected, IRB-approved storage method for all video material collected</li> </ul>
Data collection and reporting	<ul> <li>Distinguish between data collected pre-, during, and postpandemic to facilitate comparison of findings</li> <li>Combine use of observational paradigms with self-report measures to assess perceptions of the parent-infant relationship, as well as experiences of psychological distress (perinatal anxiety, depression, and traumatic stress), parenting stress, sociodemographic factors, adverse and benevolent childhood experiences, and other relevant factors</li> <li>Formally assess the feasibility, acceptability and reliability of distance-delivered parent-infant observational measures from participant and researcher perspectives</li> <li>Report on changes in methodology due to COVID-19</li> <li>Report on uptake of and findings associated with the adapted method, including qualitative and quantitative data on caregivers' experiences of the assessment process</li> </ul>
Funding opportunities	Be aware of and apply for specific funding opportunities targeting research during the pandemic, or supplementary funds that might be available to support adaptations of funded studies

footage should be promptly downloaded onto a secure, password-protected server and reviewed for risk and recording quality.

Data collection and analysis should distinguish between assessments carried out pre-, during, and post-pandemic, documenting notable periods of change (e.g., mandatory lockdowns, school closures, spikes in

case numbers, and deaths) to facilitate comparison of findings across methodologies and time. Researchers should also report on any changes in uptake rates, and collect qualitative and quantitative data to assess the feasibility, acceptability, and reliability of distance-delivered observational parent–infant assessments, from both caregivers' and researchers' perspectives.

Researchers should consider likely implications of the pandemic on existing studies, as well as how to interpret novel or unexpected findings. Future research might usefully combine observational paradigms with self-report measures to assess perceptions of the parent-infant relationship, as well as other relevant constructs, such as psychological distress (e.g., perinatal anxiety, depression, traumatic stress), parenting stress and confidence, sociodemographic factors, and adbenevolent childhood verse experiences. Researchers should also examine potential differences in outcomes across different groups, including parents with a history of psychological disorder or trauma, those with low social support, and those from minority, marginalized, or geographically remote communities. In future, we will analyze maternal and infant patterns of interaction and relational risk, as well as other medical, psychological and social data collected, to understand the effects of the pandemic on parentinfant bonding, comparing outcomes for infants with heart disease with those for healthy, typically developing infants. Finally, it is recommended that researchers apply for COVID-19 specific funding opportunities through funding agencies, institutions, governments and philanthropic organizations, especially those relevant to mental health, pediatric psychology, and the behavioral sciences.

General recommendations for conducting clinical research with pediatric and other populations during the COVID-19 pandemic have been described comprehensively elsewhere (Gruber et al., 2020; Saberi, 2020; Stiles-Shields et al., 2020), and may also be of assistance to researchers.

Clinically, it is recommended that researchers utilize existing referral pathways for parent-infant dyads who are experiencing relational difficulties to ensure timely and appropriate referral to perinatal mental health services, social services, or domestic violence organizations, with targeted provision of support for vulnerable families, as indicated. Clinical care recommendations have been made to promote maternal mental health, infant attachment, and parent-infant bonding during the COVID-19 pandemic, using trauma-informed approaches (Choi et al., 2020; Tscherning et al., 2020; Wilke et al., 2020), and for hospitalized infants, patient and family centered care practices (Duff et al., 2020). Digital healthcare solutions have also been effectively leveraged for the provision of psychological services within the community (Reay et al., 2020; Zhou et al., 2020), and to support developing parent-infant relationships within the neonatal intensive care unit (Norris & Al-Muzaffar, 2020). Many studies have also harnessed the benefits of telehealth for parent-child psychotherapeutic intervention, with empirical and preliminary meta-analytic evidence of efficacy; for example, online Parent-Child

Interaction Therapy (Flannery et al., 2020; Gurwitch et al., 2020; James Riegler et al., 2020; Rhodes et al., 2020).

#### **Conclusions**

Although the COVID-19 pandemic has brought unforeseen challenges and widespread adversity, it has also afforded opportunities to leverage available technology to develop family centered strategies for distance-delivered observational infant mental health assessment. Understanding how exposure to adversity influences the developing parent-infant relationship is a priority, especially for medically fragile infants and their caregivers who face distinct challenges and stressors in the context of COVID-19. Our technologyassisted, distance-delivered adaptation of a parent-infant observational measure represents a promising approach to safeguard families during the pandemic, while maintaining momentum of time-sensitive, prospective, longitudinal infant mental health research. Benefits of this adaptation have been widespread, including improved convenience for participating parents and infants, decreased time, cost and resource use, and potentially greater diversity in research samples. This first step provides a foundation from which we hope future studies will grow.

#### Acknowledgment

We extend our sincere gratitude to the parents and infants who generously participate in our research.

#### **Funding**

S.T. is the recipient of a National Health and Medical Research Council (NHMRC) of Australia Postgraduate Scholarship. N.K. is the recipient of a National Heart Foundation of Australia Future Leader Fellowship (101229). This work was also supported by an NHMRC Project Grant (NK, APP1081001).

Conflicts of interest: None declared.

#### References

Ainsworth, M. D. S., & Bell, S. M. (1970). Attachment, exploration, and separation: Illustrated by the behavior of one-year-olds in a strange situation. *Child Development*, 41(1), 49–67.

Aspland, H., & Gardner, F. (2003). Observational measures of parent-child interaction: An introductory review. *Child and Adolescent Mental Health*, 8(3), 136–143. https://doi.org/10.1111/1475-3588.00061

Bartick, M. (2020). COVID-19: Separating infected mothers from newborns: Weighing the risks and benefits. *Trends in Medicine*. https://postgraduateeducation.hms.harvard.edu/trends-medicine/covid-19-separating-infected-

- mothers-newborns-weighing-risks-benefits Retrieved 4 January 2021.
- Beebe, B., & Lachmann, F. M. (2013). Infant research and adult treatment: Co-constructing interactions. Routledge.
- Boekhorst, M. G., Muskens, L., Hulsbosch, L. P., Van Deun, K., Bergink, V., Pop, V., & van den Heuvel, M. I. (2020). The COVID-19 outbreak increases maternal stress during pregnancy, but not the incidence of postpartum depression. *OSF Preprints*. https://osf.io/m9bu3. Retrieved 4 January 2021.
- Campbell, A. M. (2020). An increasing risk of family violence during the COVID-19 pandemic: Strengthening community collaborations to save lives. *Forensic Science International: Reports*, 2, 100089. https://doi.org/10.1016/j.fsir.2020.100089
- Cao, X., Jiang, X., Li, X., Lo, M-c J. H., & Li, R. (2013). Family functioning and its predictors among disaster bereaved individuals in China: Eighteen months after the Wenchuan earthquake. *PLoS One*, 8(4), e60738.https://doi.org/10.1371/journal.pone.0060738
- Choi, K. R., Records, K., Low, L. K., Alhusen, J. L., Kenner, C., Bloch, J. R., Premji, S. S., Hannan, J., Anderson, C. M., Yeo, S., & Cynthia Logsdon, M. (2020). Promotion of maternal–infant mental health and trauma-informed care during the COVID-19 pandemic. *Journal of Obstetric, Gynecologic & Neonatal Nursing*, 49(5), 409–415. https://doi.org/10.1016/j.jogn.2020.07.004
- Chu, K., Schwartz, C., Towner, E., Kasparian, N., & Callaghan, B. (2020). Parenting under pressure: A mixed-methods investigation of the impact of COVID-19 on family life. *PsyArXiv Preprints*, https://psyarxiv.com/zm39b/. Retrieved 4 January 2021.
- Cobham, V. E., McDermott, B., Haslam, D., & Sanders, M. R. (2016). The role of parents, parenting and the family environment in children's post-disaster mental health. *Current Psychiatry Reports*, 18(6), 53.https://doi.org/10.1007/s11920-016-0691-4
- Cooke, J. E., Stuart-Parrigon, K. L., Movahed-Abtahi, M., Koehn, A. J., & Kerns, K. A. (2016). Children's emotion understanding and mother–child attachment: A meta-analysis. *Emotion*, 16(8), 1102–1106. https://doi.org/10.1037/emo0000221
- Crittenden, P. (2005). *Using the CARE-Index for screening, intervention, and research*. http://www.patcrittenden.com/include/docs/care\_index.pdf. Retrieved 4 January 2021.
- Crittenden, P. (2010). *CARE-Index: Infant coding manual*. Family Relations Institute.
- Crittenden, P. M., & DiLalla, D. L. (1988). Compulsive compliance: The development of an inhibitory coping strategy in infancy. *Journal of Abnormal Child Psychology*, 16(5), 585–599. https://doi.org/10.1007/BF00914268
- Davenport, M. H., Meyer, S., Meah, V. L., Strynadka, M. C., & Khurana, R. (2020). Moms are not ok: COVID-19 and maternal mental health. *Front Global Women's Health*, 1, 1–6. https://doi.org/10.3389/fgwh.2020.00001
- Deloitte (2019). *Mobile Consumer Survey: The Australian Cut.* https://www2.deloitte.com/au/mobile-consumer-survey. Retrieved 4 January 2021
- Duff, J., Curnen, K., Reed, A., & Kranz, C. (2020). Engaging parents of hospitalized neonates during a pandemic.

- Journal of Neonatal Nursing, https://doi.org/10.1016/j.jnn.2020.11.013
- Flannery, J. E., Penner-Goeke, L., Xie, E., Prince, D., Callaghan, B., Tomfohr-Madsen, L., & Roos, L. E. (2020). Digital parent training RCT meta-analysis and systematic review. *PsyArXiv Preprints*, https://psyarxiv.com/cpd9b/. Retrieved 4 January 2021.
- Fonagy, P., Steele, M., Steele, H., Moran, G. S., & Higgitt, A. C. (1991). The capacity for understanding mental states: The reflective self in parent and child and its significance for security of attachment. *Infant Mental Health Journal*, 12(3), 201–218. https://doi.org/10.1002/1097-0355(199123)12:3<201::AID-IMHJ2280120307>3.0. CO;2-7
- Fong, V. C., & Iarocci, G. (2020). Child and family outcomes following pandemics: A systematic review and recommendations on COVID-19 policies. *Journal of Pediatric Psychology*, 45(10), 1124–1143. https://doi.org/10.1093/jpepsy/jsaa093
- Green, J., Petty, J., Staff, L., Bromley, P., & Jones, L. (2021). The implications of face masks for babies and families during the COVID-19 pandemic: A discussion paper. *Journal of Neonatal Nursing*, 27(1), 21–25. https://doi.org/10.1016/j.jnn.2020.10.005
- Gruber, J., Prinstein, M. J., Abramowitz, J. S., Albano, A. M., Aldao, A., Borelli, J., Clark, L. A., Davila, J., Forbes, E. E., & Gee, D. (2020). Mental health and clinical psychological science in the time of COVID-19: Challenges, opportunities and a call to action. *PsyArXiv Preprints*, https://psyarxiv.com/desg9/. Retrieved 4 January 2021.
- Günther-Bel, C., Vilaregut, A., Carratala, E., Torras-Garat, S., & Pérez-Testor, C. (2020). A mixed-method study of individual, couple, and parental functioning during the state-regulated COVID-19 lockdown in Spain. *Family Process*, 59(3), 1060–1079. https://doi.org/10.1111/famp.12585
- Gurwitch, R. H., Salem, H., Nelson, M. M., & Comer, J. S. (2020). Leveraging parent–child interaction therapy and telehealth capacities to address the unique needs of young children during the COVID-19 public health crisis. *Psychological Trauma: Theory, Research, Practice, Policy*, 12(S1), S82–S84. https://doi.org/10.1037/tra0000863
- Harville, E., Xiong, X., & Buekens, P. (2010). Disasters and perinatal health: A systematic review. *Obstetrical & Gynecological Survey*, 65(11), 713–728. https://doi.org/10.1097/OGX.0b013e31820eddbe
- Hendriks, A., Van der Giessen, D., Stams, G., & Overbeek, G. (2018). The association between parent-reported and observed parenting: A multi-level meta-analysis. *Psychological Assessment*, 30(5), 621–633. https://doi.org/10.1037/pas0000500
- Hiraoka, D., & Tomoda, A. (2020). The relationship between parenting stress and school closures due to the COVID-19 pandemic. *Psychiatry and Clinical Neurosciences*, 74(9), 497–498. https://doi.org/10.1111/pcn.13088
- Izmailova, E. S., Ellis, R., & Benko, C. (2020). Remote monitoring in clinical trials during the COVID-19 pandemic. *Clinical and Translational Science*, 13(5), 838–841. https://doi.org/10.1111/cts.12834
- James Riegler, L., Raj, S. P., Moscato, E. L., Narad, M. E., Kincaid, A., & Wade, S. L. (2020). Pilot trial of a

- telepsychotherapy parenting skills intervention for veteran families: Implications for managing parenting stress during COVID-19. *Journal of Psychotherapy Integration*, 30(2), 290–303. https://doi.org/10.1037/int0000220
- Junior Bokolo, A. (2020). Use of telemedicine and virtual care for remote treatment in response to COVID-19 pandemic. *Journal of Medical Systems*, 44(7), 1–9. https://doi.org/10.1007/s10916-020-01596-5
- Kasparian, N. A., Winlaw, D. S., & Sholler, G. F. (2016). Congenital heart health": How psychological care can make a difference. *Medical Journal of Australia*, 205(3), 104–107. https://doi.org/10.5694/mja16.00392
- Kelley, M. L., Self-Brown, S., Le, B., Bosson, J. V., Hernandez, B. C., & Gordon, A. T. (2010). Predicting posttraumatic stress symptoms in children following Hurricane Katrina: A prospective analysis of the effect of parental distress and parenting practices. *Journal of Traumatic Stress*, 23(5), 582–590. https://doi.org/10.1002/jts.20573
- Kelly, K., Slade, A., & Grienenberger, J. F. (2005). Maternal reflective functioning, mother–infant affective communication, and infant attachment: Exploring the link between mental states and observed caregiving behavior in the intergenerational transmission of attachment. *Attachment & Human Development*, 7(3), 299–311. https://doi.org/10.1080/14616730500245963
- Lotzin, A., Lu, X., Kriston, L., Schiborr, J., Musal, T., Romer, G., & Ramsauer, B. (2015). Observational tools for measuring parent–infant interaction: A systematic review. *Clinical Child and Family Psychology Review*, 18(2), 99–132. https://doi.org/10.1007/s10567-015-0180-z
- Madigan, S., Atkinson, L., Laurin, K., & Benoit, D. (2013). Attachment and internalizing behavior in early childhood: A meta-analysis. *Developmental Psychology*, 49(4), 672–689. https://doi.org/10.1037/a0028793
- Madigan, S., Bakermans-Kranenburg, M. J., Van Ijzendoorn, M. H., Moran, G., Pederson, D. R., & Benoit, D. (2006). Unresolved states of mind, anomalous parental behavior, and disorganized attachment: A review and meta-analysis of a transmission gap. *Attachment & Human Development*, 8(2), 89–111. https://doi.org/10.1080/14616730600774458
- Madigan, S., Brumariu, L. E., Villani, V., Atkinson, L., & Lyons-Ruth, K. (2016). Representational and questionnaire measures of attachment: A meta-analysis of relations to child internalizing and externalizing problems. *Psychological Bulletin*, 142(4), 367–399. https://doi.org/10.1037/bul0000029
- Marchetti, D., Fontanesi, L., Mazza, C., Di Giandomenico, S., Roma, P., & Verrocchio, M. C. (2020). Parenting-related exhaustion during the Italian COVID-19 lockdown. *Journal of Pediatric Psychology*, 45(10), 1114–1123. https://doi.org/10.1093/jpepsy/jsaa093
- Mayopoulos, G. A., Ein-Dor, T., Dishy, G. A., Nandru, R., Chan, S. J., Hanley, L. E., Kaimal, A. J., & Dekel, S. (2021). COVID-19 is associated with traumatic childbirth and subsequent mother-infant bonding problems. *Journal of Affective Disorders*, 282, 122–125. https://doi.org/10.1016/j.jad.2020.12.101
- McDermott, B. M., & Cobham, V. E. (2012). Family functioning in the aftermath of a natural disaster. BMC

- Psychiatry, 12(1), 1–7. https://doi.org/10.1186/1471-244X-12-55
- McFarlane, A. C. (1987). Family functioning and overprotection following a natural disaster: The longitudinal effects of post-traumatic morbidity. *Australian & New Zealand Journal of Psychiatry*, 21(2), 210–218. https://doi.org/10.3109/00048678709160914
- Murray, P. D., & Swanson, J. R. (2020). Visitation restrictions: Is it right and how do we support families in the NICU during COVID-19? *Journal of Perinatology*, 40(10), 1576–1581. https://doi.org/10.1038/s41372-020-00781-1
- Nicola, M., Alsafi, Z., Sohrabi, C., Kerwan, A., Al-Jabir, A., Iosifidis, C., Agha, M., & Agha, R. (2020). The socioeconomic implications of the coronavirus pandemic (COVID-19): A review. *International Journal of Surgery*, 78, 185–193. https://doi.org/10.34293/commerce.v8i4. 3293
- Norris, C., & Al-Muzaffar, I. (2020). The use of eHealth technologies to support communication with parents in the neonatal unit; an updated literature review for the COVID-19 era. *Journal of Neonatal Nursing*, https://doi.org/10.1016/j.jnn.2020.12.002
- Opperman, C., & van Vuuren, M. J. (2018). WhatsApp in a clinical setting: The good, the bad and the law. *South African Journal of Bioethics and Law*, 11(2), 102–103. https://doi.org/10.7196/SAJBL.2018.v11i2.643
- Oskovi-Kaplan, Z. A., Buyuk, G. N., Ozgu-Erdinc, A. S., Keskin, H. L., Ozbas, A., & Tekin, O. M. (2020). The effect of COVID-19 pandemic and social restrictions on depression rates and maternal attachment in immediate postpartum women: A preliminary study. *Psychiatric Quarterly*, 1–8. https://doi.org/10.1007/s11126-020-09843-1
- Pallini, S., Baiocco, R., Schneider, B. H., Madigan, S., & Atkinson, L. (2014). Early child-parent attachment and peer relations: A meta-analysis of recent research. *Journal of Family Psychology*, 28(1), 118–123. https://doi.org/10.1037/a0035736
- Pallini, S., Chirumbolo, A., Morelli, M., Baiocco, R., Laghi, F., & Eisenberg, N. (2018). The relation of attachment security status to effortful self-regulation: A meta-analysis. *Psychological Bulletin*, 144(5), 501–531. https://doi.org/10.1037/bul0000134
- Pallini, S., Morelli, M., Chirumbolo, A., Baiocco, R., Laghi, F., & Eisenberg, N. (2019). Attachment and attention problems: A meta-analysis. *Clinical Psychology Review*, 74, 101772. https://doi.org/10.1016/j.cpr.2019. 101772
- Perez, A., Panagiotopoulou, E., Curtis, P., & Roberts, R. (2020). Barriers and facilitators to mood and confidence in pregnancy and early parenthood during COVID-19 in the UK: A mixed-methods synthesis survey. *PsyArXiv Preprints*. https://psyarxiv.com/v73fk/. Retrieved 4 January 2021.
- Rajkumar, R. P. (2020). COVID-19 and mental health: A review of the existing literature. *Asian Journal of Psychiatry*, 52, 102066. https://doi.org/10.1016/j.ajp.2020.102066
- Ranson, K. E., & Urichuk, L. (2008). The effect of parentchild attachment relationships on child biopsychosocial outcomes: A review. *Early Child Development and Care*,

- 178(2), 129–152. https://doi.org/10.1080/ 03004430600685282
- Reay, R. E., Looi, J. C., & Keightley, P. (2020). Telehealth mental health services during COVID-19: Summary of evidence and clinical practice. *Australasian Psychiatry*, 28(5), 514–516. https://doi.org/10.1177/1039856220943032
- Remtulla, R. (2020). The present and future applications of technology in adapting medical education amidst the COVID-19 Pandemic. *JMIR Medical Education*, 6(2), e20190. https://doi.org/10.2196/20190
- Rhodes, A., Kheireddine, S., & Smith, A. D. (2020). Experiences, attitudes, and needs of users of a pregnancy and parenting App (Baby Buddy) during the COVID-19 pandemic: Mixed methods study. *JMIR mHealth and Uhealth*, 8(12), e23157. https://doi.org/10.2196/23157
- Russell, B., Hutchison, M., Tambling, R., Tomkunas, A., & Horton, A. (2020). Initial challenges of caregiving during COVID-19: Caregiver burden, mental health, and the parent–child relationship. *Child Psychiatry & Human Development*, 51(5), 671–682. https://doi.org/10.1007/s10578-020-01037-x
- Saberi, P. (2020). Research in the time of coronavirus: Continuing ongoing studies in the midst of the COVID-19 pandemic. *AIDS and Behavior*, 24(8), 2232–2235. https://doi.org/10.1007/s10461-020-02868-4
- Spruit, A., Goos, L., Weenink, N., Rodenburg, R., Niemeyer, H., Stams, G. J., & Colonnesi, C. (2020). The relation between attachment and depression in children and adolescents: A multilevel meta-analysis. *Clinical Child and Family Psychology Review*, 23(1), 54–69. https://doi.org/ 10.1007/s10567-019-00299-9
- Stern, D. N. (2018). The interpersonal world of the infant: A view from psychoanalysis and developmental psychology. Routledge.

- Stiles-Shields, C., Plevinsky, J. M., Psihogios, A. M., & Holmbeck, G. N. (2020). Considerations and future directions for conducting clinical research with pediatric populations during the COVID-19 pandemic. *Journal of Pediatric Psychology*, 45(7), 720–724. https://doi.org/10.1093/jpepsy/jsaa055
- Tronick, E., & Beeghly, M. (2011). Infants' meaning-making and the development of mental health problems. *American Psychologist*, 66(2), 107–119. https://doi.org/10.1037/a0021631
- Tscherning, C., Sizun, J., & Kuhn, P. (2020). Promoting attachment between parents and neonates despite the COVID-19 pandemic. *Acta Paediatrica*, 109(10), 1937–1943. https://doi.org/10.1111/apa.15455
- Valenzuela, J., Crosby, L. E., & Harrison, R. R. (2020). Commentary: Reflections on the COVID-19 pandemic and health disparities in pediatric psychology. *Journal of Pediatric Psychology*, 45(8), 839–841. https://doi.org/10.1093/jpepsy/jsaa063
- Van Ijzendoorn, M. H., Schuengel, C., & Bakermans-Kranenburg, M. J. (1999). Disorganized attachment in early childhood: Meta-analysis of precursors, concomitants, and sequelae. *Development and Psychopathology*, 11(2), 225–250.
- Wilke, N. G., Howard, A. H., & Pop, D. (2020). Data-informed recommendations for services providers working with vulnerable children and families during the COVID-19 pandemic. *Child Abuse & Neglect*, 110, 104642.https://doi.org/10.1016/j.chiabu.2020.104642
- Zhou, X., Snoswell, C. L., Harding, L. E., Bambling, M., Edirippulige, S., Bai, X., & Smith, A. C. (2020). The role of telehealth in reducing the mental health burden from COVID-19. *Telemedicine and e-Health*, 26(4), 377–379. https://doi.org/10.1089/tmj.2020.0068