

Regular Article

Unfolding of maternal-infant bonding amidst the COVID-19 pandemic: Social support as a risk and protective factor

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Abstract

Background: Social, familial, and physiological stressors may put maternal-infant bonding at risk. Therefore, it is plausible that the stressful conditions brought on by COVID-19 could influence maternal-infant bonding. This study aimed to elucidate the contribution of COVID-19-related experience to variance in maternal-infant bonding, beyond that of established risk factors and as moderated by social support.

Methods: This longitudinal, multicenter study examined the relationship of demographic and obstetric variables, social support, postpartum depression, as well as COVID-19-related fear, exposure, and subjective difficulty with mother-infant bonding six months following birth. Participants ($N = 246$) were women who delivered during the pandemics' strict lockdown period and were recruited 10 weeks after a liveborn delivery and followed up six months later.

Results: Relationship between fear of COVID-19 and maternal-infant bonding was moderated by social support: Amongst mothers with high levels of social support, fear of COVID-19 negatively predicted bonding.

Discussion: Results indicate that social support, while overall a protective factor for mother-infant bonding, may lose its buffering effect when fear of COVID-19 is high. This relationship was maintained even when early bonding experiences such as forced separation and the risk incurred by postpartum depression were accounted for. Implications for providers are discussed.

Keywords: attachment; COVID-19 pandemic; mother-infant; social support

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Introduction

Maternal-infant bonding is one of the bedrocks of human relationships and an important predictor of child adjustment (Johnson, 2013). This early bond has been systematically shown to be negatively associated with maternal perinatal stress and postpartum depression and positively with social support (Afolabi et al., 2020; Balaji et al., 2007; Crockenberg, 1981; Hopkins et al., 2018; Jacobson & Frye, 1991; Levitt et al., 1986; Yesilcinar et al., 2017; Ziv & Cassidy, 2002), vaginal delivery (Sokol et al., 2014), and with factors promoting bonding such as breastfeeding (Johnson, 2013) and nulliparity (Barclay et al., 1997; Harwood et al., 2007; Lupton, 2000). As a result of COVID-19, changes in surroundings and living conditions may amplify maternal stress (Ostacoli et al., 2020; Werchan et al., 2022). Social distancing regulations were enforced in order to contain the spread of the virus, including distance limitations on mobility as well as

limitations on gathering size, and hospital visitations were restricted. The availability of face-to-face assistance for postpartum mothers and infants was reduced, especially from older loved ones such as parents and grandparents, who were advised to stay home and avoid face-to-face social interactions. Many individuals had been staying at home on unpaid leave or working from home, which may be beneficial if both parents are able to be involved and supportive but may also be detrimental in the cases of a stressful relationship or even domestic violence (Kourti et al., 2023). Therefore, increased stress and reduced social support may have doubly hindered the development of positive maternal-infant bonds.

To control COVID-19 and ensure mothers' and infants' safety, governments and public health organizations advised that facilities should consider a temporary maternal-infant separation in different wards and under medical testing and supervision. If the separation was unwanted, social distancing measures and respiratory hygiene measures between mother and infant were enforced (Bartick, 2020). In Israel, as of March 2020, these changes included regulations limiting one companion per parturient and limitation of medical staff per COVID-19-suspected parturient (Ministry of Health, 2020). These guidelines, especially ones leading to mother-infant separation or distancing, might have

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prevented or impeded bonding behaviors such as breastfeeding, that may have disrupted the development of the early mother–child relationship (Gribble et al., 2020). Health organizations around the world have issued several statements concerning the adverse outcomes of this policy for mother–infant’s relationships (Poon et al., 2020, UNICEF, 2020).

Considering the stressful changes in the conditions of delivery and postpartum period due to the COVID-19 pandemic, it is plausible that these may have an effect on maternal–infant bonding and attachment. Adaptation of infants to a pandemic mostly depends on the impact of illness and stress on their caretakers and the availability of these caretakers to provide infants with sufficient psychosocial needs (Murray, 2010). Indeed, birth under the COVID-19 pandemic has been shown to be disruptive of maternal–infant bonding (Liu et al., 2021; Mayopoulos et al., 2021). The consensus is that social support plays a crucial role in enhancing maternal well-being and serves as a protective factor for both maternal mental health and the bonding between mothers and infants (Hung & Chung, 2001; Ohara et al., 2017). Social support encompasses both instrumental support and emotional support, with expectations often placed on mothers’ own mothers and partners to provide these forms of support (Negron et al., 2013).

Despite these recommendations, little is known about the impact of specific COVID-19-related experiences among postpartum mothers, and possible mitigating factors. This study aimed to investigate the development of maternal–infant bonding in times of the COVID-19 pandemic, and its relation to stressful experience, including maternal exposure to, experience of, and fear of COVID-19. While nulliparity, mode of delivery, and bonding behaviors such as zero separation and breastfeeding have all been suggested as protective, our focus was on potential moderation by social support, which was compromised during the pandemic due to social distancing and lockdown regulations. Israel, characterized by a Jewish majority and a significant Arab minority, exhibited variations in the mental health of pregnant women during the pandemic. Research indicated that Arab pregnant women experienced higher levels of anxiety and distress in comparison to their Jewish counterparts. Consequently, being of Arab descent emerged as a potential risk factor for maternal mental health issues, which could be related to maternal–infant bonding (Taubman–Ben-Ari et al., 2020). We hypothesized that typical and COVID-19-related risk factors, as well as typical protective factors, measured following birth would show negative and positive relationships, accordingly, to subsequent bonding. Moreover, we hypothesized that the relationship of COVID-19-related risk factors to bonding would be moderated by the protective effects of social support, so that higher social support would attenuate the negative relationship between COVID-19-related risk factors and bonding.

Methods

Participants and procedure

This was a longitudinal, multicenter study that was conducted at three university-affiliated medical centers in Israel: Hillel Yaffe Medical center (HYMC), Meir Medical Center (MMC) and Wolfson Medical Center (WMC). The study was conducted between March 10 and December 8 2020. The initial assessment, referred to as “Time 1” (T1), occurred approximately 10 weeks after childbirth, coinciding with the first lockdown period in Israel, and “Time 2” (T2) was conducted 6 months after childbirth and following the conclusion of the second lockdown period in Israel. The T1 survey included all detailed questionnaires listed, while the

Table 1. Sample demographics and study variables

	<i>M</i>	<i>SD</i>
MPAS total	83.602	7.626
Age	32.146	4.795
Social Support	5.959	1.196
COVID-19 event exposure	3.640	1.801
Fear of COVID-19	17.11	5.265
EPDS	6.250*	5.460
		%
In a relationship	Married/Domestic partnership	95.2
	Single	2.6
	Divorced	2.2
Education	Primary	1.1
	Secondary	33
	BA	41.8
	MA	21.6
	PhD and above	2.6
Salary at home	Far below average	15
	Below average	27.5
	Average	26.7
	Above average	26.4
	Far above average	4.4
Ethnicity	Jewish	76.2
	Arab	23.8
Zero-separation plan	As planned	70
	Zero separation not planned but occurred	12.1
	No zero separation, despite plan	17.9
Breastfeeding in the first month	Yes-1	79.5
	No-2	16.8
	N/A	3.7

Note: COVID-19 = coronavirus disease 19; EPDS = Edinburgh Postpartum Depression Scale. *12.4% of the women scored ≥ 13 , considered a likely depression diagnosis.

T2 survey included all questionnaires except for the demographic questionnaire.

Overall, 1,462 women delivered during the duration of the study at the three participating medical centers. During T1, 1,079 (74%) were contacted by phone. In total, 774 (53%) consented to answering the online questionnaires, and 429 (29%) answered over 70% of the questionnaires and were later re-approached in T2. Of them, 377 (87.9%) gave their consent, and 246 completed at least 70% of the T2 questionnaires and thus entered the analysis. Demographic and clinical information regarding the final sample can be found in Table 1.

It is important to note that, during T1, lockdown regulations included considerable restrictions on freedom of movement, and shutdown of all non-essential services including medical services. COVID-19 regulations during childbirth included limiting one companion per mother, extensive protective equipment for all medical staff assisting the delivery, limitation of medical staff per COVID-19-suspected mother, facial mask-wearing by mothers

during all physical contact with the infant, and consideration of an enforced zero-separation policy for infants and mothers, meaning that mothers and infants are advised to stay together at all times (Ministry of Health, 2020). From the beginning of May 2020 and after T1, the pandemic decreased, the lockdown was released, and schools reopened. For many people, life was “back to normal.” However, gradually the pandemic escalated until the second lockdown was initiated on September 18, 2020, for a period of three weeks. This lockdown was less strict, allowing considerable freedom of movement and with many services remaining open. The Institutional Review Board of each center approved the study (HYMC-20-0079, MMC-0169-20, WMC-143-20). Participants were recruited virtually, by a team of Hebrew and Arabic speaking physicians and medical students. Mothers who were under the age of 18 or who delivered earlier than 34 gestational weeks were excluded from the study. Informed consent was obtained both telephonically and electronically before data were collected from the participants. After consent, a text message was sent to each participant, containing a link to an online questionnaire in Hebrew or Arabic, according to the participant’s preference.

Measures

Demographic questionnaire

The demographic questionnaire included items such as age, gender, ethnicity, marital status, socioeconomic status, and level of education. Questions about zero-separation policy were added to this questionnaire as mothers were asked whether they experienced zero separation at the hospital following birth (meaning they stay together at all times) and whether they had planned for zero-separation pre-birth. The variable was coded ordinally according to hypotheses so that arrangements as planned was coded as having the highest value and zero separation despite planned separation was coded as the second-lowest value, with separation despite plans not to separate as the lowest value. Separation plans were changed in accordance with specific medical center COVID-19 policies. Moreover, obstetric and pregnancy history, course of labor and course of delivery data were all retrieved from the computerized perinatal databases of each medical center.

COVID-19 exposure

This 14-item questionnaire was compiled by authors (see in Supplement 1) in order to detect exposures to COVID-19-related life events, for example “I was in contact with someone who was infected by the Coronavirus.” Each participant was asked to indicate whether or not she experienced such an event. The number of events was then summed up (score 0–14).

Fear of COVID-19 scale (FVC-19S) (Ahorsu et al., 2022)

The FVC-19S is a self-report validated scale for the assessment of fear of COVID-19. To note, this questionnaire was also validated for the Hebrew language (Tzur Bitan et al., 2020). The scale consists of seven items regarding the fear response to COVID-19, for example: “I am afraid of losing my life because of the coronavirus.” Participants are requested to rate on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), with a total score of 7–35, a higher total score indicating greater fear of COVID-19. The questionnaire has a good internal validity (alpha Cronbach 0.82) and in the current study the scale showed an internal consistency of 0.84.

Edinburgh postnatal depression scale (EPDS) (Murray & Cox, 1990)

Postpartum depression symptoms were evaluated using the validated EPDS questionnaire. This questionnaire is composed of 10 items, scored by using a four-point Likert scale (0–3). In our sample, the internal consistency was found to be 0.87, in line with previous findings (Murray & Cox, 1990).

Multidimensional scale of perceived social support (MSPSS) (Zimet et al., 1998)

The 12-item MSPSS is a self-report scale for the assessment of subjective social support. The three subscales include support by family, friends, and significant others, and each subscale is represented by 4 items, for example: “There is a special person who is around when I am in need.” Participants are requested to respond using a seven-point Likert scale ranging from 1 (very strongly disagree) to 7 (very strongly agree), a higher total score indicating greater subjective social support. The questionnaire has good validity (alpha Cronbach 0.88) and in the current study the scale showed an internal consistency of 0.92.

Maternal postnatal attachment scale (MPAS) (Condon & Corkindale, 1998)

The 19-item MPAS is a self-report scale for the assessment of mother-infant bonding, which was found to be among the most robust measures for postnatal maternal-infant bonding assessment (Witkowski et al., 2020). The MPAS includes items such as “Over the last two weeks I would describe my feelings for the baby as 1 (dislike) to 5 (intense affection)” ; “When I am caring for the baby, I get feelings of annoyance or irritation,” scored 1 (very frequently) to 5 (never); and “When I have to leave the baby I usually feel rather 1 (relieved) to 5 (sad).” All responses are recoded to represent a score of 1 (low bonding) to 5 (high bonding), a lower total score indicating a more problematic mother-infant bond. In the current sample alpha Cronbach was .788, similar to initial validation where it was .78.

Statistical analyses

Missing data patterns were analyzed using Little’s completely at random test for all variables used, and assumption of randomness was not disrupted. Sufficient complete data was obtained at both timepoints for reliable analysis of completer only data, as randomness precludes bias when using this strategy. Reported data in the current manuscript therefore includes original sample, for increased face validity and brevity, however when multiple imputations were employed this did not change results (for detailed account see Supplement 2).

Hierarchical regression analyses were conducted with demographics (household income, ethnicity, age, level of education and relationship status) included in the first step, factors typically associated with bonding and attachment (breastfeeding in the first days following delivery, parity, and mode of delivery as recorded in the hospital, zero -separation status at hospital as reported by mothers, MPSS score of social support) were included in the second step, and COVID-related factors (FVC-19S and instances of exposure to COVID-related stressors) were entered in the third step. In the fourth and final step, two-way interaction variables created from multiplication of fear of COVID, and impact of COVID, by social support, were entered, to test for possible moderation effects. Tests of multicollinearity using the most stringent threshold ($VIF < 3$) did not reveal social support to be redundant with any of the variables measured at T1. Dependent

variables were overall MPAS scores During T2, 6 months after childbirth. In order to interpret interactions found to be significant, Hayes PROCESS1 package was employed to conduct Johnson-Neyman regions of significance analyses. Additionally, a median split of the moderator was employed, with group-mean centralized independent variables used to explore simple slopes for the relationship between the moderated dependent variable and the independent variable within the two split groups.

Results

All stepwise models significantly predicted later MPAS scores (see Table 2). Each step added significantly to the variance explained in subsequent MPAS scores, apart from the third step (COVID-19 related variables; see Table 3).

When more closely examining individual coefficients within the steps, several independent variables evinced differing patterns in their relationships with the dependent variables (for full statistical account see Table 4): Within the demographic variables, with all other variables held constant, higher education was associated with lower overall score on the MPAS. No other variables predicted MPAS scores.

Of the psychosocial independent variables, only zero separation, EPDS and MSPSS showed the expected association with MPAS scores when demographics and COVID-related variables were held constant (see steps 2 and 3, Table 4). Breastfeeding and parity were not significantly associated with MPAS within this model.

Of the COVID-related independent variables, mere exposure to COVID-related events was not associated with MPAS scores when other variables were held constant. FVC-19S was not significantly associated with the MPAS in the third step, but positively and significantly predicted MPAS in the fourth step, where moderation by social support was accounted for. Furthermore, it was found that none of the mothers had contracted COVID-19 in T1, and only five of the participants had contracted COVID-19 by T2. Infected mothers' exclusion did not change the results and these women were included in analyses.

As moderation effect (MPAS interaction with Fear of COVID-19) was significant, a regions of significance analyses was conducted. This identified that the FVC-19S value at which the change in slope occurs is 5.9125, with 33.490% of the observed measurements falling below this threshold and 66.509% falling above it. Additionally, the relationship of FVC-19S with MPAS was examined in two groups: below-median and above-median MSPSS. Simple slopes for the relationships revealed that, for the group with below-median MSPSS scores (low support, $N=79$), there was no significant relationship between FVC-19S at T1 and MPAS at T2 ($r=.098$, $p=.303$). However, for the group with above-median MSPSS scores (high support, $N=61$), FVC-19S at T1 evinced a significant negative relationship with MPAS score at T2 ($r=-.331$, $p=.000$), accounting for the effect in the fourth step (see Fig. 1 for relationship plot).

In order to verify reliability of results, all analyses were repeated with T1 MPAS as dependent variable. The results were replicated (see Supplement 3).

Discussion

This study aimed to explore how demographic factors, psychosocial elements, and experiences related to COVID-19 are linked to maternal-infant bonding. Additionally, our goal was to assess the role of social support as a protective factor mitigating the potentially adverse effects of COVID-19 on subsequent

Table 2. Omnibus test for the regression model

Model	df	MPAS total	
		<i>F</i>	<i>p</i>
1	5,197	3.330	.007**
2	10,192	12.188	.000**
3	12,190	10.060	.000**
4	13,189	10.122	.000**

Note: COVID-19 = coronavirus disease 19; MPAS = Maternal postnatal attachment scale; MSPSS = Multidimensional Scale of Perceived Social Support. **Correlation is significant at the 0.01 level (2-tailed). *Correlation is significant at the 0.05 level (2-tailed).

Table 3. Stepwise change statistics for the regression

Model	df	R^2	R^2 Change	<i>F</i> Change	<i>p</i> change
1	5,197	.078	.078	3.300	.007**
2	5,192	.388	.310	19.484	.000**
3	2,190	.389	.000	.034	.967
4	1,189	.410	.022	7.033	.009**

Note: **Correlation is significant at the 0.01 level (2-tailed). *Correlation is significant at the 0.05 level (2-tailed).

maternal-infant bonding. Our hypotheses posited that both conventional risk factors, including those associated with COVID-19, and standard protective factors measured post-birth would exhibit negative and positive correlations, respectively, with subsequent maternal-infant bonding. Additionally, we postulated that mothers with social support would experience a safeguarding effect on maternal-infant bonding, mitigating the impact of risk factors specific to COVID-19.

Regarding common risk and protective factors, and in line with the literature, a higher maternal educational level was found to be related to a less positive maternal-infant bonding (Figueiredo et al., 2014), and there was no difference in overall mother-infant attachment between Jewish and Arab mothers (Zreik et al., 2017). Also consistent with the literature, perceived maternal social support was related to higher maternal-infant bonding (Johnson, 2013) and postpartum depression symptoms was related to reduced maternal-infant bonding (Lehnig et al., 2019). Breastfeeding was not found to be associated with maternal-infant bonding, which adds to the mixed findings regarding this relationship (Britton et al., 2006; Else-Quest, 2003) as was the case for parity (Lehnig et al., 2019).

COVID-19 and maternal-infant bonding

Just as COVID-19 changed many aspects of mothers' birth plan (Gildner & Thayer, 2020) it was found, as expected, that the changes in zero-separation plans predicted reduced mother-infant bonding, especially if separation was unwillingly enforced. This is aligned with the literature, in which birth plan changes during COVID-19 had a negative effect on maternal mental health (Liu et al., 2022).

We found that the mere exposure to COVID-19-related events was not significantly related to maternal-infant bonding. This is aligned with previous studies in which exposure to traumatic life events such as war or natural disasters, was not related to maternal-fetal bonding (Punamäki et al., 2017) or infant temperament (Tees et al., 2010).

Table 4. Stepwise coefficient statistics for the regression model

Model		β	t	p
1	(Constant)		16.788	0.000
	age	0.001	0.012	0.991
	ethnicity	0.079	1.138	0.257
	In current cohabitating relationship	0.031	0.415	0.679
	Education	−0.237	−3.203	0.002**
	Salary	−0.067	−0.897	0.371
	(Constant)		16.484	0.000
	age	−0.023	−0.345	0.730
	ethnicity	0.057	0.979	0.329
	In current cohabitating relationship	−0.067	−1.084	0.280
	Education	−0.189	−3.034	0.003**
2	Salary	−0.079	−1.275	0.204
	Nulliparity	0.024	0.387	0.699
	Breastfeeding	−0.100	−1.682	0.094
	Social support (MSPSS)	0.151	2.444	0.015*
	Zero separation	0.140	2.436	0.016*
	Postpartum depressive symptoms (EPDS)	−0.455	−7.466	0.000**
3	(Constant)		15.856	0.000
	age	−0.022	−0.335	0.738
	ethnicity	0.056	0.971	0.330
	In current cohabitating relationship	−0.067	−1.076	0.283
	Education	−0.189	−3.016	0.003**
	Salary	−0.077	−1.221	0.223
	Nulliparity	0.021	0.335	0.738
	Breastfeeding	−0.098	−1.622	0.106
	Social support (MSPSS)	0.151	2.365	0.019*
	Zero separation	0.141	2.397	0.018*
	Postpartum depressive symptoms (EPDS)	−0.455	−6.784	0.000**
	Exposure to COVID-19 related events	−0.013	−0.221	0.825
	Fear of COVID-19 (FCV-19s)	0.008	0.126	0.900
4	(Constant)		9.087	0.000
	age	−0.016	−0.250	0.803
	ethnicity	0.0456	0.971	0.333
	In current cohabitating relationship	−0.027	−0.436	0.663
	Education	−0.193	−3.127	0.002**
	Salary	−0.065	−1.042	0.299
	Nulliparity	0.027	0.437	0.662
	Breastfeeding	−0.108	−1.814	0.071
	Social support (MSPSS)	0.527	3.397	0.001**
	Zero separation	0.146	2.519	0.013*
	Postpartum depressive symptoms (EPDS)	−0.449	−6.795	0.000**
	Exposure to COVID-19 related events	−0.015	−0.255	0.799
	Fear of COVID-19 (FCV-19s)	0.602	2.590	0.010*
	MSPSS* FCV-19s	−0.750	−2.652	0.009**

Note: COVID-19 = Coronavirus Disease 19. **Correlation is significant at the 0.01 level (2-tailed). *Correlation is significant at the 0.05 level (2-tailed).

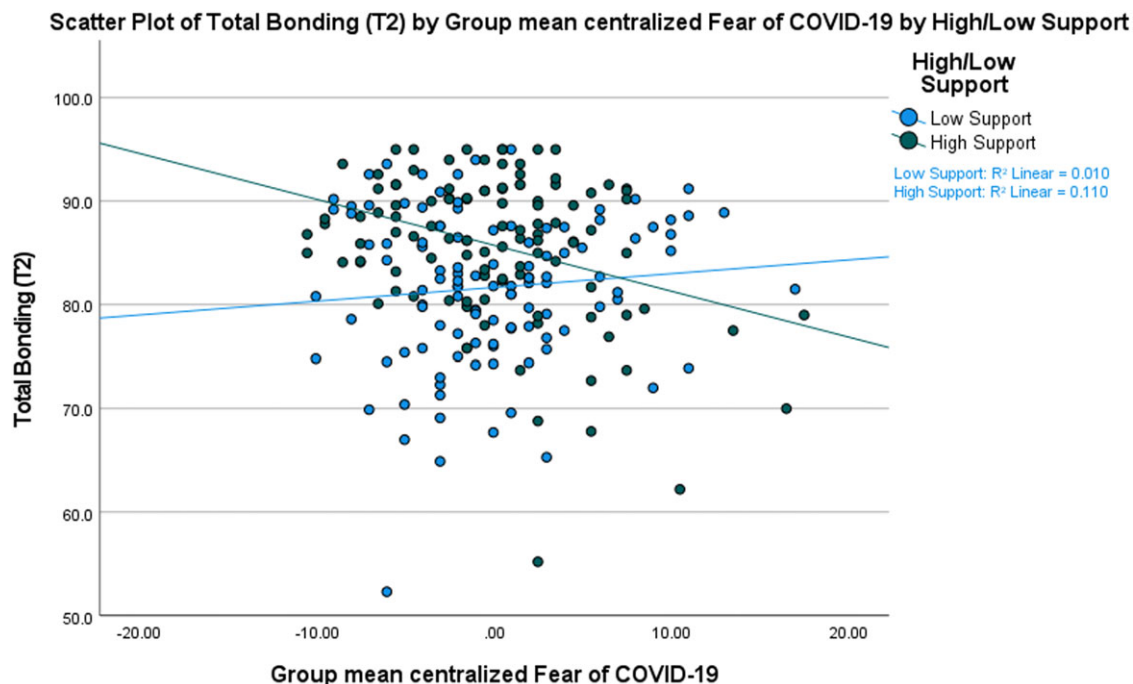


Figure 1. Relationship between fear of COVID-19 and bonding by level of support.

*Note: COVID = coronavirus disease; high/Low support groups determined by scoring above or below median on the social support scale. T2 = Time 2 (approximately six months later than measures of dependent and moderating variables).

The fear of COVID-19, in isolation, was not identified as a factor linked to maternal-infant bonding. However, when considering the interaction with social support, this interplay was found to be statistically significant and only partially fit our hypothesis; Mothers with higher levels of social support exhibited lower levels of maternal-infant bonding when experiencing heightened fear of COVID-19. One plausible explanation for this correlation is that social support may be associated with anxiety, as individuals with anxiety often seek increased social support as a coping mechanism. Consequently, it is conceivable that mothers reporting high social support may also be more prone to anxiety, and the interaction between heightened anxiety and fear of COVID-19 could better explain these findings than the direct influence of social support alone. It's also important to consider that, although social support has generally been identified as a protective factor for maternal-infant bonding in prior studies, the dynamics change during a global pandemic. In a situation where, human interaction serves as the primary vector of infection, socializing becomes a potential health risk and, consequently, a potential stressor. While not all items of the scale used to assess social support require physical contact, some allude to it. In alignment with this, our study revealed that social support might function as a risk factor for maternal-infant bonding, particularly for mothers who harbored fears of COVID-19 infection. The pandemic introduces a unique social context, necessitating a nuanced examination of the relationship between maternal-infant bonding and social support, considering the novel factors brought about by the global health crisis.

The analyses showed that the relationship between bonding, support and fear was already apparent in T1, which is unsurprising considering the high stability of maternal-infant bonding (Capelli et al., 2023), and suggests that these relationships are established early in the mother-infant relationship, exerting a lasting impact, and possibly mediating later bonding. Consequently, the results

underscore the significance of early intervention, as the identified patterns suggest that addressing these factors early in the mother-infant relationship can be particularly crucial.

Limitations and implications

The current study benefits from being a longitudinal study, which allows results to reflect the pandemic's long-lasting effect. This was also a multicenter study, which allowed a diverse population in terms of ethnicity, religion and socioeconomic status. Some of the maternal reports on demographics, obstetric and delivery data were cross-validated against their medical records, therefore this data can be considered as more accurate. Nevertheless, our study is not free of limitations. Most of the data was collected by self-report, therefore social desirability must be considered as a limitation of this study. Moreover, a substantial number of women did not answer the phone call for recruitment, creating a self-selection recruitment bias. We can assume that mothers who chose to participate in this study had the time and mental capacity to do so, while those who chose not to participate may have been suffering from possible socioeconomic or other difficulties. This is in line with the literature, as approaching postpartum mothers often results in low participation, especially in high-risk populations (Beasley et al., 2020; Lawton et al., 2016). Due to our active recruitment process, this presents a smaller bias than studies recruiting through social media (Berthelot et al., 2020; Lebel et al., 2020) and yet the current sample cannot be considered as a representative sample due to response bias. Finally, while the experience of contracting COVID-19 was included in the events reported by participants, it was a rare occurrence. To our knowledge, none had contracted the virus by T1, and between T1 and T2, only five women had contracted the virus. These women did not pose outliers, and their removal from the sample did not change the results of the analyses. Nevertheless, due to the

limited number of cases, specific conclusions regarding the impact of COVID-19 infection on the tested model cannot be confidently drawn.

The current study's results present important information concerning maternal-infant bonding during a global pandemic. The prevention of planned zero-separation was identified as a negative predictor of maternal-infant bonding. This implies that the epidemiological advantages of such a policy should be carefully balanced against the potential risks of disrupted bonding (Kim et al., 2011; Ranson & Urichuk, 2008). However, it's crucial to note that the operationalization of the zero-separation variable in our study limited a comprehensive assessment of whether, for certain mothers, the absence of zero separation – whether it deviated from the initial plan or not – had varying effects.

These findings are valuable for both healthcare professionals and policy makers, as well as mothers' families and loved ones. Particular attention should be directed at addressing the specific maternal stressor experienced by mothers, and providing adequate support accordingly, as per the mother's needs and preferences. Thus, even though social support has been shown to be a positive factor for maternal-infant bonding, human interaction during such times makes this association more complex. In light of these results, healthcare professionals should still encourage social support for mothers in the postpartum period, engage in the best practices for mitigating potential postpartum depression, but also provide public health psychoeducation in order to try and minimize the fear of the pandemic's impact of support for fearful mothers by examining non-anxiety provoking manner of support. Furthermore, if fear of social engagement is apparent, healthcare professionals and mothers' loved ones should consider providing suitable maternal support through means of lesser physical contact, such as telephone or online connection. Finally, women with heightened fear of infection may face an increased risk of disruptions in bonding with their infants, necessitating closer follow-up and support. Considering that fear of infection is a potential component of additional peripartum mental disturbances like postpartum anxiety and OCD (Brockington et al., 2006; Field, 2018), which can further contribute to disrupted bonding (Tietz et al., 2014), it is essential to explore the interaction between such fear and social support in predicting subsequent bonding. This investigation should extend beyond the context of the pandemic to encompass a broader understanding of these dynamics in various peripartum mental health scenarios, particularly for mothers giving birth in times of stress, such as national or community emergencies. Future research endeavors should prioritize a deeper exploration of the characteristics of maternal fear of infection and its specific role in mediating or moderating the relationship between social support and bonding. Furthermore, there is a need for longitudinal studies that examine changes in maternal-infant bonding over time as the pandemic evolves. This longitudinal perspective can offer a nuanced understanding of the dynamic interplay between maternal well-being, social support, and the evolving circumstances of the pandemic. Additionally, these findings emphasize the need to investigate how other fears that may limit the buffering effects of typical resilience promoting factors: for example, fears regarding safety that may hinder health promoting behaviors and help seeking.

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References

- Afolabi, O., Bunce, L., Lusher, J., & Banbury, S. (2020). Postnatal depression, maternal-infant bonding and social support: A cross-cultural comparison of Nigerian and British mothers. *Journal of Mental Health*, 29(4), 424–430. <https://doi.org/10.1080/09638237.2017.1340595>
- Ahorsu, D. K., Lin, C. Y., Imani, V., Saffari, M., Griffiths, M. D., & Pakpour, A. H. (2022). The fear of COVID-19 scale: Development and initial validation. *International Journal of Mental Health and Addiction*, 20(3), 1537–1545. <https://doi.org/10.1007/S11469-020-00270-8/TABLES/3>
- Balaji, A. B., Claussen, A. H., Smith, D. C., Visser, S. N., Morales, M. J., & Perou, R. (2007). Social support networks and maternal mental health and well-being. *Journal of Women's Health*, 16(10), 1386–1396. <https://doi.org/10.1089/jwh.2007.CDC10>
- Barclay, L., Everitt, L., Rogan, F., Schmied, V., & Wyllie, A. (1997). Becoming a mother - an analysis of women's experience of early motherhood. *Journal of Advanced Nursing*, 25(4), 719–728. <https://doi.org/10.1046/j.1365-2648.1997.t01-1-1997025719.x>
- Bartick, B. M. (2020). *Separating infected mothers from newborns: Weighing the risks and benefits* (pp. 1–6). Harvard Medical School Trends in Medicine.
- Beasley, L. O., Ciciolla, L., Jespersen, J. E., Chiaf, A. L., Schmidt, M., Shreffler, K. M., Breslin, F. J., Bakhireva, L. N., Sanjuan, P. M., Stephen, J. M., Coles, C. D., Chambers, C. D., Kable, J. A., Leeman, L., Singer, L. T., Zellner, J., Morris, A. S., & Croff, J. M. (2020). Best practices for engaging pregnant and postpartum women at risk of substance use in longitudinal research studies: A qualitative examination of participant preferences. *Adversity and Resilience Science*, 1(4), 235–246. <https://doi.org/10.1007/s42844-020-00019-1>
- Berthelot, N., Lemieux, R., Garon-Bissonnette, J., Drouin-Maziade, C., Martel, É., & Maziade, M. (2020). Uptrend in distress and psychiatric symptomatology in pregnant women during the coronavirus disease 2019 pandemic. *Acta Obstetrica et Gynecologica Scandinavica*, 99(7), 848–855. <https://doi.org/10.1111/aogs.13925>
- Britton, J. R., Britton, H. L., Gronwaldt, V. (2006). Breastfeeding, sensitivity, and attachment. *Pediatrics*, 118(5). <https://doi.org/10.1542/peds.2005-2916>
- Brockington, I. F., Macdonald, E., & Wainscott, G. (2006). Anxiety, obsessions and morbid preoccupations in pregnancy and the puerperium. *Archives of Women's Mental Health*, 9(5), 253–263. <https://doi.org/10.1007/S00737-006-0134-Z/METRICS>
- Capelli, E., Anceresi, G., Grumi, S., & Provenzi, L. (2023). Stability of maternal postnatal bonding between 3 and 6 months: Associations with maternal mental health and infant temperament. *Infant Behavior and Development*, 71, 101826. <https://doi.org/10.1016/j.infbeh.2023.101826>
- Condon, J. T., & Corkindale, C. J. (1998). The assessment of parent-to-infant attachment: Development of a self-report questionnaire instrument. *Journal of Reproductive and Infant Psychology*, 16(1), 57–76. <https://doi.org/10.1080/02646839808404558>
- Crockenberg, S. B. (1981). Infant irritability, mother responsiveness, and social support influences on the security of infant-mother attachment. *Child Development*, 52(3), 857–865. <https://doi.org/10.1111/j.1467-8624.1981.tb03124.x>
- Else-Quest, N. M. (2003). Breastfeeding, bonding, and the mother-infant relationship. *Merrill-Palmer Quarterly*, 49(4), 495–517.
- Field, T. (2018). Postnatal anxiety prevalence, predictors and effects on development: A narrative review. *Infant Behavior and Development*, 51, 24–32. <https://doi.org/10.1016/j.infbeh.2018.02.005>
- Figueredo, B., Tendais, I., & Dias, C. C. (2014). Maternal adjustment and maternal attitudes in adolescent and adult pregnant women. *Journal of Pediatric and Adolescent Gynecology*, 27(4), 194–201. <https://doi.org/10.1016/j.jpag.2013.09.014>
- Gildner, T. E., & Thayer, Z. M. (2020). Birth plan alterations among American women in response to COVID-19. *Health Expectations*, 23(4), 969–971. <https://doi.org/10.1111/hex.13077>

- Gribble, K., Marinelli, K. A., Tomori, C., & Gross, M. S. (2020). Implications of the COVID-19 pandemic response for breastfeeding, maternal caregiving capacity and infant mental health. *Journal of Human Lactation*, 36(4), 591–603. <https://doi.org/10.1177/0890334420949514>
- Harwood, K., McLean, N., & Durkin, K. (2007). First-time mothers' expectations of parenthood: What happens when optimistic expectations are not matched by later experiences? *Developmental Psychology*, 43(1), 1–12. <https://doi.org/10.1037/0012-1649.43.1.1>
- Hopkins, J., Miller, J. L., Butler, K., Gibson, L., Hedrick, L., & Boyle, D. A. (2018). The relation between social support, anxiety and distress symptoms and maternal fetal attachment. *Journal of Reproductive and Infant Psychology*, 36(4), 381–392. <https://doi.org/10.1080/02646838.2018.1466385>
- Hung, C. H., & Chung, H. H. (2001). The effects of postpartum stress and social support on postpartum women's health status. *Journal of Advanced Nursing*, 36(5), 676–684. <https://doi.org/10.1046/j.1365-2648.2001.02032.x>
- Jacobson, S. W., & Frye, K. F. (1991). Effect of maternal social support on attachment: Experimental evidence. *Child Development*, 62(3), 572–582. <https://doi.org/10.1111/j.1467-8624.1991.tb01553.x>
- Johnson, K. (2013). Maternal-infant bonding: A review of literature. *International Journal of Childbirth Education*, 28(3), 17–23.
- Kim, P., Feldman, R., Mayes, L. C., Eicher, V., Thompson, N., Leckman, J. F., & Swain, J. E. (2011). Breastfeeding, brain activation to own infant cry, and maternal sensitivity. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, 52(8), 907–915. <https://doi.org/10.1111/j.1469-7610.2011.02406.x>
- Kourti, A., Stavridou, A., Panagouli, E., Psaltopoulou, T., Spiliopoulou, C., Tsolia, M., Sergentanis, T. N., & Tsitsika, A. (2023). Domestic Violence During the COVID-19 Pandemic: A Systematic Review. *Trauma, Violence, and Abuse*, 24(2), 719–745. <https://doi.org/10.1177/15248380211038690>
- Lawton, J., Snowden, C., Morrow, S., Norman, J. E., Denison, F. C., & Hallowell, N. (2016). Recruiting and consenting into a peripartum trial in an emergency setting: A qualitative study of the experiences and views of women and healthcare professionals. *Trials*, 17(1), 1–14. <https://doi.org/10.1186/s13063-016-1323-3>
- Lebel, C., MacKinnon, A., Bagshawe, M., Tomfohr-Madsen, L., & Giesbrecht, G. (2020). Elevated depression and anxiety symptoms among pregnant individuals during the COVID-19 pandemic. *Journal of Affective Disorders*, 277, 5–13. <https://doi.org/10.1016/j.jad.2020.07.126>
- Lehning, F., Nagl, M., Stepan, H., Wagner, B., & Kersting, A. (2019). Associations of postpartum mother-infant bonding with maternal childhood maltreatment and postpartum mental health: A cross-sectional study. *BMC Pregnancy and Childbirth*, 19(1), 1–10. <https://doi.org/10.1186/s12884-019-2426-0>
- Levitt, M. J., Weber, R. A., & Clark, M. C. (1986). Social network relationships as sources of maternal support and well-being. *Developmental Psychology*, 22(3), 310–316. <https://doi.org/10.1037/0012-1649.22.3.310>
- Liu, C. H., Hyun, S., Mittal, L., & Erdei, C. (2022). Psychological risks to mother-infant bonding during the COVID-19 pandemic. *Pediatric Research*, 91(4), 853–861. <https://doi.org/10.1038/s41390-021-01751-9>
- Liu, C. H., Koire, A., Erdei, C., & Mittal, L. (2022). Unexpected changes in birth experiences during the COVID-19 pandemic: Implications for maternal mental health. *Archives of Gynecology and Obstetrics*, 306(3), 687–697. <https://doi.org/10.1007/s00404-021-06310-5>
- Lupton, D. (2000). A love/hate relationship: The ideals and experiences of first-time mothers. *Journal of Sociology*, 36(1), 50–63. <https://doi.org/10.1177/144078330003600104>
- 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>
- Ministry of Health (2020). *Israel ministry of health COVID guidelines*. <https://govextra.gov.il/ministry-of-health/corona/corona-virus-en>
- Murray, C. J. S. (2010). A collaborative approach to meeting the psychosocial needs of children during an influenza pandemic. *Journal for Specialists in Pediatric Nursing*, 15(2), 135–143. <https://doi.org/10.1111/j.1744-6155.2009.00229.x>
- Murray, D., & Cox, J. L. (1990). Screening for depression during pregnancy with the Edinburgh depression scale (EPDS). *Journal of Reproductive and Infant Psychology*, 8(2), 99–107. <https://doi.org/10.1080/02646839008403615>
- Negron, R., Martin, A., Almog, M., Balbierz, A., & Howell, E. A. (2013). Social support during the postpartum period: Mothers' views on needs, expectations, and mobilization of support. *Maternal and Child Health Journal*, 17(4), 616–623. <https://doi.org/10.1007/s10995-012-1037-4>
- Ohara, M., Okada, T., Aleksic, B., Morikawa, M., Kubota, C., Nakamura, Y., Shiino, T., Yamauchi, A., Uno, Y., Murase, S., Goto, S., Kanai, A., Masuda, T., Nakatochi, M., Ando, M., & Ozaki, N. (2017). Social support helps protect against perinatal bonding failure and depression among mothers: A prospective cohort study. *Scientific Reports*, 7(1), 1–8. <https://doi.org/10.1038/s41598-017-08768-3>
- Ostacoli, L., Cosma, S., Bevilacqua, F., Berchialla, P., Bovetti, M., Carosso, A. R., Malandrone, F., Carletto, S., & Benedetto, C. (2020). Psychosocial factors associated with postpartum psychological distress during the Covid-19 pandemic: A cross-sectional study. *BMC Pregnancy and Childbirth*, 20(1), 703. <https://doi.org/10.1186/s12884-020-03399-5>
- Poon, L. C., Yang, H., Kapur, A., Melamed, N., Dao, B., Divakar, H., McIntyre, H. D., Kihara, A. B., Ayres-de-Campos, D., Ferrazzi, E. M., Renzo, G. C. di, & Hod, M. (2020). Global interim guidance on coronavirus disease 2019 (COVID-19) during pregnancy and puerperium from FIGO and allied partners: Information for healthcare professionals. *International Journal of Gynecology and Obstetrics*, 149(3), 273–286. <https://doi.org/10.1002/ijgo.13156>
- Punamäki, R. L., Isosävi, S., Qouta, S. R., Kuittinen, S., & Diab, S. Y. (2017). War trauma and maternal-fetal attachment predicting maternal mental health, infant development, and dyadic interaction in Palestinian families. *Attachment and Human Development*, 19(5), 463–486. <https://doi.org/10.1080/14616734.2017.1330833>
- Ranson, K. E., & Urichuk, L. J. (2008). The effect of parent-child attachment relationships on child biopsychosocial outcomes: A review. *Early Child Development and Care*, 178(2), 129–152. <https://doi.org/10.1080/03004430.600685282>
- Sokol, L. E., Battle, C. L., Howard, M., & Davis, T. (2014). Correlates of impaired mother-infant bonding in a partial hospital program for perinatal women. *Archives of Women's Mental Health*, 17(5), 465–469. <https://doi.org/10.1007/s00737-014-0419-6>
- Taubman-Ben-Ari, O., Chasson, M., Abu Sharkia, S., & Weiss, E. (2020). Distress and anxiety associated with COVID-19 among Jewish and Arab pregnant women in Israel. *Journal of Reproductive and Infant Psychology*, 38(3), 340–348. <https://doi.org/10.1080/02646838.2020.1786037>
- Tees, M. T., Harville, E. W., Xiong, X., Buekens, P., Priddy, J., & Elkind-Hirsch, K. (2010). Hurricane Katrina-related maternal stress, maternal mental health, and early infant temperament. *Maternal and Child Health Journal*, 14(4), 511–518. <https://doi.org/10.1007/s10995-009-0486-x>
- Tietz, A., Zietlow, A. L., & Reck, C. (2014). Maternal bonding in mothers with postpartum anxiety disorder: The crucial role of subclinical depressive symptoms and maternal avoidance behaviour. *Archives of Women's Mental Health*, 17(5), 433–442. <https://doi.org/10.1007/s00737-014-0423-X/TABLES/4>
- Tzur Bitan, D., Grossman-Giron, A., Bloch, Y., Mayer, Y., Shiffman, N., & Mendlovic, S. (2020). Fear of COVID-19 scale: Psychometric characteristics, reliability and validity in the Israeli population. *Psychiatry Research*, 289, 113100. <https://doi.org/10.1016/j.psychres.2020.113100>
- UNICEF (2020). UNICEF UK Baby Friendly Initiative: Statement on infant feeding during the Coronavirus (COVID-19) outbreak. *Published online 2020*. <https://www.unicef.org.uk/babyfriendly/wp-content/uploads/sites/2/2020/04/Unicef-UK-Baby-Friendly-Initiative-statement-on-infant-feeding-during-the-Covid-19-outbreak.pdf>
- Werchan, D. M., Hendrix, C. L., Ablow, J. C., Amstadter, A. B., Austin, A. C., Babineau, V., Anne Bogat, G., Cioffredi, L.-A., Conradt, E., Crowell, S. E., Dumitriu, D., Fifer, W., Firestein, M. R., Gao, W., Gotlib, I. H., Graham, A. M., Gregory, K. D., Gustafsson, H. C., Havens, K. L., Howell, B. R., Humphreys, K. L., King, L. S., Kinser, P. A., Krans, E. E., Lenniger, C., Levendosky, A. A., Lonstein, J. S., Marcus, R., Monk, C., Moyer, S., Muzik, M., Nuttall, A. K., Potter, A. S., Salisbury, A., Shuffrey, L. C., Smith, B. A., Smith, L., Sullivan, E. L., Zhou, J.,

- Thomason, M. E., & Brito, N. H.** (2022). Behavioral coping phenotypes and associated psychosocial outcomes of pregnant and postpartum women during the COVID-19 pandemic. *Scientific Reports*, 12(1209). <https://doi.org/10.1038/s41598-022-05299-4>
- Wittkowski, A., Vatter, S., Muhinyi, A., Garrett, C., & Henderson, M.** (2020). Measuring bonding or attachment in the parent-infant-relationship: A systematic review of parent-report assessment measures, their psychometric properties and clinical utility. *Clinical Psychology Review*, 82, 101906. <https://doi.org/10.1016/j.cpr.2020.101906>
- Yesilcinar, I., Yavan, T., Karasahin, K. E., & Yenen, M. C.** (2017). The identification of the relationship between the perceived social support, fatigue levels and maternal attachment during the postpartum period. *Journal of Maternal-Fetal and Neonatal Medicine*, 30(10), 1213–1220. <https://doi.org/10.1080/14767058.2016.1209649>
- Zimet, G. D., Dahlem, N. W., Zimet, S. G., & Farley, G. K.** (1998). The multidimensional scale of perceived social support. *Journal of Personality Assessment*, 52(1), 30–41.
- Ziv, Y., & Cassidy, J.** (2002). Maternal responsiveness and infant irritability: The contribution of Crockenberg and Smith's, antecedents of mother-infant interaction and infant irritability in the first 3 months of life. *Infant Behavior and Development*, 25(1), 16–20. [https://doi.org/10.1016/S0163-6383\(02\)00100-5](https://doi.org/10.1016/S0163-6383(02)00100-5)
- Zreik, G., Oppenheim, D., & Sagi-Schwartz, A.** (2017). Infant attachment and maternal sensitivity in the Arab Minority in Israel. *Child Development*, 88(4), 1338–1349. <https://doi.org/10.1111/cdev.12692>