



Postnatal mental health during the COVID-19 pandemic: Impact on mothers' postnatal sense of security and on mother-to-infant bonding

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ABSTRACT

Background: The unprecedented COVID-19 pandemic context imposed new living conditions which greatly modified women's experience of the postpartum period and brought significant changes to postnatal care.

Objective: The main objective of this study was to evaluate the impact of the COVID-19 pandemic context on maternal sense of security and on mother-to-child bonding in the postpartum.

Design: This study had a mixed research design. We compared levels of mother-child bonding disturbances and of maternal emotional security amongst two samples of postnatal women recruited before and during the pandemic. Postnatal depression was also evaluated. A qualitative analysis of the participants' comments on the impact of the COVID-19 pandemic was performed with an open-coding approach.

Participants: Two samples of French-speaking mothers in the first six months after their childbirth, recruited before the pandemic (N=874) and during the pandemic (N=721).

Findings: Mother-child bonding disturbances measured with PBQ and levels of emotional security levels evaluated with PPSSI did not differ significantly between the samples. A high prevalence of women at risk of postnatal depression was found in both samples. However, participants' comments on their postnatal experience during the pandemic contrasted with their quantitative data. Fears of contamination, social isolation, and lack of support were the main factors of insecurity. Lack of closeness with relatives and friends, limited presence of the partner in the maternity ward, and early interactions with the newborn with a mask appear to have altered mother-child bonding during this pandemic period.

Conclusions and implications for practice: The findings highlight the importance of considering social and environmental factors and needs when evaluating postnatal mental health and providing postnatal care to new mothers during a health crisis. Health services and professionals should pay particular attention to mothers' mental health and well-being and guarantee continuity of care to avoid parents' isolation in the sensitive postpartum period.

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Introduction

The COVID-19 outbreak led to major changes in living conditions worldwide. Unprecedented measures such as lockdowns, self-isolation, social distancing, closure of non-essential shops, remote working, and online education were implemented in most countries. There is growing empirical evidence now that this specific context adversely affected the general population's mental health (Alzueta et al., 2021; Xiong et al., 2020). Fear of infection (Quadros et al., 2021), uncertainties about financial and eco-

nomic outcomes, social isolation and increased domestic workload appeared to be important factors of emotional distress (Davenport et al., 2020; Xiong et al., 2020). A systematic review on the impact of COVID-19 on mental health in eight different countries reported that the pandemic particularly increased stressors and generated a higher prevalence of depression, anxiety, and post-traumatic stress disorders in the countries studied (Xiong et al., 2020). The impact may have been more significant for women compared to men (Connor et al., 2020). In this context, pregnant and postnatal women were a particularly vulnerable group with an increased risk of psychological distress (Connor et al., 2020; Matvienko-Sikar et al., 2020).

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The postpartum period during a global pandemic

The postpartum period is often considered to be a joyful yet challenging time in a woman's life. The early postpartum is a time of bonding between the mother and the new baby, and of intimacy with the partner and family members (Vogels-Broecke, 2021). Continuity of postnatal care and individualized support for mothers, from midwives and health professionals, are particularly important in this transitional phase of life (Dahlberg and Aune, 2013; Nilsson et al., 2015; Wiklund et al., 2018; Vogels-Broecke et al., 2021).

However, the reorganisation of health services as a result of the COVID-19 pandemic affected perinatal care and women's experiences of birth and postpartum. Access to prenatal and postnatal services and to mental health settings were reduced due to the health crisis in hospitals and to lockdown measures (Thapa et al., 2020; Motrico et al., 2020; Xiong et al., 2020). Working practices in maternity care changed and prioritized online or phone contacts rather than face-to-face management to avoid cross-contamination (Bick et al., 2020; Thapa et al., 2020). The French Health Authority (HAS), along with the main perinatal health associations, highly recommended early postnatal discharge from two days after birth, remote consultations with the midwives and health professionals, social distancing, home isolation for (future) mothers infected by COVID-19, and restrictions on visits by family members at the maternity wards (HAS, 2020). The presence of partners during perinatal appointments and in maternity wards was limited in many places in Europe (Coxon et al., 2020). Family visits during postpartum hospital stays were also prohibited in most countries (Viaux et al., 2020).

During lockdowns, women in the postnatal period have been particularly isolated. The parents have had to cope alone with a new baby and have lacked family and social support (Bick et al., 2020). The fear of being contaminated or of the newborn's contamination at the hospital or during visits at health facilities can constitute an additional stressor for mothers. Preliminary data from a large survey on the postpartum period during the COVID-19 pandemic, carried out in the UK on 1457 women, highlighted changes in infant feeding practices due to the lack of face-to-face breastfeeding support, as well as in birth plans (Vazquez-Vazquez et al., 2020).

A sense of control over birth-related events impacts the experience of motherhood as a whole (Chabbert and Wendland, 2016). If positive expectations about birth are not fulfilled it can negatively affect women's birth experience and, in some cases, lead to a sense of guilt (Vogels-Broecke et al., 2021). Due to the COVID-19 pandemic, expectations and birth plans have often had to be reconsidered. This may have affected women's sense of achievement and made them feel insecure (Rodriguez-Amalgro et al., 2019).

Mothers' postnatal sense of security

Security is an elementary human need and a multidimensional indicator of life quality (Maslow, 1943). The concept of individual security has cognitive and emotional components. A sense of security can be an individual perception of being protected from threats (Bar-Tal and Jacobson, 1998), but can also be an emotional state: feeling safe, confident, and free from doubt and anxiety (Werner-Bierwisch et al., 2018).

In the context of postpartum and parenthood, this construct has only recently been used. Persson et al. (2007, 2009, 2011) investigated factors that could contribute to a positive experience of childbirth and early postpartum for both parents. A sense of security appeared to be a crucial aspect for parents and for their child's well-being. These authors defined it as "a sense of empowerment and self-efficacy, affinity within the family, autonomy and

control and well-being - including finding breastfeeding manageable" (Persson et al., 2007).

In a systematic review, Werner-Bierwisch et al. (2018) described factors that can impact mothers' emotional security, namely: the woman's emotional state, knowledge, and previous experiences of maternity, the physical health of the mother and child, the mother's personal life situation, perinatal health support, maternity care settings and options, partners' active involvement during the pregnancy and postpartum process, support from relatives, a planned follow-up after birth (Persson et al., 2011), preparation for childbirth and parenting, and consistent information provided by healthcare professionals (Wiklund et al., 2018). Midwives and healthcare professionals play a key role in fostering a sense of security for mothers (Werner-Bierwisch et al., 2018).

Lack of security in early postpartum might predispose mothers to higher risk of mental distress, including postnatal anxiety and depression (Persson and Kvist, 2014; Escribano et al., 2020a; Schaming and Wendland, 2021). Anxiety and depression can be markers of insecurity (Persson and Kvist, 2014). A mother's sense of security is greatly dependant on her own and on her child's health status, and can be negatively impacted in case of complications (Escribano et al., 2020a; Persson et al., 2011). Early postnatal discharge can be a factor of insecurity for mothers as they lose the close attention and face-to-face support they had from midwives at the maternity ward (Nilsson et al., 2015), and this is particularly relevant regarding breastfeeding support (Askelsdottir et al., 2013). The discrepancy between reality and expectations about maternity can also generate anxiety and insecurity (Emmanuel et al., 2011). Feelings of insecurity in the early postnatal period may also negatively affect mothers' adaptation to their new parental role and the bonding process with their child (Werner-Bierwisch et al., 2018).

Mother-infant bonding

The first months of the postpartum are a highly sensitive period for the development of the relationship between a mother and her newborn (Moehler et al., 2006). Mother-infant bonding is the most important process in the early interactions between a mother and her baby (Brockington, 2004). It refers to the special emotions and feelings a mother develops towards her infant (Kinsey and Hupcey, 2013) and relates to the affective component of the mother-child relationship (Brockington, 2001, 2006a; Bienfait et al., 2011).

Recent data suggests that early maternal bonding is a sound predictor of bonding at 12 months of age (Rossen et al., 2019) especially during the highly sensitive period between 2 weeks and 4 months after birth with a peak at 6 weeks (Moehler et al., 2006). An early warm and caring maternal attitude fosters positive bonding with the newborn child (Wittkowski et al., 2007), which in turn contributes to the development of parenting skills and of the mother's sensitivity to her infant's needs (Figueiredo et al., 2007). Perinatal professionals can support positive mother-infant bonding by promoting the dyad's physical proximity the mother's positive emotional state in the early postpartum (Kinsey and Hupcey, 2013).

Although most mothers develop a positive and strong connection with their infant, it is estimated that around 7% of women experience difficulties in bonding (Brockington et al., 2006a). These alterations can have long-term adverse consequences on child emotional development, on the mother-infant relationship (Brockington et al., 2001), as well as on family functioning (Kerstin et al., 2016). In rare cases, it can lead to child maltreatment (Brockington et al., 2001).

Mothers' mental health and emotional state can influence the quality of bonding (Reck et al., 2006; Kinsey et al., 2014). A large body of research indicates a strong association between maternal depression and impairment of mother-infant bonding (Reck et al.,

2006; Moehler et al., 2006; Kerstis et al., 2016; Rizzo and Watsford, 2020). Birth-related events and the psychosocial context can have a significant impact on mothers' ability to create a healthy bond with their newborn (Kinsey et al., 2014). Factors such as prenatal maternal anxiety disorders (Nath et al., 2019), complications at birth (Chabbert and Wendland, 2016), lack of social support, adverse life events, maternal stress (Kinsey et al., 2014), and disappointments about motherhood (Rizzo and Watsford, 2020) can hinder positive mother-infant bonding.

These aspects are of particular relevance in the current context of the COVID-19 pandemic. This crisis implied major changes for women in the perinatal period and modified their maternity experience. In the pandemic context, support from midwives and healthcare professionals is even more important for preserving women's psychological well-being and mental health in the early postpartum (Coxon et al., 2020; Matvienko-Sikar, 2020; Viaux et al., 2020).

Although the long-term effects of the pandemic on maternal mental health are not yet known, the first studies have raised serious concerns about mothers' psychological status during the postnatal period. Apart from feelings of loneliness and isolation, higher prevalence of mood disorders such as anxiety and depression were observed among postnatal women (Davenport et al., 2020; Thapa et al., 2020; Vazquez-Vazquez et al., 2020; Zanardo et al., 2020). These studies insist in particular on the necessity of assessing mental health effects of the COVID-19 pandemic among perinatal women (Bick et al., 2020; Davenport et al., 2020; Motrico et al., 2020; Zeng et al., 2021), and in different cultural contexts (Coxon et al., 2020).

To our knowledge, the impact of the COVID-19 pandemic on positive postnatal mental health indicators such as mothers' sense of security and quality of mother-infant bonding has not been evaluated yet. The relationships between these variables have not been studied so far either. These two constructs can be used as indicators of psychological well-being during the postpartum period, and can constitute protective factors, especially against postpartum depression (Persson and Kvist, 2014; Kinsey et al., 2014).

A qualitative study carried out in 2020 in the UK on perinatal distress during the COVID-19 pandemic investigated symptoms and experiences of 424 perinatal women who had been previously diagnosed with anxiety or depression symptoms. It particularly revealed the qualitative nature of perinatal distress, as well as COVID-19 specific factors - such as lack of control, fear for the wellbeing of family, work and finance concerns- which were not detected with the quantitative screening instruments (Jones et al., 2022). To this respect, little is known about qualitative factors which could affect mother-infant bonding and mothers' emotional security in this unprecedented context. Exploring them would also provide a better understanding of women's experience of postpartum during the pandemic.

Objectives

The main objective of this study is to compare mothers' emotional security and quality of mother-infant bonding before and during the COVID-19 pandemic among two samples of French-speaking mothers. Secondly, we also aim to explore the associations between these variables and postnatal depression. A final objective is to identify qualitative factors that had an impact on maternal sense of security and on quality of bonding in this pandemic context.

We expect that mothers assessed during the COVID-19 pandemic will experience lower levels of emotional security and will show higher levels of mother-infant bonding impairment and of postnatal depression symptoms.

Methods

This study had a mixed research method. It comprised a comparative quantitative study, completed by a qualitative component.

Participants and procedure

Women from the general population, aged between 18 and 45, who are mothers of infants aged 0 to 6 months and who are fluent in French language, were recruited. Mothers who had lost their infant at birth or during the postpartum were not included in the sample.

There were two phases of participant recruitment: 1) from January to March 2020, before the COVID-19 outbreak in France and the first general lockdown (Sample 1); 2) from October 2020 to March 2021 during the second lockdown in France (October 30th - December 15th) and during a few weeks after (Sample 2). Mothers were recruited on social media groups, mainly on Facebook support groups for maternity care, motherhood, and pregnancy, as well as via the researchers' networks and via word of mouth. They answered an online questionnaire accessible through a link on Framforms. The time to complete the questionnaire was estimated at 25 minutes.

This research was approved by the University of Paris Research and Ethics Committee (CER-U-Paris, n°2019-90). Data collection and analyses were performed in a way that guaranteed participant anonymity and confidentiality. Each participant was provided with detailed information about the research and its objectives and was requested to give consent before completing the survey. Participants had the possibility to leave their email address at the end of the survey if they had felt any discomfort or distress when filling in the questionnaire, so that researchers could get back to them and refer them to a mental health service if needed. The researchers' contact details were also made available on the form. Each participant was associated with a unique code to facilitate data collection and to prevent participants from answering the questionnaire several times.

Measures

Eligible participants answered a set of self-reported instruments specific to the postpartum.

The participants' socio-demographic and perinatal data were collected using an ad-hoc questionnaire specific to the postnatal period (Wendland, 2012 - COMPLIGRO). This 34 item questionnaire in French was validated by a Research and Ethics committee (CPP Ile de France II, n°2012-26). It is used to collect socio-demographic, obstetrical, and clinical information about women and their infants. We added a specific question on emotional security: "Did you feel secure during the first week after the birth of your baby?" evaluated on a four-point Likert scale (1- Absolutely to 4- Not at all), and another item relating to mother-infant bonding: "Did you experience any difficulties in the early interactions with your baby?". Mothers could answer on a dichotomous mode (Yes/No) and were invited to specify the nature of the difficulties they faced with their newborn in the next question.

Mother-Infant bonding was assessed using the Postpartum Bonding Questionnaire (PBQ) (Brockington et al., 2001, 2006b). The PBQ is a questionnaire used to assess quality of bonding between a mother and her infant and to detect early disturbances in this process. It includes items such as "I feel close to my baby", "My baby irritates me" and "I am afraid of my baby". The French version of the PBQ was validated on a sample of 1227 mothers, comprises 22 items and has satisfactory psychometric properties, including good test-retest reliability (Demanche et al., 2021). Internal consistency across the two data collection times was good (Samples 1 and 2:

$\alpha=0.74$). The items are rated on a five-point Likert scale ranging from always (score 5) to never (score 0). Items on positive feelings are reverse scored. Final scores range from 0 to 110 in the French version of the questionnaire. Higher scores at the PBQ scale indicate more disturbances in mother-infant bonding. The clinical cut-off score was established at 10 by the validation study of the French version. In the original version (Brockington et al., 2001, 2006b), mothers obtaining a score higher than 26 were likely to present a bonding disorder. A score higher than 40 indicated major bonding impairment (rejection or child neglect). For the validated 22-item questionnaire in French, these thresholds would be 22 for mild bonding disorder and 35 for severe alteration.

Mothers' postnatal sense of security was evaluated using the mothers' version of the Parents' Postnatal Sense of Security Instrument (PPSSI) developed and validated in Sweden by Persson et al. (2007, 2009). It assesses maternal emotional security in the first week of the postpartum and consists of 18 statements, on a four-point Likert-scale ranging from 1 (strongly disagree) to 4 (strongly agree). The French version, validated on a sample of 874 French mothers, showed good psychometric properties, including test-retest reliability (Schaming and Wendland, 2021). In this study, internal consistency was similar at both data collection periods (Sample 1: $\alpha=0.85$; Sample 2: $\alpha=0.86$). The mothers' questionnaire has been validated in other cultural contexts (Geçkil et al., 2017; Escribano et al., 2020a). The instrument has four subscales: 1) empowerment - which refers to the empowering and caring attitude of midwives and nurses towards the mother.; 2) general well-being - which has to do with the general feeling of well-being perceived by mothers during the first week of postpartum; 3) affinity within the family - which corresponds to the presence and emotional support received from partner and relatives; 4) breastfeeding - which relates to the feeling that breastfeeding is manageable. Scores range from 18-72. A higher score denotes higher sense of security.

The Edinburgh Postnatal Depression Scale (EPDS) (Cox et al., 1987) is a 10-item screening instrument widely used to measure symptoms of postnatal depression. The participants answered the French validated version of the EPDS (Guedeney and Fermanian, 1998). Items on this scale refer to the severity of symptoms during the prior week. They are rated on a four-point Likert scale ranging from 0 to 3. A higher score means a higher risk for postnatal depression. The French validation study set a clinical cut-off point at 10.5 for postnatal depression (Guedeney and Fermanian, 1998).

In the second recruitment phase, specific questions regarding postnatal experience during the COVID-19 pandemic were added to the research protocol. Participants were asked if the current pandemic context had impacted their sense of security during the first week of the postpartum period and their bonding to their infant. Mothers who had answered positively to these questions were then invited to leave comments for each of them. Finally, they were able to share comments on the survey itself in the last part of the questionnaire.

Data analysis

The quantitative data was analysed using *Jamovi* (1.8.0.0) software. Descriptive analyses were carried out on the socio-demographic and perinatal characteristics of both samples, as well as on the scores of the three questionnaires. Normality was checked using Shapiro-Wilk test. Mean and median scores on the PBQ, PPSSI, and EPDS as well as socio-demographic data were then compared using the Mann-Whitney U test given the non-normality of their distributions, and Chi2 tests were used for categorical data. Effect size was calculated using Cohen's *d*. Statistical significance was set at $p < 0.05$. Spearman's correlation coefficients were used

to examine associations between PBQ, PPSSI and EPDS scores. Correlation coefficients between 0.1 and 0.3 were considered to represent a weak relationship between the variables, 0.3 to 0.5 as moderate, and > 0.5 as strong.

The qualitative responses left by participants (Sample 2) to the specific questions on their postnatal experience during the COVID-19 pandemic were analysed with the *NVivo* (1.4) software using an inductive thematic analysis (Thomas, 2006). An open-coding method (Glaser, 2016) was performed in order to explore and to extract major categories and sub-categories from the participants' comments without a pre-existing structure. The analysis started by a familiarisation reading to identify main concepts. A second reading made it possible to code the items and classify them into sub-themes and then into themes. The final analysis was carried out by two co-researchers and reviewed by another member of the scientific team to ensure greater objectivity.

Results

A total of 2,103 women participated in the study ($n_{S1}=1284$ and $n_{S2}=819$). Participations that did not meet our inclusion criteria or were incomplete (i.e. missing answers to one or more questionnaires) got discarded ($n_{S1}=508$, $n_{S2}=98$). The first sample consisted of 874 mothers and the second of 721 mothers.

Similarities and differences between the samples

Most women came from France (89%) and were married or living with a partner in both samples (respectively 97.8% and 98.5%). Their infant's age ranged from 2 days to 28 weeks and was 14 weeks on average. More than half of them were primiparous (58.6% in Sample 1 and 52.3% in Sample 2). Regarding obstetric data, around 81% of women had a vaginal childbirth. Multiple birth and birth complication rates were also similar in both groups. More than 7% of participants had received a diagnosis of anxiety or depression at the time of the survey and approximately 3% had prescribed medication at both times. Participants' answers to the question on their sense of security during the first postnatal week did not differ between the groups, albeit a slightly higher proportion of women had replied "a little" in the pandemic sample. Before the pandemic, more than 13% of mothers ($n=117$) reported experiencing difficulties in the early interactions with their child. This prevalence did not vary substantially in the second sample (12.1%, $n=87$).

The two samples differed regarding the mothers' mean age, their level of education, and their socio-professional categories and status. Mothers recruited during the pandemic were on average older ($M_{S1}=30.5$, range 18-44; $M_{S2}=31.9$, range 18-45; $d=0.34$). More women in sample 2 occupied managerial jobs (43.1% in Sample 2 versus 25.4%) and had a postgraduate degree (46.7% versus 32%). The analysis also revealed that it was less common for women to be breastfeeding in Sample 2 compared to Sample 1 (50.2% and 60.9%, respectively). A higher rate of women also declared receiving postnatal psychological support in Sample 2 (11.2% versus 7.3% before pandemic). Table 1 provides main socio-demographic and clinical data about the study participants.

Overall, the mothers' obstetrical characteristics and mean age in our first sample were comparable to data of the last French national perinatal survey (INSERM and DRESS, 2017). Nevertheless, the socio-demographic profile of our study population differed slightly from national data in both samples: women were more likely to be primiparous, partnered, university graduates, and with a better socio-economic status than in the general French population.

Table 1
Sociodemographic and perinatal-related characteristics of the study population and comparison of samples.

Characteristics	Pre-pandemic (N=874)		Pandemic (N=721)				
	Min-Max	Mean (SD)	Min-Max	Mean (SD)	U	df	p value
Mother's age	18-44	30	19-45	32 [29;35]	253825	1592	<.001***
Infant's age (weeks)	0-27	13.9 (6.87)	1-28	13.8 (6.87)	309053	1592	0.510
	N	%	N	%	χ^2	df	p value
Primiparity	512	58.6	377	52.3	11.8	7	0.107
Country of residence							
France	777	88.9	646	89.6	1.54	3	0.673
Other European country	53	6.1	46	6.4			
Outside Europe	44	5	29	4.0			
Civil status							
Married or living with a partner	855	97.8	710	98.5	1.68	3	0.641
Divorced or separated	3	0.3	3	0.4			
Single	15	1.7	7	1.0			
Widow	1	0.1	1	0.1			
Socio-professional category							
Office Employee	361	41.3	248	34.4	109	8	<.001
Managerial status	222	25.4	311	43.1			
Unemployed/Not working	110	12.6	45	6.2			
Middle-level occupation	103	11.8	51	7.1			
Craftswoman, shop or business owner	46	5.3	23	3.2			
Student	15	1.7	8	1.1			
Factory employee	9	1.0	6	0.8			
Farmer	8	0.9	2	0.3			
Other	0	0	27	3.7			
Education level							
Postgraduate degree	280	32	337	46.7	38.9	6	<.001***
Undergraduate degree	395	45.2	254	35.2			
A-level or equivalent	117	13.4	75	10.4			
Secondary school and vocational degrees	45	5.1	34	4.7			
Secondary school without diploma	16	1.8	5	0.7			
High school without diploma	16	1.8	13	1.8			
No qualifications	5	0.6	3	0.4			
Delivery							
Normal vaginal	538	61.6	429	59.5	1.21	3	0.750
Induced vaginal	168	19.2	154	21.4			
C-section unplanned	109	12.5	88	12.2			
C-section planned	59	6.8	50	6.9			
With complication	279	31.9	213	29.5	1.05	1	0.306
Multiple birth	17	1.9	6	0.8	3.44	1	0.064
Type of feeding							
Breastfeeding	532	60.9	362	50.2			
Formula feeding	207	24.7	246	34.1	23.2	2	<.001***
Mixed (breastfeeding and formula)	135	15.4	113	15.7			
Psychological/psychiatric care							
Ante-natal	118	13.5	82	11.4	1.63	1	0.202
Post-natal	64	7.3	81	11.2	7.31	1	0.007*
Medication for anxiety/depression	25	2.9	24	3.3	0.291	1	0.590
Diagnosis of anxiety/depression	63	7.2	56	7.8	0.179	1	0.673
Difficulties in mother-infant interactions	117	13.4	87	12.1	0.617	1	0.432
Sense of security first postnatal week							
Absolutely	246	28.1	224	31.1			
Quite a lot	305	34.9	263	36.5	3.61	3	0.293
A little	148	20.5	203	23.2			
Not at all	120	13.7	86	11.9			

*p<.05 **p<.01 ***p<.001.

Abbreviations: Min, Minimum; Max, Maximum; SD: Standard Deviation; U = Mann Whitney U; χ^2 = Chi2 test value; df= degrees of freedom.

Descriptive analysis of study variables

Participants' mean and median scores for the PBQ, the EPDS, and the PPSSI did not significantly differ between both samples (Table 2).

Mother-infant bonding mean scores (M_{s1} = 13.1; M_{s2} = 12.78) were above the clinical threshold (≥ 10) in both samples. Nearly half of the participants ($n=435$) were experiencing bonding disturbances in the pre-pandemic sample and 53.8% ($n=388$) in the pandemic sample. A higher prevalence of women with scores above the cut-off but not reaching the threshold for a bonding disorder (scores ranging from 10 to 21) was observed in the second

sample. This prevalence was 36.2% ($n=316$) before the pandemic and increased to 41.2% ($n=297$) during the pandemic. However, prevalence of women with mild (scores ranging 23 to 34) to severe bonding disorders (≥ 35) were equivalent in both groups. Respectively, they were found in 10.8% and 2.9% of women in the pre-pandemic sample and 9.8% and 2.8% in the pandemic sample.

Postpartum sense of security average scores on the different dimensions did not significantly vary from one sample to another. The levels of emotional security were the highest in both groups in the "Empowerment" dimension. Conversely, the lowest scores were observed on the "General well-being" dimension.

Table 2
Study variables: descriptive analyses and comparison of samples.

	Before Pandemic (N=874)			During Pandemic (N=721)				
	Median [p25;p75]	Mean (SD)	Min-Max	Median	Mean(SD)	Min-Max	U	p-value
Bonding								
PBQ-FR	11[6;18]	13.01 (9.19)	0-84	10 [7;18]	12.78 (9.73)	0-57	305295	0.285
Depression								
EPDS-FR	8 [5; 13]	9.27 (5.84)	0-29	8 [4;13]	8.75(5.80)	0-30	298368	0.068
Sense of Security								
PPSSI-FR	53 [46 ;61]	53.13(9.69)	23-72	55 [47 ; 62]	53.58(10.14)	20-72	302167	0.158
Empowerment	20 [16;23]	18.92 (4.53)	6-24	20 [16;23]	18.92(4.72)	6-24	312083	0.742
General well-being	12 [9;16]	12.17(4.18)	5-20	13 [9;16]	12.46(4.32)	5-20	302130	0.156
Affinity	14 [12;16]	13.31(3.03)	4-16	15 [12;16]	13.47(3.07)	4-16	301771	0.137
Breastfeeding	9 [7;11]	8.72(2.51)	3-12	9 [7;11]	8.72 (2.58)	3-12	313316	0.846

Abbreviations: SD= standard deviation; p25= 25th percentile; p75=75th percentile; Min, minimum; Max, maximum; U, Mann Withney U.

EDPS-FR: Edinburgh Postnatal Depression Scale; PBQ-FR: Postpartum Bonding Questionnaire; PPSSI-FR: Parents' Postnatal Sense of Security Instrument.

Table 3
Correlations between study variables.

		Postnatal Depression	Sense of Security	Bonding
		EPDS	PPSSI	PBQ
Before pandemic				
EDPS	Spearman's rho	–		
PPSSI	Spearman's rho	-0.46***	–	
PBQ	Spearman's rho	0.51***	-0.35***	–
During pandemic				
EDPS	Spearman's rho	–		
PPSSI	Spearman's rho	-0.44***	–	
PBQ	Spearman's rho	0.52***	-0.36***	–

*p<.05 **p<.01 ***p<.001.

Although the EPDS average score was below clinical level for postnatal depression in both samples, a EPDS score above the clinical cut-off point (≥ 10.5) was identified in 38% of participants ($n=332$) before the pandemic and 35% ($n=252$) during the pandemic.

Associations between mother-infant bonding, mothers' sense of security, and postnatal depression

A strong and positive correlation was found between EDPS and PBQ scores in both samples. Negative, moderate correlations were found between mothers' sense of security and mother-infant bonding disturbances (Table 3). A negative, significant, yet moderate relationship was observed between PPSSI and EPDS scores. Consequently, lower scores of maternal emotional security in the immediate postpartum correlated with increased risk of postnatal depression and of mother-infant bonding impairment.

Impact of Covid-19 pandemic context on women's experience of the postpartum period

All participants answered the questions related to their postnatal experience during the COVID-19 pandemic. A third of respondents ($n=239$) declared that the pandemic context had impacted the early interactions and the bonding with their child. A quarter ($n= 180$) reported an impact on their sense of security during the first week of the postpartum period. Part of these participants left comments regarding the impact on their postnatal sense of security ($n= 128$) and on the quality of bonding with their child ($n=206$). Mean words by participant was 14 words. The qualitative

analysis of participants' comments on the impact of the pandemic during the postpartum experience is detailed in Tables 4 and 5.

Fears and anxiety related to the COVID-19 pandemic emerged as main sources of insecurity for 54.6% ($n=97$) of respondents. The fears about contamination of the baby (17.42%, $n=31$) and of contracting the COVID-19 virus, and consequently not being able to care for their child, represented major concerns for these mothers.

"I'm afraid I'll get Covid or some other disease and I won't be able to look after my baby"; "Fears that someone will touch him and make him sick";

Fears of contact with the outside world (visitors and outings with the baby) also appeared to have altered their sense of security (11%, $n=20$).

"Fear of people wanting to see the baby"; "Afraid to leave the house with my baby"

Three other themes arose from the analyses:

- 1 changes in postnatal care, such as the health protocol at the maternity and remote postnatal care (20.7%, $n=37$).

"My child's father could only go to the maternity ward once a day. I only saw him for an hour on the second day"; "I left hospital after 24 hours"; "Most childbirth support groups and other groups were closed or online"

- 2 social isolation (lack and avoidance of social contacts) and loneliness (18%, $n=33$)

"Far fewer people came to see our baby"; "I cried because I felt so alone. I felt very lonely"; "I had to say no to people who wanted to see the baby"

- 3 lack of social support from family and friends (6.7%, $n=12$).

"Lack of interaction with my friends who are new mothers, sharing emotions that could have legitimised mine "; "Not possible to have help from our family for our older children"; "Absence of my parents"

As far as the impact on mother-infant interactions and bonding is concerned, nearly a third of respondents ($n=75$) reported that having to wear a mask had impaired the bonding process with their newborn. This was particularly true at childbirth (9.36%, $n=25$), in the maternity ward (3.75%, $n=10$), and in the daily interactions with their child (6.37%, $n=17$).

Table 4

Main categories and sub-categories extracted from participants' comments on their postnatal sense of security during the COVID-19 pandemic.

Main categories (number of items)	Sub-categories (number of items)	Participants' quotes
Postnatal Sense of Security		
Fears and anxiety (n=97)		
Fear of contamination-infection (n=62)	Fear of getting contaminated at hospital (n= 7)	"Always afraid that a caregiver will bring germs"; "Fear of anyone entering my room (fear of contamination)"
	Maternal fear of getting infected (n=11) and of contaminating the baby (n=6)	"I'm afraid I'll get covid or some other disease and I won't be able to look after my baby"; "Fear of being hospitalised and having to leave my child"
Fear of virus infection by family members (n=8)	Fear of virus infection by family members (n=8)	"My oldest daughter was suspected of having Covid the week after the birth of her little brother, so she had to stay at home, and I was afraid of a possible transmission"; "I was afraid that my older daughter would bring home COVID or other diseases from school"
	Contamination fears regarding the baby (n=31)	"Fears that someone will touch him and make him sick"; "Fears that my baby might be contaminated"; "Stress about the possibility of contaminating the baby"; "Thinking about hygiene measures to avoid contaminating him"
Fear of social interaction (n=17)	Fear of visitors (n=4)	"Fear of people wanting to see the baby; "Fear of seeing people"
	Fear of leaving the maternity ward (n=2)	"...as if in a cocoon in the maternity ward"
Anxiety and stress (n=17)	Fear of going outside home with the baby (n=9)	"I didn't go out or almost didn't go out to avoid the virus"; "Afraid to leave the house with my baby"
	Fear of asking for help and support (n=2)	"Fear of getting help"
Anxiety and stress (n=17)	Stress during baby's social contact (n=3)	"Stress as soon as someone wanted to get close to my daughter"
	Anxiety and stress related to baby's health (n=5)	"Fear of not noticing if he gets sick", "Fear and constant stress for my baby"
Anxiety and stress (n=17)	Anxiety caused by the pandemic context (n=7)	"Staying in a hospital during this virus is not reassuring"; "I was afraid of everything; the climate was very anxiety-provoking"; "I didn't sleep at all... in the hospital fearing that something would happen"; "Financial security"
	Anxiety about hygiene (n=2)	"Cleaning the house and telling my husband when he came home to wash up before taking the baby"; "I was anxious about health, cleanliness, very/too vigilant in baby care"
Changes in postnatal care (n= 37)		
Health protocol in hospital (n=29)	Early discharge (n=2)	"I left hospital after 24 hours"
	Care in case of suspected Covid-19 infection (n=2)	"My baby could not join me until the next day in the other hospital and had to undergo a covid test"; "Suspected Covid+ on the day I gave birth, my husband could not come and the nursing staff came to my room as little as possible as they had to put on the full outfit. I was in pain and scared"
Postnatal follow-up (n=8)	Restrictions on partner's presence (n=4)	"Very limited visits from the father"; "My child's father could only go to the maternity ward once a day. I only saw him for an hour on the second day"
	Wearing a face mask (n=11)	"... having to think about the mask on top of everything else"; "Wearing a mask 24 hours a day in the maternity ward"; "... it disrupts the new and emerging interactions with baby"
Postnatal follow-up (n=8)	Interactions with midwives and nurses (n=2)	"more distant relationships, more careful about not touching each other"
	Lack of postnatal support groups (n=3)	"Most childbirth support groups and other groups were closed or online"; "Workshops (breastfeeding, childcare, massage, baby holding, etc.) were not maintained at the maternity hospital nor at the PMI"
Social isolation and loneliness (n=33)	Remote medical follow-up (n=5)	"Medical appointments that were not always in person at a time when human contact would have facilitated exchanges"
	Feelings of social isolation (n=7)	"We were completely alone; «I didn't see many people".
Social isolation and loneliness (n=33)	Maternal feelings of loneliness (n=2)	"I cried because I felt so alone. I felt very lonely"
	Absence or limited visits from relatives (n=14)	"No visits to the hospital"; "Far fewer people came to see our baby; "I had few visits from my family";
Social isolation and loneliness (n=33)	Lack of social interactions for the child (n=2)	"Baby stays in our arms and has no other contact apart from mum and dad"
	Avoidance of social contacts and visitors (n=8)	"I had to say no to people who wanted to see the baby"; "... we didn't see anyone for at least the first 15 days or even the first 3 weeks"; "we limited the comings and goings"; "refusal of relatives' visits"
Lack of social contact and support (n=12)	Lack of social contacts (n=6)	"Lack of interaction with my friends who are new mothers, sharing emotions that could have legitimised mine "
	Lack of contact with extended family (n=4)	"I didn't have the presence of my mum"; "absence of my parents »
Lack of social contact and support (n=12)	Lack of family support (n=2)	"Not possible to have help from our family for our older children"
	Mother-child bonding	"Personally, I understand the word security in the sense that I was able to create a bond with my baby, without having everyone (family, friends...) around us so not many people could carry our daughter. No criticism, no "do this or that". I was in communion with my daughter"

Table 5

Main categories and sub-categories extracted from participants' comments on their early interactions and bonding with their child during the COVID-19 pandemic.

Main categories (number of items)	Sub-categories (number of items)	Participants' quotes
Mother-to-child bonding		
Social distancing and isolation (n=119)	Lack of support (n=5)	"Difficulties in breastfeeding because of no help, feeling of failure"
	Lack of breastfeeding support (n=2)	
	Lack of family and relatives support (n=3)	"no respite offered by friends/family if needed"; "No possible help from outside family"; "it does not help when becoming a mother and the constraints that this implies in terms of autonomy"
	Lack of visitors (n=20)	"Less family and friends coming to see the baby"; "See less people than if there had been no lockdown or curfew and never many people at the same time during visits..."; "Without Covid we would certainly have gathered more people"; "Less visits, shortened"
Social isolation (n=56)	Fewer outings with baby (n=4)	"she doesn't go out as much as I would have liked"; "We don't go out much with the baby"
	Avoidance of physical and social contacts with baby (n=10)	"Grandparents don't hold him"; "Much less hugging and kissing from the family, I'm watching" "very few people have kissed him since birth"; "introducing the baby to my family has been complicated"; "Decreased visits from relatives, refusal of visits from children as they are not masked"; "I did not want to accept visits for my baby"
	Delay or postponement of family reunions with newborn (n=22)	"Not being able to introduce my daughter to my family does not help me when it comes to bonding with her. I need to introduce her to them, to make her more real, to make this birth and this life part of our family history"; "the baby meeting the family only took place late, difficult to create a bond from the first hours of life between the baby and our relatives"; "No opportunity to meet extended family members"; "Very few family members have seen my daughter"; "Impossible to introduce our child to our family and friends because of lockdown and in order to avoid any risk for her and for us"; "Living abroad, we have not been able to return to France to introduce our baby to our two families"; "He is three months old and still has not met all members of the family"
Consequences of social distancing (n=58)	Lack of emotional sharing with family (n=3)	"Unshared moment of joy"; "Not sharing the baby's arrival; "Not being able to enjoy the joy of introducing the baby to his brothers and sisters who could not enter the clinic"
	Lack of social interaction for the child (n=34)	"She doesn't see anyone". "He only spent the first months of his life with his two parents"; "Baby is not seeing as many people as we would like to, we do not go out as we would like to, activities are quite limited"; "He has met with very few people, I fear that makes him anxious about strangers"; "... no one else held him during his first month of life"
	Lack of social interactions with the relatives (n=9)	"There was less interaction with my family, and it frustrated me not to share more moments with them"; "not being able to see the family as much as I wanted"; "the very few contacts we had, were distant"
	Lack of contact with friends (n=3)	"Meeting opportunities with friends are limited"; "Very few meetings with other mums"; "My friends haven't all seen my baby yet. Nothing like my first baby."
Wearing a face mask (n=75)	Negative effects of social distancing measures on the baby (n=9)	"Baby only sees masks and does not socialise much"; "Hyper attachment to parents and difficulty being carried by others"; "needs mum for everything, even after 5 months"; "has a very poor tolerance for noise and agitation"; "very difficult for him now to be serene when there are people around. He is grumpy with outsiders"; "Not much interaction with others so my baby has never been looked after by anyone else. It makes her very exclusive towards me"
	Baby's contacts with people wearing a mask (n=3)	"Masked faces presented to the baby, in my opinion, prevent him from becoming familiar with the relatives"; "with the mask the baby is interacting less with the environment"; "I'm afraid the mask will disturb her perception"; "Not easy for a baby, who responds a lot to facial expressions he sees, to interact with masked people"
	Daily mother-infant interactions with a mask (n=17)	"A mask that prevents us from making eye contact when I wear it outside"; "it disrupts new and emerging interactions with baby"; "I sometimes breastfeed while wearing the mask, so our interactions are hindered"; "My baby looks at me differently when I wear the mask"; "She doesn't recognise me and doesn't smile with the mask on..."; "The mask creates a barrier"; "...prevents us from making eye contact when I wear it outside"; "it can take a while to calm down when we have the mask on"
	Wearing a mask during delivery (n=25)	"First encounter with baby with a mask"; "Wearing a mask during labour made me very hot and prevented me from fully enjoying skin to skin with my baby"; "first kiss with the mask"; "The birth with a mask, even if it was a caesarean section, I find it completely crazy"; "I didn't see the smile on the dad's face when he was born. And I wanted to give this gift to the father"; "A mask during childbirth that made it difficult"; "And since I was being scolded about my mask during labour, I didn't dare to be happy..."; "A mask for birth and for the first skin-to-skin/breastfeeding experience?!"
COVID-19 protocol at hospital (n=39)	Wearing a mask at the maternity ward (n=17)	"When the midwives came into my room, I had to put on my mask while my son and I were just getting to know each other"
	Mother-child separation in case of COVID-19 suspicion/infection (n=2)	"...because of the maternity hospital's covid protocol I only met baby 16 hours after the birth"; "no skin to skin contact until day 4"; "I was suspected of having Covid-19 (contact case) and was unable to see my daughter straight away"
	Family and siblings visits not allowed (n=9)	"No visit allowed from our eldest child, so family reunited late (11 days)"; "My baby could not meet his brothers and grandparents in the maternity ward"; "Father and older sister couldn't see our baby in hospital, no family bonding"
	Absence or restricted presence of partner (n=14)	"Less presence of the father in the hospital"; "My partner was not able to be present at the birth, I did not attach myself directly to the baby because he was not there to reassure me"; "Baby's dad not present at the beginning of the delivery because of Covid"; "The father could only be present at the maternity ward for 4 hours a day"; "The dad couldn't be there. The family relationship was not built up properly"
	Distance in contacts with nursing staff (n=2)	"Not many checks from midwives in the room so little follow-up and advice"; "all nursing staff wearing masks, I found it aggressive"
	Early discharge (n=2)	"Extremely tired because I was discharged from the hospital the day after birth"

(continued on next page)

Table 5 (continued)

Main categories (number of items)	Sub-categories (number of items)	Participants' quotes
Positive effects on bonding (n=32)	Positive effects about social distancing (n=3)	"Baby who has not been disturbed by visits, calmer"; "Positive effect in the relationship with the baby"; it allowed me to have time to meet my baby, to be in our own bubble in the days following his birth, without all the visits that usually accompany this period"
	Greater availability on the part of the mother (n=2)	"No outings, no visits, I'm available and I can easily rest;" This second lockdown has been beneficial, strangely enough. It allowed me to spend time with my daughter"; "I was able to concentrate fully on building our family"; we were calmer and that was good. I did less and that was good for him"; "I was more present, without temptations (concerts, outings, ...)"
	More time to bond with the baby (n=6)	"More time to meet my baby, get to know him and establish a routine"
	Partner's presence at home -remote work (n=2)	"Better because the dad is more present because of remote work ";
	Less stress due to absence of visitors at maternity (n=13)	"No visits to the maternity ward, and that was a HAPPY thing!"; "Positive! Not having a visit to the hospital is really relaxing and allows you to have all the time in the world with your baby"; No visits to the hospital, we were able to take the time to get to know baby"; «In a positive way: no visits possible in the maternity ward and so the 3 of us were in our cocoon for the 5 days we stayed in the maternity ward, unforgettable moments for me!";
Mother's postnatal emotional state (n=17)	Nuclear family bonding (n=6)	"Quiet meeting... Just mum, dad and baby. And I was able to rest"; "Positively: we stayed very close, very focused on our baby, our new family cocoon"; More like a cocoon, between us, we were very zen to welcome them"; "The chance to experience the first few days just as a family"
	Feelings of loneliness (n=2)	"the loneliness due to the lockdown took me away from my babies"
	Feelings of freedom deprivation (n=3)	"The deprivation of freedom due to lockdown "; "We are limited in what we can do (going out to visit etc)"
	Fears of interacting with the outside world (n=2)	"Fear of meeting people"
	Contamination fears regarding the baby (n=6)	"Fear of giving him kisses"; "Fear that he would catch the virus"
	Anxiety and stress caused by the pandemic (n=4)	"More anxious because of the meeting and because of this anxious context, perhaps I was not as calm as I should have been and I did not enjoy the birth of my son as much as I had dreamt"; "worried all the time"; "more anxiety-provoking climate"; The stress was difficult to deal with in addition to the painful contractions. It made my delivery more difficult »

"First encounter with baby with a mask"; "When the midwives came into my room, I had to put on my mask while my son and I were just getting to know each other";

"My baby looks at me differently when I wear the mask"; "She doesn't recognise me and doesn't smile with the mask on..."; «It disrupts new and emerging interactions with baby"

Up to 44.5% of respondents (n=119) mentioned that social distancing measures, in particular the limitation of visitors, and lack of support from the extended family, had also impacted the quality of interactions with their child.

Nearly 10% of these mothers (n=25) complained about having to delay family reunions to introduce the newborn, or about not being able to share this joyful moment with relatives.

"The baby meeting the family only took place late, difficult to create a bond from the first hours of life between the baby and our relatives"; "Not being able to enjoy the joy of introducing the baby to his brothers and sisters who could not enter the clinic"

Some mothers (16%, n=43) also reported adverse effects of social distancing on their newborns, namely a lack of interactions with the outside world, a fear of strangers, and greater sensitivity or irritability to noises and environmental stimulations.

"He has met with very few people, I fear that makes him anxious about strangers"; "Baby only sees masks and does not socialise much"; "very difficult for him now to be serene when there are people around. He is grumpy with outsiders"

Their stay at the maternity ward during childbirth and in the early postpartum period was also mentioned in the comments as having an impact on mother-child bonding. To this respect, 5.25% of respondents (n=14) stressed that the absence or limited presence of the partner at the maternity ward due to the health pro-

tocol had hindered the quality of the first interactions with their infant.

"My partner was not able to be present at the birth, I did not attach myself directly to the baby because he was not there to reassure me"; "; "The dad couldn't be there. The family relationship was not built up properly"

However, more than 12% of respondents (n=33) also highlighted positive aspects of the pandemic, such as greater presence of the partner at home due to remote work, less visitors which left more time for calm bonding with their baby and rest. A positive impact on nuclear family bonding was also reported.

"It allowed me to have time to meet my baby, to be in our own bubble in the days following his birth, without all the visits that usually accompany this period"; "No outings, no visits, I'm available and I can easily rest;" "The chance to experience the first few days just as a family"; "Better because the dad is more present because of remote work "

Discussion

The main purpose of this study was to evaluate the impact of the COVID-19 pandemic on two positive dimensions of mothers' postnatal mental health, namely mother-infant bonding and sense of security in the early postpartum. The findings of the quantitative analyses suggested a rather limited impact of the pandemic context on these two variables. However, the qualitative component of the study provided more insight into the postnatal experience of women during the pandemic and contrasted with participants' quantitative data.

Contrary to our expectations, we did not observe higher levels of insecurity among postnatal women in the context of the health crisis. Indeed, mothers in both samples reached on average the

same score of emotional security and overall, felt secure in their first postnatal week. These scores are in line with previous studies using the PPSSI to evaluate maternal sense of security in non-crisis settings and in other cultural contexts (Persson et al., 2007; Escribano et al., 2020).

In contrast to our second hypothesis, the average level of mother-child bonding disturbances was slightly lower in the second sample recruited during the pandemic. However, this result must be nuanced as during the pandemic we observed a higher prevalence of women experiencing mild difficulties in bonding with their child. Although only a small proportion of mothers reported having experienced difficulties in the early interactions with their child, this proportion reached more than a third of the sample when they were questioned specifically on the impact of COVID-19 pandemic on this aspect of motherhood.

Our results concur with two comparative studies evaluating parental mental health during the COVID-19 health crisis with standardized tools, which did not demonstrate a significant effect of the pandemic context on maternal postnatal anxiety (Fournier et al., 2022) nor on parental burnout levels in France (Vigouroux et al., 2021).

Quantitative levels of postnatal depressive symptoms were also similar in both groups. However, the prevalence of women above the clinical threshold for postnatal depression in both samples is worrisome, since only a limited number of women reported having received a clinical diagnosis of depression or psychological or pharmacological treatment. The observed rates are close to the 40.7% prevalence of postnatal depression found by Davenport et al. (2020) among North American women at the beginning of the pandemic. Our results bring to light the lack of detection of these depressive symptoms by mothers and health professionals. One explanation could be social stigma on postnatal mental health disorders which may prevent women from mentioning their difficulties and sometimes encourage them to ignore them (Bodnar-Deren et al., 2017). It may also result from a lack of information about postnatal mental health and symptoms of postnatal depression, as health professionals tend to prioritize information about the baby's well-being during postnatal consultations (Guerra-Reyes et al., 2017).

The comparison of the perinatal characteristics of the samples revealed a change in feeding practices in the pandemic sample with less women breastfeeding their infant. This is consistent with the trend observed in the UK by Vazquez-Vasquez et al. (2021) at the beginning of the outbreak, authors who explained this drop by a lack of breastfeeding support due to the new pandemic living conditions.

Similarly to Escribano et al. (2020) and Persson and Kvist (2014), we found a negative correlation between postnatal sense of security and postnatal depression. Furthermore, the relationship between postnatal depression and bonding difficulties was strong and positive. This result confirms previous research on the association between maternal depressive symptoms and impaired bonding with their child (Reck et al., 2006; Kerstis et al., 2016; Rizzo and Watsford, 2020). To the authors' knowledge, the relationship between mother-child bonding and maternal sense of security had so far not been evaluated. Our findings indicate a negative and moderate relationship between the two constructs. However, this first result needs further investigation, especially on the associations between the different dimensions of both variables.

These quantitative results can be partially explained by the fact that the screening tools we used were tailored to measure sense of security during the first postnatal week and quality of maternal bonding in non-pandemic times. Our qualitative analysis revealed different and unprecedented aspects which substantially impacted the postnatal experience of new mothers and their mental health

during the outbreak, as well as the quality of bonding with their child. Wearing a mask during the first interaction with their newborn or early mother-child separation due to COVID-19 infection or suspected infection are new elements which need to be taken into consideration in postnatal care during pandemics. Some factors, such as contamination fears, stress induced by the pandemic environment and restrictions, as well as feelings of isolation from beloved ones and loneliness, had already been reported in preliminary studies on the postpartum during the COVID-19 pandemic (Davenport et al., 2020). Nevertheless, lockdowns and social distancing measures appear to have had both positive and negative effects on maternal bonding. The limitation of social contacts and activities enabled some mothers to rest and to bond more peacefully with their child. They may also have benefited from greater presence and support of their partner in the first weeks following birth due to generalized remote work. Several participants also pointed out that having more time alone with their baby, especially at the maternity ward, had facilitated nuclear family bonding. The analysis of mothers' comments revealed the particular importance of a supportive social environment, of the fathers' involvement, and of a sense of closeness with the extended family in the mother-infant bonding process, as shown in Kinsey et al. (2014). One participant's statement illustrates this: *"Not being able to introduce my daughter to my family does not help me when it comes to bonding with her. I need to introduce her to them, to make her more real, to make this birth and this life part of our family history"*.

When participants were asked to comment on their sense of security in the COVID-19 context, they mainly referred to basic security needs such as health concerns, safety, or financial security. Although the well-being of mothers and their emotional state are evaluated by the PPSSI, the nature of anxiety and stressors which influence these aspects differed quite a bit in a time of pandemic. Providing a clean and safe environment to their baby and protecting their child and other family members from possible virus contamination appeared to be at the forefront of mothers' concerns. Indeed, only a few mothers mentioned affective elements, anxiety related to baby care, or parenting. For some participants, anxiety resulted from the accumulation of all these stressors.

We can also assume that health safety measures to protect the general population may have contributed to reinforcing maternal sense of security, and not the contrary as expected. Early discharge from the maternity ward can be a time of insecurity but can also provide security for parents and foster family bonding, depending on the support they receive (Nilsson et al., 2015). The context also imposed a certain focus on the nuclear family. As stressed by Hjälmut and Lomborg (2012), the special feeling of being together as a family in the first days after childbirth could also give parents a sense of security. One participant expressed this feeling in particular, stating *"Personally, I understand the word security in the sense that I was able to create a bond with my baby, without having everyone (family, friends...) around us, so not many people could carry our daughter. No criticism, no "do this or that". I was in communion with my daughter"*.

It is important to note that in the sample recruited during the COVID-19 pandemic, the prevalence of women receiving postnatal psychological support was higher than before the pandemic. Specific postnatal health services were reinforced in France since the COVID-19 outbreak to support parents in the postpartum, especially in case of early discharge from the hospital after childbirth. The PRADO service is one of these services, which guarantees a first follow-up visit by a midwife 24 hours after discharge and a second visit a few days later, if needed. Mothers are generally also informed at the maternity ward that they can access the local maternal and child welfare centres (PMI) which remained

opened during lockdowns and were also offering teleconsultations (HAS, 2020).

A recent qualitative study on new parents' experience during the COVID-19 pandemic carried out in Canada emphasized that mothers had not only sought for postnatal support online from formal health services, but also from informal sources of information such as support groups on social media and groups with beloved ones. The authors stressed that virtual social connection was a way to counteract feelings of isolation and enabled them to share the joy of having a new baby with their relatives and with other parents (Olliver et al., 2021). Therefore, mothers' emotional state may also have been influenced positively by this alternative to in-person contact.

Limitations

Online data collection enabled us to reach a great number of French-speaking mothers from all over France, and to compare large samples. This allowed us also to collect a significant amount of qualitative data which contrasted with the quantitative data we collected and highlighted new factors specific to the COVID-19 pandemic.

Nevertheless, this format allows for less control over sampling and the socio-demographic profile of our study population. Moreover, mothers were recruited on social media groups dedicated to maternal care, parenting and baby care, which can also constitute a bias as these groups usually interest women who are particularly sensitive to these issues and who are possibly actively seeking for information and social support on these groups.

Furthermore, direct observation of mother-infant interactions is considered as the gold standard when evaluating quality of bonding, and self-reports may be more subject to respondent bias, notably to simulation or dissimulation (Brockington et al., 2006b). The PBQ in particular can be vulnerable to social desirability. Indeed, some items relating to infant rejection and neglect can elicit feelings of parental incompetence and can be difficult to address (Busonera et al., 2017).

The PPSSi measures emotional security levels during the first week of post-partum and therefore is reliant on the mothers' memory of these first days after the birth of their child. However, this instrument was used in studies at different times of post-partum and showed good validity and reliability (Persson and Fridlund, 2007; Escribano et al., 2020; Schaming and Wendland, 2021).

In addition, most of the participants were married or in a partnership. Future research could investigate the fathers' and partners' postnatal experience during the pandemic in order to explore correlations with the mothers' experiences. This is particularly relevant since the mother's perception of security is closely intertwined with their partner's perception of security (Escribano et al., 2020b), and maternal bonding is also particularly influenced by partners' support and attitudes toward the mother and the child (Kinsey et al., 2014).

Conclusion

The results of this mixed study did not show a negative impact of the pandemic context on maternal sense of security nor on mother-to-child bonding when these variables were screened using validated quantitative tools. However, the qualitative analysis revealed original data which may not have been evaluated by these screening tools. Risk of exposure to the virus and fears of contamination, social isolation, as well as lack of family support were the main sources of insecurity for mothers. Mother-child bonding was particularly hindered by sanitary measures such as having to wear a mask in the early interactions with their newborn or the restrictions on partner presence during childbirth at the maternity

ward. Not being able to introduce the baby to loved ones right after birth and share these joyful and unique moments with them due to lockdown and travel restrictions, also negatively impacted the postnatal experience of mothers. On a more positive note, social distancing measures limited visitors and allowed parents and siblings more time and calm to bond with the newborn.

These results point out the importance of taking into account social and environmental factors when evaluating postnatal mental health and providing postnatal care to new mothers in a time of health crisis. This is even more relevant since some health measures may still apply beyond pandemic acute phases such as wearing a mask or limited visits at hospital. Those also can have a long-term impact on the experience of birth and on the way postnatal care will be provided to women in the future. Health professionals should be particularly aware of these special needs and concerns, guarantee continuity of care and access to health and support structures, promote the inclusion of both parents in their intervention and pay extra attention to maternal mental health and well-being in this sensitive postpartum period. Given the potential impact of mother-child bonding difficulties on maternal and child health in the long term, early intervention and detection of alterations should be a growing concern.

The high prevalence of postnatal depression in our study samples also highlighted the need for closer attention to women's mental health during the postpartum period and for better detection of symptoms of depression in both pandemic and non-pandemic times. Long-term consequences of the pandemic on these postnatal variables are difficult to foresee and further investigation is needed, in particular on more at-risk populations and in other cultural contexts.

Ethical approval

This research was approved by the University of Paris Research and Ethics Committee (CER-U-Paris, n°2019-90).

Declaration of Competing Interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

CRediT authorship contribution statement

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References

- Alzueta, Perrin, P., Baker, F.C., Caffarra, S., Ramos-Usuga, D., Yuksel, D., Arango-Lasprilla, J.C., 2021. How the COVID-19 pandemic has changed our lives: A study of psychological correlates across 59 countries. *J. Clin. Psychology* 77 (3), 556–570. doi:10.1002/jclp.23082.
- Askelsdottir, B., Lam-de Jonge, W., Edman, G., Wiklund, I., 2013. Home care after early discharge: Impact on healthy mothers and newborns. *Midwifery* 29 (8), 927–934. doi:10.1016/j.midw.2012.11.001.

- Bar-Tal, D., Jacobson, D., 1998. A Psychological perspective on security. *Appl. Psychol.* 47 (1), 59–71. doi:[10.1080/026999498378079](https://doi.org/10.1080/026999498378079).
- Bick, D., Cheyne, H., Chang, Y.S., Fisher, J., 2020. Maternal postnatal health during the COVID-19 pandemic: vigilance is needed. *Midwifery* 88, 102781. doi:[10.1016/j.midw.2020.102781](https://doi.org/10.1016/j.midw.2020.102781).
- Bienfait Maury, M., Haquet, A., Faillie, J.-L., Franc, N., Combes, C., Daudé, H., Piccaud, J.-C., Rideau, A., Cambonie, G., 2011. Pertinence of the self-report mother-to-infant bonding scale in the neonatal unit of a maternity ward. *Early Hum. Dev.* 87 (4), 281–287. doi:[10.1016/j.earlhumdev.2011.01.031](https://doi.org/10.1016/j.earlhumdev.2011.01.031).
- Bodnar-Deren, S., Benn, E.K.T., Balbierz, A., Howell, E.A., 2017. Stigma and postpartum depression treatment acceptability among black and white women in the first six-months postpartum. *Matern. Child Health J.* 21 (7), 1457–1468. doi:[10.1007/s10995-017-2263-6](https://doi.org/10.1007/s10995-017-2263-6).
- Brockington, I.F., Oates, J., George, S., Turner, D., Vostanis, P., Sullivan, M., Loh, C., Murdoch, C., 2001. A Screening Questionnaire for mother-infant bonding disorders. *Arch. Womens Ment. Health* 3 (4), 133–140. doi:[10.1007/s007370170010](https://doi.org/10.1007/s007370170010).
- Brockington, I.F., 2004. Postpartum Psychiatric disorders. *Lancet* 363, 303–310. doi:[10.1016/S0140-6736\(03\)15390-1](https://doi.org/10.1016/S0140-6736(03)15390-1).
- Brockington, I.F., Aucamp, H.M., Fraser, C., 2006a. Severe disorders of the mother-infant relationship: definitions and frequency. *Arch. Womens Ment. Health* 9, 243–251. doi:[10.1007/s00737-006-0133-0](https://doi.org/10.1007/s00737-006-0133-0).
- Brockington, I.F., Fraser, C., Wilson, D., 2006b. The Postpartum Bonding Questionnaire: a validation. *Arch. Womens Ment. Health* 9, 233–242. doi:[10.1007/s00737-006-0132-1](https://doi.org/10.1007/s00737-006-0132-1).
- Busonera, A., Cataudella, S., Lampis, J., Tommasi, M., Zavattini, G.C., 2017. Psychometric properties of the postpartum bonding questionnaire and correlates of mother-infant bonding impairment in Italian new mothers. *Midwifery* 55, 15–22. doi:[10.1016/j.midw.2017.08.011](https://doi.org/10.1016/j.midw.2017.08.011).
- Chabbert, M., Wendland, J., 2016. Le vécu de l'accouchement et le sentiment de contrôle perçu par la femme lors du travail: un impact sur les relations précoces mère-bébé ? *Revue de Médecine Périnatale* 8 (4), 199–206.
- Connor, M., 2020. Health risks and outcomes that disproportionately affect women during the Covid-19 pandemic: A review. *Soc. Sci. Med.* 266, 113364. doi:[10.1016/j.socscimed.2020.113364](https://doi.org/10.1016/j.socscimed.2020.113364).
- Cox, J.L., Holden, J.M., Sagovsky, R., 1987. Detection of postnatal depression; development of the 10 items Edinburgh Postnatal Depression Scale. *Br. J. Psychiatry* 150, 782–786. doi:[10.1192/bjp.150.6.782](https://doi.org/10.1192/bjp.150.6.782).
- Coxon, K., Turienzo, C.F., Kwekel, L., Goodarzi, B., Brigante, L., Simon, A., Lanau, M.M., 2020. The impact of the coronavirus (COVID-19) pandemic on maternity care in Europe. *Midwifery* 88, 102779. doi:[10.1016/j.midw.2020.102779](https://doi.org/10.1016/j.midw.2020.102779).
- Dahlberg, U., Aune, I., 2013. The woman's birth experience—The effect of interpersonal relationships and continuity of care. *Midwifery* 29 (4), 407–415. doi:[10.1016/j.midw.2012.09.006](https://doi.org/10.1016/j.midw.2012.09.006).
- 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. Glob. Womens Health* 1, 1. doi:[10.3389/fgwh.2020.00001](https://doi.org/10.3389/fgwh.2020.00001).
- Demanche, A., Michel, L., Chabbert, M., Wendland, J., 2021. Version française du Post-Partum Bonding Questionnaire – French version of the Post-Partum Bonding Questionnaire. *Devenir* 33 (4), 287–310. doi:[10.3917/dev.214.0287](https://doi.org/10.3917/dev.214.0287).
- Emmanuel, E.N., Creed, D.K., St John, W., Brown, C., 2011. Maternal role development: the impact of maternal distress and social support following childbirth. *Midwifery* 27 (2), 265–272. doi:[10.1016/j.midw.2009.07.003](https://doi.org/10.1016/j.midw.2009.07.003).
- Escubano, S., Oliver-Roig, A., Cano-Climent, A., Richart-Martínez, M., Persson, E.K., Juliá-Sanchis, R., 2020. The Spanish version of the Mothers' Postnatal Sense of Security Scale: Psychometric properties and predictive utility. *Res. Nurs. Health* 43 (6), 651–661. doi:[10.1002/nur.22071](https://doi.org/10.1002/nur.22071).
- Escubano, S., Oliver-Roig, A., Cano-Climent, A., Richart-Martínez, M., Juliá-Sanchis, R., 2020. Factors Related to the Intra-Partner Postnatal Sense of Security in a Spanish Sample. *J. Pediatr. Nurs.* 51, 85–91. doi:[10.1016/j.pedn.2019.12.001](https://doi.org/10.1016/j.pedn.2019.12.001).
- Figueiredo, B., Costa, R., Pacheco, A., Pais, A., 2007. Mother-to-infant and father-to-infant initial emotional involvement. *Early Child Dev. Care* 177 (5), 521–532. doi:[10.1080/03004430600577562](https://doi.org/10.1080/03004430600577562).
- Fourneret, A.L., Wendland, J., 2022. Impact de la crise sanitaire covid-19 sur l'anxiété postnatale maternelle: une étude comparative et exploratoire. *Devenir* 34 (2), 137–159. doi:[10.3917/dev.222.0137](https://doi.org/10.3917/dev.222.0137).
- Geçkil, E., Koçak, V., Altıntuğ, K., Ege, E., 2017. Annelerin doğum sonu güvenlik hisleri ölçeği. *Anadolu Hemşirelik ve Sağlık Bilimleri Dergisi* 19 (4), 0–0.
- Glaser, B.G., 2016. Open coding descriptions. *Grounded Theory Review* 15 (2), 108–110.
- Guedeney, N., Fermanian, J., 1998. Validation study of the French version of the Edinburgh Postnatal Depression Scale (EPDS): new results about use and psychometric properties. *Eur. Psychiatry* 13 (2), 83–89. doi:[10.1016/S0924-9338\(98\)80023-0](https://doi.org/10.1016/S0924-9338(98)80023-0).
- Guerra-Reyes, L., Christie, V.M., Prabhakar, A., Siek, K.A., 2017. Mind the gap: Assessing the disconnect between postpartum health information desired and health information received. *Womens Health Issues* 27 (2), 167–173. doi:[10.1016/j.whi.2016.11.004](https://doi.org/10.1016/j.whi.2016.11.004).
- HAS – Haute Autorité de Santé, 2020. Réponses rapides dans le cadre du COVID-19 – Continuité du suivi postnatal des femmes et de leur enfant lors de la levée du confinement. Retrieved on 05/01/2021 from: https://www.has-sante.fr/jcms/p_3168632/fr/reponses-rapides-dans-le-cadre-de-la-covid-19-continue-du-suivi-postnatal-des-femmes-et-de-leur-enfant.
- Hjälhmult, E., Lomborg, K., 2012. Managing the first period at home with a newborn: a grounded theory study of mothers' experiences. *Scand. J. Caring Sci.* 26 (4), 654–662. doi:[10.1111/j.1471-6712.2012.00974.x](https://doi.org/10.1111/j.1471-6712.2012.00974.x).
- INSERM – DREES, 2017. *Enquête nationale périnatale - Rapport 2016*. Retrieved on the 20/05/21 from: <https://drees.solidarites-sante.gouv.fr/publications/rapports/enquete-nationale-perinatale-2016-les-naissances-et-les-etablissements>.
- Jones, K., Harrison, V., Moulds, M.L., et al., 2022. A qualitative analysis of feelings and experiences associated with perinatal distress during the COVID-19 pandemic. *BMC Pregnancy Childb.* 22 (2022), 572. doi:[10.1186/s12884-022-04876-9](https://doi.org/10.1186/s12884-022-04876-9).
- Kerstis, B., Aarts, C., Tillman, C., Persson, H., Engström, G., Edlund, B., Skalkidou, A., 2016. Association between parental depressive symptoms and impaired bonding with the infant. *Arch. Womens Ment. Health* 19 (1), 87–94. doi:[10.1007/s00737-015-0522-3](https://doi.org/10.1007/s00737-015-0522-3).
- Kinsey, C.B., Hupcey, J.E., 2013. State of the science of maternal-infant bonding: a principle-based concept analysis. *Midwifery* 29 (12), 1314–1320. doi:[10.1016/j.midw.2012.12.019](https://doi.org/10.1016/j.midw.2012.12.019).
- Kinsey, C.B., Baptiste-Roberts, K., Zhu, J., Kjerulff, K.H., 2014. Birth-related, psychosocial, and emotional correlates of positive maternal-infant bonding in a cohort of first-time mothers. *Midwifery* 30 (5), e188–e194. doi:[10.1016/j.midw.2014.02.006](https://doi.org/10.1016/j.midw.2014.02.006).
- Maslow, A., 1943. A Theory of Human Motivation. *Psychol. Rev.* 50, 370–396.
- Matvienko-Sikar, K., Meedya, S., Raval, C., 2020. Perinatal mental health during the COVID-19 pandemic. *Women Birth* 33 (4), 309–310. doi:[10.1016/j.wombi.2020.04.006](https://doi.org/10.1016/j.wombi.2020.04.006).
- Moehler, E., Brunner, R., Wiebel, A., Reck, C., Resch, F., 2006. Maternal depressive symptoms in the postnatal period are associated with long-term impairment of mother-child bonding. *Arch. Womens Ment. Health* 9 (5), 273–278. doi:[10.1007/s00737-006-0149-5](https://doi.org/10.1007/s00737-006-0149-5).
- Motrico, E., Mateus, V., Bina, R., Felice, E., Bramante, A., Kalcev, G., Mauro, M., Martins, S., Mesquita, A., 2020. Good practices in perinatal mental health during the COVID-19 pandemic: a report from task-force RISEUP-PPD COVID-19. *Clínica y Salud* 31 (3), 155–160. doi:[10.5093/clysa2020a26](https://doi.org/10.5093/clysa2020a26).
- Nath, S., Pearson, R.M., Moran, P., Pawlby, S., Molyneux, E., Challacombe, F.L., Howard, L.M., 2019. The association between prenatal maternal anxiety disorders and postpartum perceived and observed mother-infant relationship quality. *J. Anxiety Disord.* 68, 102148. doi:[10.1016/j.janxdis.2019.102148](https://doi.org/10.1016/j.janxdis.2019.102148).
- Nilsson, I., Danbjørg, D.B., Aagaard, H., Strandberg-Larsen, K., Clemensen, J., Kronborg, H., 2015. Parental experiences of early postnatal discharge: A meta-synthesis. *Midwifery* 31 (10), 926–934. doi:[10.1016/j.midw.2015.07.004](https://doi.org/10.1016/j.midw.2015.07.004).
- Ollivier, R., Aston, M., Price, S., Sim, M., Benoit, B., Joy, P., Nassaji, N.A., 2021. Mental Health & Parental Concerns during COVID-19: The experiences of new mothers amidst social isolation. *Midwifery* 94, 102902. doi:[10.1016/j.midw.2020.102902](https://doi.org/10.1016/j.midw.2020.102902).
- Persson, E.K., Fridlund, B., Dykes, A., 2007. Parents' postnatal sense of security (PPSS): development of the PPSS instrument. *Scand. J. Caring Sci.* 21 (1), 118–125. doi:[10.1111/j.1471-6712.2007.00442.x](https://doi.org/10.1111/j.1471-6712.2007.00442.x).
- Persson, E.K., Dykes, A.-K., 2009. Important variables for parents' postnatal sense of security: evaluating a new Swedish instrument (the PPSS instrument). *Midwifery* 25 (4), 449–460. doi:[10.1016/j.midw.2007.08.001](https://doi.org/10.1016/j.midw.2007.08.001).
- Persson, E.K., Fridlund, B., Kvist, L.J., Dykes, A., 2011. Mothers' sense of security in the first postnatal week: Interview study. *J. Adv. Nurs.* 67 (1), 105–116. doi:[10.1111/j.1365-2648.2010.05485.x](https://doi.org/10.1111/j.1365-2648.2010.05485.x).
- Persson, E.K., Kvist, L.J., 2014. Postnatal sense of security, anxiety and risk for postnatal depression. *J. Womens Health, Issues Care* 3 (3), 2. doi:[10.4172/2325-9795.1000141](https://doi.org/10.4172/2325-9795.1000141).
- Quadros, Garg, S., Ranjan, R., Vijayasarithi, G., Mamun, M.A., 2021. Fear of COVID 19 infection across different cohorts: a scoping review. *Front. Psychiatry* 12, 708430. doi:[10.3389/fpsy.2021.708430](https://doi.org/10.3389/fpsy.2021.708430).
- Reck, C., Klier, C.M., Pabst, K., Stehle, E., Steffanelli, U., Struben, K., Backenstrass, M., 2006. The German version of the Postpartum Bonding Instrument: psychometric properties and association with postpartum depression. *Arch. Womens Ment. Health* 9 (5), 265–271. doi:[10.1007/s00737-006-0144-x](https://doi.org/10.1007/s00737-006-0144-x).
- Rizzo, I., Watsford, C., 2020. The relationship between disconfirmed expectations of motherhood, depression, and mother-infant attachment in the postnatal period. *Aust. Psychol.* 55 (6), 686–699. doi:[10.1111/ap.12472](https://doi.org/10.1111/ap.12472).
- Thomas, D.R., 2006. A general inductive approach for analyzing qualitative evaluation data. *Am. J. Eval.* 27 (2), 237–246. doi:[10.1177/1098214005283748](https://doi.org/10.1177/1098214005283748).
- Rodríguez-Almagro, J., Hernández-Martínez, A., Rodríguez-Almagro, D., Quirós-García, J.M., Martínez-Galiano, J.M., Gómez-Salgado, J., 2019. Women's perceptions of living a traumatic childbirth experience and factors related to a birth experience. *Int. J. Environ. Res. Public Health* 16 (9), 1654. doi:[10.3390/ijerph16091654](https://doi.org/10.3390/ijerph16091654).
- Rossen, L., Mattick, R.P., Wilson, J., et al., 2019. Mother-infant bonding and emotional availability at 12-months of age: the role of early postnatal bonding, maternal substance use and mental health. *Matern. Child Health J.* 23, 1686–1698. doi:[10.1007/s10995-019-02809-1](https://doi.org/10.1007/s10995-019-02809-1).
- Schaming, C., Wendland, J., 2021. Évaluation du sentiment de sécurité postnatal chez les mères : adaptation et validation en langue française du Parents' Postnatal Sense of Security instrument (PPSSI). *Devenir* 33 (3), 181–207. doi:[10.3917/dev.213.0181](https://doi.org/10.3917/dev.213.0181).
- Thapa, S.B., Mainali, A., Schwank, S.E., Acharya, G., 2020. Maternal mental health in the time of the COVID-19 pandemic. *Acta Obstet. Gynecol. Scand.* 99, 817–818. doi:[10.1111/aogs.13894](https://doi.org/10.1111/aogs.13894).
- Vazquez-Vazquez, A., Dib, S., Rougeaux, E., Wells, J.C., Fewtrell, M.S., 2020. The impact of the Covid-19 lockdown on the experiences and feeding practices of new mothers in the UK: Preliminary data from the COVID-19 New Mum Study. *Appetite* 156, 104985. doi:[10.1016/j.appet.2020.104985](https://doi.org/10.1016/j.appet.2020.104985).
- Viaux, S., Maurice, P., Cohen, D., Jouannic, J.M., 2020. Giving birth under lockdown during the COVID-19 epidemic. *J. Gynecol. Obstet. Hum. Reprod.* 49 (6), 101785. doi:[10.1016/j.jogoh.2020.101785](https://doi.org/10.1016/j.jogoh.2020.101785).

- Le Vigouroux, S., Lebert-Charron, A., Wendland, J., Boujut, E., Scola, C., Dorard, G., 2021. COVID-19 and parental burnout: Parents locked down but not more exhausted. *J. Fam. Issues* 0 (0), 1–16. doi:[10.1177/0192513X211030038](https://doi.org/10.1177/0192513X211030038), Vol.
- Vogels-Broeke, M., de Vries, R., Nieuwenhuijze, M., 2021. Validating a framework of women's experience of the perinatal period; a scoping review. *Midwifery*, 102866 doi:[10.1016/j.midw.2020.102866](https://doi.org/10.1016/j.midw.2020.102866).
- Wendland, J., 2012. «Questionnaire Socio-démographique Postnatal – Projet COMPLIGRO – Vécu de la grossesse et de la maternité chez les femmes enceintes ou récemment accouchées ayant présenté des complications. de la grossesse». Université Paris Descartes, non-published.
- Werner-Bierwisch, T., Pinkert, C., Niessen, K., Metzger, S., Hellmers, C., 2018. Mothers' and fathers' sense of security in the context of pregnancy, childbirth and the postnatal period: an integrative literature review. *BMC Pregnancy Childbirth* 18 (1), 473. doi:[10.1186/s12884-018-2096-3](https://doi.org/10.1186/s12884-018-2096-3).
- Wiklund, I., Wiklund, J., Pettersson, V., Boström, A.-M., 2018. New parents' experience of information and sense of security related to postnatal care: A systematic review. *Sex Reprod. Healthc.* 17, 35–42. doi:[10.1016/j.srhc.2018.06.001](https://doi.org/10.1016/j.srhc.2018.06.001).
- Wittkowski, A., Wieck, A., Mann, S., 2007. An evaluation of two bonding questionnaires: a comparison of the mother-to-infant bonding scale with the postpartum bonding questionnaire in a sample of primiparous mothers. *Arch. Womens Ment. Health* 10 (4), 171–175. doi:[10.1007/s00737-007-0191-y](https://doi.org/10.1007/s00737-007-0191-y).
- Xiong, Lipsitz, O., Nasri, F., Lui, L.M., Gill, H., Phan, L., Chen-Li, D., Iacobucci, M., Ho, R., Majeed, A., McIntyre, R.S., 2020. Impact of COVID-19 pandemic on mental health in the general population: a systematic review. *J. Affect. Disord.* 277, 55–64. doi:[10.1016/j.jad.2020.08.001](https://doi.org/10.1016/j.jad.2020.08.001).
- Zanardo, Manghina, V., Giliberti, L., Vettore, M., Severino, L., Straface, G., 2020. Psychological impact of COVID-19 quarantine measures in northeastern Italy on mothers in the immediate postpartum period. *Int. J. Gynaecol. Obstet.* 150 (2), 184–188. doi:[10.1002/ijgo.13249](https://doi.org/10.1002/ijgo.13249).
- Zeng, Chen, L.-G., Yang, C.-M., Zeng, L.-P., Zhang, L.-Y., Peng, T.-M., 2021. Comment: mental health care for pregnant women in the COVID-19 outbreak is urgently needed. *Women Birth* 34 (3), 210–211. doi:[10.1016/j.wombi.2020.03.009](https://doi.org/10.1016/j.wombi.2020.03.009).