General

Influence of mothers' stress on their infants' stress level: A preliminary study

Shinnosuke Ikeda[1], Hisashi Mitsuishi[2]

[1] Human and Social Administration Department, Kanazawa University, [2] Faculty of Health and Medical Sciences, Kyoto University of Advanced Science

Keywords: stress, rearing-related stress, COVID-19 stress, mother-child, cortisol

https://doi.org/10.52965/001c.93908

Health Psychology Research

Vol. 12, 2024

Background

In a previous study, mothers' stress was demonstrated to affect the stress of their infants. However, stress is a multi-layered concept, and there is a lack of studies on the type of stress that influences infant stress.

Objective

This study examined how various types of mothers' stress influence their infants' stress by measuring stress that emanates from COVID-19, child rearing, and stress levels based on speech and cortisol in saliva.

Methods

This study was conducted in two phases, and the stress of 21 mother-infant dyad were evaluated using questionnaires, participants' saliva, and voice recording.

Results

The results demonstrated that maternal stress increased infant stress, rearing stress decreased infant stress, and COVID-19 stress did not affect infant stress. Furthermore, there was no relationship between stress measured using questionnaires and stress measured using saliva, indicating that these factors independently affect infant stress.

Conclusion

It is clear that stress is multi-layered and that it is necessary to grasp each of the various stresses and their relationship appropriately.

INTRODUCTION

We live with various stresses daily,[1,2] and children are no exception to this.[3,4] Stress can be experienced in early childhood when young children begin to acquire language and communicate with others[5] and during later stages when children are exposed to more complex social situations at school.[6] Furthermore, it has been reported that children experience stress during infancy, even before they acquire language,[7] leading to a variety of effects on their development.[8] For example, Smith et al. examined the effects of spending time in a neonatal intensive care unit (NICU) during the newborn period on brain development.[9] The NICU is considered a relatively stressful environment,[10] and spending time in such an environment has been demonstrated to adversely affect the development of the frontal and temporal lobes and motor skills. Thus, reducing the experience of stress for infants during infancy is important.

To reduce infants' stress experiences, it is necessary to identify the causes of stress in infants and the types of stress that they experience in their daily lives. It has been reported that infants experience stress when separated from their caregivers, such as when attending daycare centers.[11] Looking at the larger picture, it has been noted that there is a relationship between the stress felt by the mother and the subsequent stress felt by the infant.[12] A study conducted by Waters et al. examined the possibility of stress contagion in 12- to 14-month-old infants and their mothers.[12] In the study, mothers and infants were separated; mothers in one group were asked to perform a stressful task, while mothers in another group were asked to perform a less stressful task. The mothers and infants were then reunited, and the infants' heart rate responses were used to measure their stress levels. The results demonstrated that infants in the group in which the mother experienced stress felt more stressed after the reunion, suggesting that when mothers (or primary caregivers), who are important to the infants, experience stress, their stress is contagious to their infants.

In light of the above, it seems necessary to consider the relationship between the stress experienced by infants and that of the primary caregivers, that is, their mothers, to reduce stress in infants. How can we understand the stress felt by mothers? In previous studies, stress was measured using questionnaires[13] and cortisol in saliva.[14] Using these methods, we can measure the general stress experienced by an individual. Another stress that is more specific to caregivers is child-rearing stress. Rearing-related stress refers to the stress that parents feel when rearing their children, and it has been demonstrated that high rearing-related stress, especially for caregivers rearing infants, can negatively affect children's later development.[15]

Additionally, the recent COVID-19 pandemic has caused high level of stress among caregivers. To date, children are said to be less susceptible to contracting the severe disease,[16] but caregivers may also experience stress from COVID-19 due to worries about their children being infected. A questionnaire developed in a previous study to measure the stress caused by COVID-19,[17] can be used to capture the COVID-19-related stress of caregivers.

Therefore, the first purpose of this study was to examine the influence of caregivers' stress on stress in their infants. In addition to the general stress measured through questionnaires and saliva, rearing-related stress and COVID-19 stress were also examined. By measuring the infant's stress from salivary cortisol, it would be possible to examine how the various stresses of caregivers affect the infant's stress.

The second purpose of this study was to examine the usefulness of voice as an indicator of stress. Saliva is commonly used as a physiological indicator of stress. However, saliva-based stress measurement cannot be done easily at home, as it requires specialized equipment and knowledge. For this reason, there is a need for a method that allows caregivers to measure their own and their infant's stress more easily. In this context, a recent study has revealed that voice can be used to measure an individual's mental health.[18] The system, Sensibility Technology (ST), can identify the speaker's emotions based on various parameters in voice, independent of the linguistic content.[19] Furthermore, Hagiwara et al. have demonstrated that, based on the results of this analysis, a measure of an individual's mental health called "Genkiatsu (vitality in English)" can be calculated, and that there is indeed an association between this vitality and depressive tendencies.[20] If this system could measure stress, it would be a great support for caregivers. However, it is not clear whether this system is compatible with vitality and stress and whether it can measure stress in infants. Therefore, in this study, in addition to measuring salivary stress, vitality was measured using the ST system, and the relationship between these and saliva-measured stress was examined in caregivers and infants.

As mentioned above, this study preliminarily investigated how various stresses of caregivers influence infant stress and whether such parent-infant stress can be captured through voice. Considering that a previous study revealed a relationship between mother-infant stress (Waters et al., 2014), it is expected that the stress of caregivers will influence the stress of infants. Additionally, if vitality, as measured by voice, is an indicator of depression,[20] and as stress and depression have been found to be related,[21] a relationship between vitality and stress is also expected.

MATERIALS AND METHODS

PARTICIPANTS

The participants in this study were recruited from a Japanese population through a recruitment company. The following conditions were set for recruitment: the mother and their child participated together. The child would be 12–24 months old. The child could recite the mother's speech to some extent, and the mother could use an iPhone for voice recording. Additionally, the study's content was explained to the participants in advance, and their consent to participate was obtained. Ultimately, 26 mother-infant dyad participated in the study, but the data of 21 pairs were included in the analysis after excluding those with missing data. The mean age of the mothers was 31.6 years (range = 26–39 years, SD = 4.45), and the mean age of the children was 20.0 months (range = 14–24 months, SD = 3.61).

ETHICAL CONSIDERATION

This study was approved by the Ethical Review Committee of the Kyoto University of Advanced Science (Approval No. 21-501). A written informed consent was obtained from all individual participants included in the study.

MATERIALS

This study was conducted through a recruiting company; the company mailed survey kits to the participants and asked them to complete an online questionnaire. Five items were measured in this study: 1. Saliva-based stress values (mothers and infants), 2. Vitality based on voice (mothers and infants), 3. General stress based on a questionnaire (mothers), 4. Rearing-related stress based on a questionnaire (mothers), and 5. COVID-19 stress based on questionnaires (mothers). First, for the investigation of saliva (1), the SOMA Cube reader was used. Additionally, to measure the source pressure from voice (2), the ST of AGI. Inc. was used. ST was implemented using Surface 2.0 on Windows 8. The collected audio was converted to Waveform Audio File Format files for analysis. The participants were asked to use the voice memo application installed on their iPhones for the voice recordings. The voice data recorded were collected by uploading the participants' recordings to an online storage uploader site.

Additionally, the Psychological Stress Response Scale SRS-18,[22] Rearing Related Stress Scale,[23] and COVID-19 Stress Scales[17] were used to measure stress in mothers (3–5). Of these, the COVID-19 Stress Scale was in English, so the second author translated it into natural Japanese in consultation with a researcher specializing in nursing science and then back-translated it in consultation with native English speakers to confirm the validity of the translation. The Psychological Stress Response Scale is a questionnaire

Table 1. List of utterances by mothers and children

Mother	Child
irohanihoheto	*aaaa*
aiueo kakikukeko	*eeee*
honzitsu wa seiten nari	*uuuu*
mukashimukashi arutokoroni	*zousan ookiina*
totemo genkidesu	*onakasuita*
kinouwa yokunemuremashita	*kyouwa iitenki*
syokuyokuga arimasu	*genki ippai*
kokoroga odayakadesu	*poppoppo hatopoppo*
okorippoidesu	*syabondama tonda*
tsukarete guttarishiteimasu	*saita*
uewomuite arukou	*musunde hiraite*
ganbaruzo	
aaaa	
eeee	
uuuu	
pataka pataka pataka pataka	

Note. These are short sentences in Japanese.

that can measure general stress status rather than focusing only on specific aspects of stress and consists of three factors: depression-anxiety, irritability–anger, and helplessness. Additionally, the Rearing Related Stress Scale is a questionnaire that measures stress related to infant care. It consists of two factors: child-related rearing stress, such as poor sleeping habits and shyness, and mother-related rearing stress, such as wanting to abandon the child and not being compatible with the child. The COVID-19 Stress Scale consists of six factors, including contamination, such as anxiety about being infected by mail and traumatic stress, which is caused by thinking about the virus.

PROCEDURE

This study consisted of two phases. In the first phase, the participants were asked to sign a consent form and answer demographic items by mail and online, respectively. Additionally, the COVID-19 Stress Scale was administered along the questionnaires used to measure stress. This reduced the burden of answering the questions in the second phase as much as possible. In the second phase, the participants were asked to collect saliva (for mothers and infants), record their voices (for mothers and infants), and respond to a psychological stress response scale (for mothers) and a rearing stress scale (for mothers). All the scales for measuring stress, including the COVID-19 Stress Scale, were administered on a Google Form, and the link was given to the participants for online responses. For voice recording, the data were collected by having the children speak the lines specified by the researcher, recording them with an iPhone voice memo application, and uploading them to an uploader. In creating the dialogues, the researcher consulted with the ST developers and created one for children and one for mothers (Table 1).

The dialogue sentences for children were all familiar phrases from nursery rhymes and picture books, which were easy for them to hear and speak. For the children's dialogue sentences, the mothers were asked to speak to them, while the children were asked to recite them. Therefore, the recorded voice data included both the mother's voice and the child's voice, of which only the child's voice was subject to analysis. When it was difficult to record all the dialogue, only the dialogue that was possible was asked to be recorded.

For saliva collection, saliva was collected at rest using an oral fluid collector (OFC) swab manufactured by SOMA Bioscience Ltd., which was inserted into the mouth. The participants placed the stick-shaped OFC swab on the top of their tongues and closed their mouths. When the OFC swab absorbed saliva, an indicator line on the swab stem turned bright blue, at which point the OFC was removed from the participant's mouth. Before the swabs were inserted into the mouth, the participants were instructed to rinse the inside of their mouth with water. They were also asked not to eat, exercise, or consume caffeine for 1 h before the sample collection. Saliva was collected at home from the mother and child 30–60 minutes after they woke up and returned within two days by refrigeration.

The second survey phase was conducted in two slots: June 19–20, 2021, and July 14–15, 2021. Each participant was requested to conduct the first phase at any time prior to the experiment.

CODING

To calculate stress by saliva using SOMA cube reader collection, the OFC swab containing the absorbed saliva was placed into a 3 ml buffer solution for analysis using a Cube Reader (SOMA Bioscience Ltd) at all time points and mixed for 2 min. The saliva/buffer mix samples brought from home were analyzed in the laboratory using an OFC swab. Two drops of the saliva/buffer mix from the OFC swab were added to the sample test window of the cortisol LFD. In this procedure, the liquid runs the length of the test strip via lateral flow, creating control and test lines visible in the test window. The test line intensity was inversely proportional to the cortisol concentration in the sample, providing a quantitative value to the reader. This method of saliva analysis was previously validated using ELISA analysis.[24]

To measure vitality from voice, the voices of mothers and infants were analyzed using ST, which calculates five parameters of the speaker's state of mind: joy, anger, sorrow, calmness, and excitement, based on the acoustic information contained in the recorded voice. By weighting these five values and adding them together, vitality could be calculated.[19] In this study, the vitality of the mother and child was calculated using the mentioned calculation method.

For the three stress-related scales, the mean of the response values for each item was calculated. The COVID-19 Stress Scale was a 5-point scale, with each item ranging from 0 to 4; the stress response scale was a 4-point scale, with each item ranging from 0 to 3; and the rearing stress scale was a 4-point scale, with each item ranging from 1 to 4. To easily compare this study with previous studies that

Table 2. Mean value and standard deviation for each measurement variable

	Mean	SD
Mother stress (cortisol)	4.51	2.31
Child stress (cortisol)	4.57	2.07
Stress response	2.06	2.10
Rearing related stress	3.30	0.89
COVID-19 stress	8.25	3.40
Mother vitality (voice)	0.42	0.08
Child vitality (voice)	0.44	0.08

Note. The unit of stress measured from cortisol was nmol/l. Stress response, rearing-related stress, and COVID-19 stress were measured in mothers only. Stress response ranged from 0–9, rearing stress ranged from 2–8, and COVID-19 stress ranged from 0–24.

used these scales, no transformation was performed, the mean of the responses for each factor was obtained, and the total value was used for analysis as the score of each scale.

RESULTS

The mean and standard deviation of saliva-based stress values, voice-based vitality, and stress values for the three scales are illustrated in Table 2. The purpose of this study was two-fold: to clarify the effect of maternal stress on infant stress and determine whether there was a relationship between saliva-based stress values and speech-based vitality. Before examining the relationship between maternal stress and infant stress, the relationship between saliva-based stress values and speech-based vitality was first examined. Therefore, the correlation coefficients between saliva-based stress values and voice-based vitality were calculated for mothers and infants, respectively ($r = .247$, $p = .280$ for mothers; $r = -.161$, $p = .487$ for infants), and no significant correlation was obtained for either. Therefore, it is suggested that saliva-based stress values and voice-based vitality measure different aspects of mental health.

Next, we examined the effect of maternal stress on stress in the infant. For this purpose, a multiple regression analysis was conducted with the stress value based on the infant's saliva as the dependent variable, the stress value based on the mother's saliva, the vitality based on voice, and the stress value of the three scales as the independent variables. These independent variables were entered together without separating them into multiple steps. The correlation coefficients between the dependent variables are presented in Table 3. The results of the multiple regression analysis are presented in Table 4. Although no correlation was found between the various maternal stresses entered as independent variables, a significant correlation was obtained only between the stress response scale and the rearing stress scale. However, in the multiple regression analysis, the VIFs of these variables were 5.104 and 5.160, respectively. As it is customary for the VIFs to exceed 10, which causes multicollinearity problems, a multiple regression analysis was conducted with these two variables simultaneously in this study. The results demonstrated that scores on the stress response scale and saliva-based stress values had a significant positive effect. Additionally, rearing stress had a significant negative effect. These results indicated that the general stress felt by mothers increased the infant's stress, and the more the mothers felt rearing stress, the lower the infant's stress. Furthermore, COVID-19 stress and vitality did not affect infant stress.

DISCUSSION

This study examined the effects of various types of mothers' stress on stress in their infants. We also used the ST system, which has been used in various fields in recent years, to examine mental health based on voice and examined the relationship between the vitality calculated by this system and the stress measured from saliva.

The results demonstrated no significant correlation between various types of stress and vitality. Vitality is not a direct reflection of stress but rather a concept that captures an aspect of mental health that is different from stress. A study using ST demonstrated that vitality is an indicator of depression.[19] A previous study has also revealed that there is an association between stress and depression,[21] and our study also predicted that there would be an association between vitality and stress, but the prediction was not supported. As shown in our results, stress consists of various independent aspects. Therefore, the type of stress explored in this study may not have been related to vitality. Further studies should be conducted to examine various types of stress to understand mental health from various perspectives.

Furthermore, there was no relationship between the values of maternal stress measured by saliva and the values of general maternal stress measured by questionnaires, and they affected infant stress independently. This suggests two types of stress: one that mothers are aware of (measurable by scales) and one that they are not aware of (measurable by saliva), with each type of stress affecting infants independently. Additionally, while there was a high positive correlation between general stress and rearing stress, they had different effects on infant stress. In other words, general stress increased infant stress, while rearing stress decreased infant stress. It has already been pointed out that maternal stress and infant stress are related, and the stressful behaviors of mothers may have a negative impact on infants' mental health.[12] Previous studies have also reported that rearing stress in mothers raising infants has a negative impact on the mental health of their children later in life.[25] Why did rearing stress reduce infant stress in the current study? In this study, mothers' parenting stress was relatively low ($M = 3.30$ in the range of 2–8), which may be because they were not experiencing a great deal of stress. The mothers who participated in this study generally felt only minor rearing stress, and this rearing stress might have indicated that they were especially committed to rearing their children. Therefore, the minor stress about child-rearing may have made their infants more comfortable and lowered their stress. Certainly, if mothers feel high stress about

Table 3. Correlation coefficient between independent variables

	Mother stress (cortisol)	Stress response	Rearing-related stress	Covid-19 stress	Mother vitality (voice)
Mother stress (cortisol)		.306	.814	.389	.280
Stress response	.235		<.001	.443	.448
Rearing related stress	.055	.875**		.165	.614
COVID-19 stress	-.198	.177	.315		.267
Mother vitality (voice)	.247	.175	.117	-.254	

Note. The bottom of the diagonal line represents the correlation coefficient, and the top represents the p-value. ** p < .01

Table 4. Results of multiple regression analysis

Variables	Standardized coefficient	
Mother stress (cortisol)	.506	**
Stress response	.962	**
Rearing related stress	-.717	*
COVID-19 stress	-.142	
Mother vitality (voice)	-.170	
R^2	.687	**

* p < .05, ** p < .01

child-rearing, it will have a negative impact on their infants' mental health. In the future, it will be necessary to examine the relationship between maternal stress and infant stress in more detail, assuming a nonlinear model.

CONCLUSION

This study examined the effects of various stresses of mothers on the stress of their infants and found that general stress and rearing stress had independent effects. However, some issues are still to be addressed: first, the measurement of mental health based on voice using ST should be further investigated. Although previous studies have found an association between voice-based vitality and depression, the present study did not find an association with stress. However, the present study suggests that various aspects of stress may be independent of each other. In the future, it will be necessary to examine these various aspects of mental health to clarify which specific aspects of vitality are reflected in the concept.

Additionally, although the present study was conducted on infants, it is desirable to examine the possibility of using ST for preschoolers and school-aged children after infancy. Second, related to this point, it is necessary to research the relationship between maternal COVID-19 stress and child stress in preschoolers and school-aged children. Our results also revealed that general maternal stress and other factors affected infant stress, whereas COVID-19 stress did not. However, infants aged 14–24 months, who were included in the present study, have not yet developed communication and motor skills compared to young children, and therefore have relatively less exposure to infected people and the virus, being relatively less likely to be infected with COVID-19. Nevertheless, in early childhood, motor skills are developed, and children can touch various things outside, communicating with others. In other words, mothers of young children may experience more stress regarding COVID-19. Therefore, it is necessary to examine whether COVID-19 stress affects stress in mothers who have children after the infancy period. Third, the sample size of the present study is relatively small, and therefore, we could not examine the effects of socioeconomic status (SES) and age in months. In the future, it will be necessary to examine the relationship between maternal and child stress, including whether the results of this study can be replicated with a larger sample, taking into account the effects of SES and monthly age. It is hoped that understanding the various aspects of mental health will improve so that caregivers can raise their children without excessive stress, and the children can grow up without suffering from stress.

DISCLOSURE STATEMENT

The authors declare that there are no conflicts of interest.

FUNDING DETAILS

This work was supported by the MEXT Promotion of Distinctive Joint Research Center Program under Grant Number JPMXP0619217850.

Submitted: May 31, 2023 EST, Accepted: August 09, 2023 EST

REFERENCES

1. Abidin RR, Wilfong E. Parenting stress and its relationship to child health care. *Children's Health Care*. 1989;18(2):114-116. doi:10.1207/s15326888chc1802_9

2. Bolger N, DeLongis A, Kessler RC, Schilling EA. Effects of daily stress on negative mood. *Journal of Personality and Social Psychology*. 1989;57(5):808-818. doi:10.1037/0022-3514.57.5.808

3. Kearney CA, Drabman RS, Beasley JF. The trials of childhood: The development, reliability, and validity of the daily life stressors scale. *J Child Fam Stud*. 1993;2(4):371-388. doi:10.1007/bf01321232

4. Rodríguez FMM, Trianes Torres MV, Páez JM, Inglés CJ. Prevalence of strategies for coping with daily stress in children. *Psicothema*. 2016;28(4):370-376. doi:10.7334/psicothema2015.10

5. Gunnar MR, Kryzer E, Van Ryzin MJ, Phillips DA. The rise in cortisol in family daycare: Associations with aspects of care quality, child behavior, and child sex. *Child Development*. 2010;81(3):851-869. doi:10.1111/j.1467-8624.2010.01438.x

6. Band EB, Weisz JR. How to feel better when it feels bad: Children's perspectives on coping with everyday stress. *Developmental Psychology*. 1988;24(2):247-253. doi:10.1037/0012-1649.24.2.247

7. Jansen J, Beijers R, Riksen-Walraven M, de Weerth C. Cortisol reactivity in young infants. *Psychoneuroendocrinology*. 2010;35(3):329-338. doi:10.1016/j.psyneuen.2009.07.008

8. Lester BM, Miller RJ, Hawes K, et al. Infant neurobehavioral development. *Seminars in Perinatology*. 2011;35(1):8-19. doi:10.1053/j.semperi.2010.10.003

9. Smith GC, Gutovich J, Smyser C, et al. Neonatal intensive care unit stress is associated with brain development in preterm infants. *Annals of Neurology*. 2011;70(4):541-549. doi:10.1002/ana.22545

10. Walter-Nicolet E, Annequin D, Biran V, Mitanchez D, Tourniaire B. Pain management in newborns: From prevention to treatment. *Pediatric Drugs*. 2010;12(6):353-365. doi:10.2165/11318900-000000000-00000

11. Nystad K, Drugli MB, Lydersen S, Lekhal R, Buøen ES. Toddlers' stress during transition to childcare. *European Early Childhood Education Research Journal*. 2021;29(2):157-182. doi:10.1080/1350293x.2021.1895269

12. Waters SF, West TV, Mendes WB. Stress contagion: Physiological covariation between mothers and infants. *Psychol Sci*. 2014;25(4):934-942. doi:10.1177/0956797613518352

13. Lee EH. Review of the psychometric evidence of the perceived stress scale. *Asian Nursing Research*. 2012;6(4):121-127. doi:10.1016/j.anr.2012.08.004

14. Burke HM, Davis MC, Otte C, Mohr DC. Depression and cortisol responses to psychological stress: A meta-analysis. *Psychoneuroendocrinology*. 2005;30(9):846-856. doi:10.1016/j.psyneuen.2005.02.010

15. Louie AD, Cromer LD, Berry JO. Assessing parenting stress: Review of the use and interpretation of the parental stress scale. *Family Journal*. 2017;25(4):359-367. doi:10.1177/1066480717731347

16. Weisberg SP, Connors TJ, Zhu Y, et al. Distinct antibody responses to SARS-CoV-2 in children and adults across the COVID-19 clinical spectrum. *Nat Immunol*. 2021;22(1):25-31. doi:10.1038/s41590-020-00826-9

17. Taylor S, Landry CA, Paluszek MM, Fergus TA, McKay D, Asmundson GJG. Development and initial validation of the COVID Stress Scales. *Journal of Anxiety Disorders*. 2020;72. doi:10.1016/j.janxdis.2020.102232

18. Tokuno S. Stress evaluation by voice: From prevention to treatment in mental health care. *Econophysics, Sociophysics, and Multidisciplinary Sciences Journal*. 2015;5(1):30-35.

19. Shinohara S, Nakamura M, Omiya Y, et al. Depressive mood assessment method based on emotion level derived from voice: comparison of voice features of individuals with major depressive disorders and healthy controls. *International Journal of Environmental Research and Public Health*. 2021;18(10):5435. doi:10.3390/ijerph18105435

20. Hagiwara N, Omiya Y, Shinohara S, et al. Validity of mind monitoring system as a mental health indicator using voice. *Adv Sci Technol Eng Syst J*. 2017;2(3):338-344. doi:10.25046/aj020343

21. Hammen C. Stress and depression. *Annu Rev Clin Psychol*. 2005;1(1):293-319. doi:10.1146/annurev.clinpsy.1.102803.143938

22. Suzuki S, Shimada Y, Miura M, Katayanagi K, Umano R, Sakano Y. Development of a new Psychological Stress Response Scale (SRS-18) and investigation of the reliability and the validity. *Japanese Journal of Behavioral Medicine*. 1997;4(1):22-29. doi:10.11331/jjbm.4.22

23. Sato T, Sugawara M, Toda M, Shima S, Kitamura T. Rearing related stress and depressive severity. *The Japanese Journal of Psychology*. 1994;64(6):409-416. doi:10.4992/jjpsy.64.409

24. Fisher R, McLellan CP, Sinclair WH. The validity and reliability for a salivary cortisol point of care test. *J Athl Enhancement*. 2015;4(4). doi:10.4172/2324-9080.1000204

25. Hattangadi N, Cost KT, Birken CS, et al. Parenting stress during infancy is a risk factor for mental health problems in 3-year-old children. *BMC Public Health*. 2020;20(1):1-7. doi:10.1186/s12889-020-09861-5