Research Square

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Social determinants of perinatal mental health and well-being: A social network analysis

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Abstract

Background

The transition to motherhood is a time of marked social changes. It is also a time of mental health vulnerability. This study examined the role that changes in women's social environment during the peripartum period have on mental health and well-being.

Methods

Adopting a matched case-control design, we used social network analyses to capture changes in the social environment of women during (N = 378) and outside (N = 378) the peripartum and measured individual differences in social sensitivity, anxiety and depressive symptoms, and mental well-being. Changes in social environments and their association with individuals' mental health and well-being were tracked three times across a six-month period.

Results

Compared to controls, peripartum women reported reduced social sensitivity, and greater emotional closeness, network density and family:friends ratio. Peripartum women also showed fewer mental health symptoms and greater well-being. Emotionally closer and closely-knit social environments were protective for women during the peripartum but not for controls.

Conclusions

The observed mental health and well-being benefits of social changes during the peripartum add to growing evidence of the peripartum as a time of heightened malleability characterised not only by vulnerability but also opportunity.

Background

The peripartum period, the time from conception to one year after birth, is a period of heightened vulnerability for the onset and recurrence of mental health problems in women[1], with as many as one in five experiencing anxiety (1) and/or depression (2). However, while average symptoms of anxiety and depression tend to show increases across pregnancy and the early postpartum period (e.g., (3)), analyses of symptom trajectories show that the largest group of people report consistently low symptoms despite going through a period of major biological and social changes (4). What's more, very few studies have directly compared symptoms in women in the peripartum to those outside the peripartum. Studies that have, largely show lower symptoms in peripartum compared to non-peripartum women (5–8). Understanding determinants of good mental health and well-being during the peripartum is essential to better inform mental health prevention efforts and identify novel avenues for intervention during this period.

Growing evidence suggests that the peripartum is not only a time of vulnerability, but also a time of heightened plasticity and opportunity (9). The novel environmental conditions and experiences of pregnancy, childbirth and the postpartum period - from physiological changes to caring for the child - may confer opportunities for adaptation (10, 11), the acquisition of new skills and maternal behaviours (12, 13), as well as cognitive advantages (14). Whether these adaptations could account for the large number of individuals who show persistently low levels of anxiety and depression across the peripartum period remains poorly understood.

Social (re)orientation

Arguably, a major (yet little researched) change during the peripartum, that may provide mental health benefits, is the social re-orientation towards the foetus and later the baby. Social re-orientation, the shift in social focus (15), has been more extensively studied in adolescence, another developmental period associated with significant hormonal changes, as well as changes in brain structure and function that are of similar magnitude to those observed during the peripartum (16–18). Considering social re-orientation from a lifespan perspective can provide insights into its potential role in maternal well-being.

Social re-orientation from a lifespan perspective

During adolescence, individuals become more independent from caregivers and re-orient their social behaviours and attention towards peers (15, 19). As their social environment expands beyond the family, the relationships with peers become increasingly rewarding and a relevant source of emotional support (20, 21), and stronger predictor of well-being than the relationships with caregivers (22). At the same time, however, the re-orientation towards peers can be a source of risk for mental health problems, as adolescents become more sensitive to social information in their environment, especially to social rejection (23). Social rejection sensitivity is elevated during adolescence (24, 25) and a factor associated with increased risk of anxiety and depression across the lifespan (26). Together, these findings suggest that the impact of social re-orientation towards peers in adolescence is two-fold: It is protective when it leads to strong social peer relationships but can also be a source of risk by elevating social sensitivity towards peer evaluation.

In the peripartum, instead, social sensitivity to peer evaluation may decrease, as a novel source of social affection and valuation is introduced into the parent's life. During this period, women – and arguably non-birthing partners though they are beyond the scope of this article – re-orient their social behaviours and attention towards the baby. While affection can take time to emerge (27), social orientation towards the baby is innate. Immediately following delivery, females of all species of mammals – likely triggered by hormones – shift their behaviour towards the care and the survival of their offspring (28–31). There is evidence that physical social behaviours, such as physical contact, benefit maternal well-being (e.g., (32, 33)). Little is known, however, about the impact of psychological changes following social re-orientation, including potential changes in social sensitivity, on maternal well-being.

Social networks to study social re-orientation

One way to explore changes in the social environment is through the analysis of social networks. Social networks are a way of representing social connections as a set of *nodes* (actors) and the *ties* (relationships) between them (34). By identifying relevant *alters*, individuals to whom people relate, and analysing the composition of networks and the characteristics of these relationships (e.g. emotional closeness), social network analyses can capture changes in individuals' social environments and how these interact with behavioural and health outcomes (35, 36).

Preliminary evidence examining social networks and maternal well-being has mainly focused on capturing the social support available to mothers (e.g., (37)). While not using formal network analyses, but instead deriving network size, frequency of contact and satisfaction with social contacts from 137 first-time parent dyads, one study showed that size and satisfaction with friends' networks decreased from the antenatal period to 24 months postpartum, whereas family networks' size and satisfaction showed an initial decrease early in the postpartum and then increased (38). Larger family networks and greater satisfaction with family and friend networks were associated with fewer symptoms of depression (38). While providing further evidence for the importance of social support, these findings fail to capture the process of social re-orientation during the peripartum.

The current study

The current study applied network analyses to capture changes in the social environment of women during the peripartum period, including changes in the interconnectedness (or density), emotional closeness and composition of their networks, reflecting social (re-) orientation. Adopting a matched case-control design, these changes and their association with individuals' mental health and well-being were tracked across a six-month period and compared to social network changes of age- and country-matched non-peripartum women. The adoption of a matched case-control design was particularly important in the context of the current study, as data was collected thrice in three-month intervals during the COVID-19 pandemic, which had considerable impacts on people's social connections. Women in the peripartum and controls would have been similarly affected, allowing us to infer that any group differences observed are due to peripartum status rather than the pandemic. To examine whether social re-orientation during the peripartum leads to reduced social sensitivity, the current study also measured individual differences in social sensitivity. Specifically, the study tested the following hypotheses: Social re-orientation among peripartum compared to non-peripartum control women would be reflected in reduced social sensitivity (H1a) and differences in social networks, with peripartum women reporting greater density, closeness and a higher family:friends ratio in their social networks compared to the control group, indexing a re-orientation towards the family environment (H1b); and this same pattern would be observed within the peripartum from pregnancy to postpartum (H1c). *H2*: These structural (i.e., degree and family:friends ratio) and functional (i.e., emotional closeness) network

changes would be associated with lower anxiety and depressive symptoms and greater well-being in peripartum compared to control women (H2a) and these association would strengthen within the peripartum period from pregnancy to postpartum (H2b).

Methods

Study design

Data was analysed from the COVID-19 Risks Across the Lifespan (CORAL) study (39) (https://www.thecoralstudy.com/). A three-wave longitudinal online study of the cognitive, social and psychological functioning during the COVID-19 pandemic that ran between May 2020 and April 2021. The study protocol was approved by the University of New South Wales Human Research Ethics Committee (HC200287).

Procedure

Participants were recruited via social media and advertisement in mothers' groups. After providing informed consent, participants completed an online survey at three assessment timepoints: baseline (T1), three months (T2) and six months (T3) follow-up. Participants responded to a series of questions concerning their pregnancy, COVID-19, mental health and well-being, and social networks. At each timepoint, every 100th participant was rewarded with an AUD$100 (GBP£50 or US$60) Amazon voucher, and those participants that completed T2 and T3 were compensated with an AUD $10 (GBP£5/ USD$6) voucher.

Participants

At T1, 742 participants from the CORAL sample (N = 3,208) reported being pregnant. Participants were included in the peripartum subsample of this study if they met the following inclusion criteria: (a) were pregnant at T1 as verified by the screening question and the provision of a due date, (b) were 17–45 years old at T1 and (c) completed the social network questions at least once. A sample of eligible non-peripartum participants was randomly selected. Participants were eligible for inclusion in the non-peripartum sample if they: (a) identified as female and reported consistent gender across timepoints, (b) were 17–45 years old at T1, (c) completed the social network alters question at least once, and (d) were not pregnant at all time points. From this group, the sample of non-peripartum control women was then selected. Participants were paired with a pregnant case based on exact matching by country, followed by greedy nearest-neighbour matching by age. Prioritisation was based on the number of completed time points. For each participant in the peripartum group, matched cases in the same country of residence were found. Next, from the pool of cases with more completed time points, we selected the case with the closest age. This resulted in two subsamples of similar ages and exact same country of residence including, 378 peripartum women (M_{age}= 32.21 years, *SD* = 4.66) and 378 non-peripartum control women (M_{age}= 31.49 years, *SD* = 7.51) who met all inclusion criteria. Samples differ in their educational background (see Table 1).

Table 1

Sample Demographics

Variable		Peripartum	Control	
n		378	378	t test / χ^2
Age		32.21 (4.66)	31.49 (7.51)	-1.59
Education	University	308 (81%)	271 (72%)	13.23***
	Professional/ Vocational training	45 (12%)	54 (14%)	
	High School	25 (7%)	53 (14%)	
Country	United States of America	104 (28%)	104 (28%)	0
	United Kingdom	160 (42%)	160 (42%)	
	Australia	114 (30%)	114 (30%)	
Ethnicity	Caucasian	328 (87%)	308 (81%)	7.99
	Asian	15 (4%)	21 (6%)	
	Hispanic	8 (2%)	5 (1%)	
	African	3 (1%)	5 (1%)	
	Aboriginal or Torres Strait Islander	1 (0%)	2 (1%)	
	Mixed	8 (2%)	18 (5%)	
	Other	12 (3%)	15 (4%)	
	Prefer not to say	2 (1%)	4 (1%)	
Have children in the house	Yes	181 (48%)	200 (53%)	1.71

Note. Demographic characteristics of the sample. *** $p < .001$

Measures

Only the measures used in the analyses for the present study are reported in the following section:

Social Networks

Participants provided information about their social networks. Participants were asked to endorse between one and six '*alters*', people with whom they spent most of their free time with over the past year before COVID-19 at T1, and over the past month in T2 and T3. For each alter, participants provided information about the nature of their relationship (e.g. friend, husband), how close they felt and how the alters in their network were related. Based on this information, the following parameters were obtained:

Density. Density reflects the number of connections within a network. It is computed by dividing the number of ties in a network by all possible ties in the network, using the following formula:

$$\frac{n + aa}{n + n\left(\frac{n-1}{2}\right)}$$

Where *n* is the number of alters in the network, and *aa* the number of ties between alters. A denser network would indicate that the network's members tend to know each other and that the network is oriented towards more closely knit, family-type relationships.

Closeness. Closeness reflects the strength of the connections within a network. For each alter, participants indexed how close they feel to that person from 1 ("Not close at all") to 10 ("Extremely close / closer than any other person I know"). Closeness was

computed as the average strength of all the ties in the network. Higher closeness reported in the network would reflect emotionally closer social environments.

Family:friends ratio. Family:friends ratio reflects the composition of a network. It was computed as the proportion of alters who are family members, compared to those who are friends. When participants did not report any friend alter, the variable was computed as the number of family members. A higher family:friends ratio would indicate a prioritisation of time spent with family members over friends.

Social Sensitivity

The 18-item Online and Offline Social Sensitivity Scale (O2S3) (26) was used to assess social sensitivity and was administered only at T1. The scale requires participants to index the extent to which they agree with statements describing feelings towards both online and offline interactions (e.g. "I worry about being criticised for things I have said or done"), from 0 (strongly disagree) to 3 (strongly agree). The scale is psychometrically well-validated across the lifespan (26). The scale demonstrated good internal consistency ($\omega = 0.92$).

Anxiety symptoms

The 7-item Generalized Anxiety Disorders-7 scale (GAD-7) (40) was used to measure symptoms of anxiety, with participants indicating how often they experienced symptoms of generalized anxiety (e.g. "Worrying too much about different things") over the past two weeks from 0 (not at all) to 3 (nearly every day). The scale is psychometrically well-validated, including in perinatal populations (41, 42). The scale demonstrated good internal consistency ($\omega_{T1} = 0.93$, $\omega_{T2} = 0.92$, $\omega_{T3} = 0.92$).

Depressive symptoms

The 8-item Patient Health Questionnaire (PHQ-8) (43) was administered to measure symptoms of depression. The scale requires participants to index how often they have experienced symptoms of depression (e.g. "Feeling down, depressed or hopeless") in the past 2 weeks from 0 (not at all) to 3 (nearly every day). The scale is psychometrically well-validated, including for use in the perinatal period (44). The scale demonstrated good internal consistency ($\omega_{T1} = 0.90$, $\omega_{T2} = 0.89$, $\omega_{T3} = 0.91$).

Mental well-being

The 7-item Short Warwick-Edinburgh Mental Well-being scale (WEMWBS) (45) was used to measure mental well-being. The scale requires participants to report how often they experienced certain feelings or thoughts (e.g. "I've been dealing with problems well") over the past two weeks from 1 (none of the time) to 5 (all of the time). The scale is psychometrically well-validated (45). The scale demonstrated good internal consistency ($\omega_{T1} = 0.87$, $\omega_{T2} = 0.87$, $\omega_{T3} = 0.87$).

Data analysis

All analyses were conducted in R (version 4.3.1). Linear mixed-effects models were conducted using the lme4 (46), lmerTest (47) and emmeans (48) packages. Effect sizes and confidence intervals were obtained using effectsize (49) and parameters (50) packages. Coefficients were standardised, with the exception of time, which was recoded as 0, 1, 2 for interpretability. Plot figures were made using ggplot2 (51, 52) and ggeffects (53) packages. Missing at random was assumed for all analyses. For further detail on missing data, please refer to the supplementary material (S1).

Group differences in social sensitivity were investigated with a linear regression. Linear mixed effect models were fitted to investigate group differences in social network indices (i.e., degree, closeness, family:friends ratio) and whether these vary across time.

The association of social re-orientation with mental well-being was tested separately for each mental well-being outcome (anxiety symptoms, depressive symptoms and mental well-being). For each outcome, a linear mixed-effect model was fitted to investigate the association of the outcome with social network measures over time and between groups. To limit overfitting due to the high multi-collinearity between the structural network indices density and family:friend ratio, only density and closeness were used as network indices.

These analyses were repeated in sensitivity analyses that tested whether any observed effects would hold, when controlling for potential confounds. First, to control for the observed group differences in education at baseline (Table 1), and because educational

attainment has been associated with mental health status (54, 55), educational background was included as a covariate in the models predicting mental health. Second, as social re-orientation also occurs during adolescence (10–24 years; (56)), and given the observed age-related differences in mental health in this cohort, with young people reporting poorer mental health (39), sensitivity analyses were conducted restricting the sample to participants aged 25 or over in the models predicting mental health. This restriction prevented the overlap of two developmental periods of marked social changes. Third, being in a relationship may confer mental health benefits (57), especially during periods of social isolation. While relationship status was not assessed in CORAL, relationship status was inferred from the social network composition at each timepoint. If participants indexed any of the members of their network as Husband/Wife or Boyfriend/Girlfriend they were coded as being in a relationship (yes/no). This variable was included as a covariate in the models predicting mental health. This inclusion would help elucidate whether differences in mental health between the peripartum and non-peripartum control groups are also associated with relationship status.

Finally, an exploratory analysis was conducted to examine whether these reductions in social sensitivity lasted beyond the peripartum. While the number of children someone had was not captured for non-pregnant participants in CORAL, there was a question on participants' household composition. Those who reported children in the household were classified as mothers. Repeating the social sensitivity analyses with maternal status as predictor would allow preliminary inferences on lasting reductions in social sensitivity. Additionally, testing the association of social re-orientation with well-being using maternal status as a predictor could provide preliminary evidence on the lasting protective effects of social re-orientation during the peripartum.

Analyses testing the association of social re-orientation with mental well-being were Bonferroni corrected with $\alpha \leq .016$ to account for the inclusion of three outcomes of interest (i.e., anxiety and depressive symptoms, mental well-being).

Results

Means and standard deviations of the analysed variables (Table S1) as well as bivariate correlations between variables (Table S2) can be found in the supplementary materials.

Social sensitivity in peripartum women and non-peripartum control women

As predicted, the peripartum group (M = 22.38) reported significantly lower levels of social sensitivity than the non-peripartum control group (M = 26.39); β = -4.01, SE = 0.85, t (577) = − 4.72, d = .39 [.23, .56], p < .001.

Social re-orientation in peripartum women and non-peripartum control women over time

Linear-mixed effects models yielded a significant main effect of both Group and Time on the three social network variables, with the peripartum group showing greater network density, closeness and family:friends ratio (Fig. 1) and the indices increasing over time (Table 2). The effect of Group did not interact with Time suggesting the differences in network structure and function observed in peripartum vs. control women remained stable across the three timepoints (Table 2).

Distribution of mean Density, Closeness and Family:friends ratio among peripartum and non-peripartum controls

Table 2

Linear mixed-effects models investigating group differences in social network indices and their variation over time.

	Density				**Closeness**				**Family:friends Ratio**			
	β	***SE***	***95% CI***	***p***	***β***	***SE***	***95% CI***	***p***	***β***	***SE***	***95% CI***	***p***
(Intercept)	**0.71**	**0.01**	**[0.69, 0.73]**	**< .001*** **	**7.28**	**0.08**	**[7.13, 7.43]**	**< .001*** **	**1.58**	**0.10**	**[1.39, 1.77]**	**< .001*** **
Group	**0.06**	**0.01**	**[0.03, 0.08]**	**< .001*** **	**0.50**	**0.10**	**[0.30, 0.71]**	**< .001*** **	**0.32**	**0.14**	**[0.06, 0.59]**	**.018***
Time	**0.03**	**0.01**	**[0.02, 0.05]**	**< .001*** **	**0.27**	**0.05**	**[0.17, 0.38]**	**< .001*** **	**0.28**	**0.06**	**[0.15, 0.40]**	**< .001*** **
Group × Time	0.01	0.01	[-0.01, 0.03]	.425	0.03	0.09	[-0.15, 0.20]	.771	0.12	0.10	[-0.08, 0.33]	.247

Note. **p* < .05, ***p* < .001

Social orientation as a predictor of well-being in peripartum women and non-peripartum women over time.

The linear mixed models examining whether differential network properties were differentially associated with mental health and well-being across groups and time showed a main effect of Group, with peripartum women reporting lower anxiety and depression and greater well-being (Fig. 2).

Anxiety and Depressive symptoms, and Mental Well-being among peripartum and non-peripartum controls.

Closeness also showed a significant main effect for depression and mental well-being, with closer networks being associated with greater well-being and fewer symptoms of depression. No significant effects of Time or Density or interactions were observed (Table 3).

Table 3

Linear mixed-effects models for all well-being outcomes including Density, Closeness, Group, and Time as covariates

	Anxiety model				**Depression model**				**Mental well-being model**			
	β	***SE***	***95% CI***	***p***	***β***	***SE***	***95% CI***	***p***	***β***	***SE***	***95% CI***	***p***
(Intercept)	8.84	0.32	[8.21, 9.48]	< .001***	10.18	0.33	[9.53, 10.84]	< .001***	20.56	0.27	[20.02, 21.10]	< .001***
Group	**-2.03**	**0.45**	**[-2.90, -1.15]**	**< .001*** **	**-2.43**	**0.46**	**[-3.33, -1.53]**	**< .001*** **	**1.65**	**0.37**	**[0.92, 2.38]**	**< .001*** **
Time	– 0.09	0.18	[-0.44, 0.26]	.616	-0.29	0.18	[-0.64, 0.07]	.115	0.05	0.17	[-0.28, 0.37]	.785
Density	0.16	0.26	[-0.35, 0.68]	.531	0.16	0.27	[-0.36, 0.69]	.546	0.11	0.24	[-0.36, 0.57]	.649
Closeness	-0.56	0.27	[-1.09, -0.02]	.042†	**-0.97**	**0.28**	**[-1.52, -0.43]**	**< .001*** **	**0.74**	**0.25**	**[0.26, 1.22]**	**.003***
Group x Time	-0.09	0.33	[-0.73, 0.55]	.779	0.34	0.33	[-0.31, 0.99]	.308	-0.58	0.30	[-1.17, 0.02]	.057
Group x Density	-0.72	0.41	[-1.53, 0.09]	.083	-0.20	0.42	[-1.03, 0.63]	.632	0.05	0.37	[-0.67, 0.77]	.891
Group x Closeness	0.33	0.44	[-0.54, 1.19]	.459	0.50	0.45	[-0.38, 1.38]	.268	-0.36	0.39	[-1.12, 0.40]	.355
Time x Density	0.26	0.20	[-0.13, 0.65]	.196	0.30	0.20	[-0.10, 0.69]	.143	-0.25	0.18	[-0.62, 0.11]	.169
Time x Closeness	-0.19	0.21	[-0.60, 0.22]	.357	-0.13	0.21	[-0.55, 0.28]	.527	0.22	0.19	[-0.16, 0.59]	.262
Group x Time x Density	-0.29	0.38	[-1.04, 0.46]	.447	-0.86	0.39	[-1.62, -0.10]	.026†	0.38	0.35	[-0.30, 1.07]	.270
Group x Time x Closeness	0.78	0.39	[0.01, 1.55]	.048†	0.57	0.40	[-0.21, 1.36]	.152	-0.09	0.36	[-0.79, 0.61]	.805

Note. †$p < .05$, *$p < .016$, ***$p < .001$

Sensitivity Analyses

Social sensitivity

Sensitivity analyses showed that the observed effect of social sensitivity remained significant after controlling for educational level. Higher educational level was associated with lower levels of social sensitivity (Table S3). When excluding adolescents (i.e., individuals age 24 years or younger) from the analyses (retained sample: $n_{control}$= 301, $n_{peripartum}$= 356), the group difference held (Table S4), with the peripartum group reporting lower social sensitivity compared to the non-peripartum controls. The same was observed when accounting for relationship status at Time 1, which did not have a significant effect on social sensitivity (Table S5).

Mental health and well-being

In the sensitivity analysis controlling for educational background (Table S6), the effect of Group remained. Higher education was associated with fewer mental health symptoms and greater well-being. Similarly, the effect of Group remained significant when accounting for relationship status, which did not have a significant effect on mental health or well-being (Table S7).

When excluding adolescents from the analyses, the main effect of Group remained significant for anxiety, depression and well-being. In the depression model the main effect was qualified by a higher-order three-way interaction between Group, Time, and Density (Table S8). For mental well-being, a significant two-way interaction was observed between Time and Density. No significant higher-order interactions were observed for anxiety symptoms.

Simple slope analyses were used to deconstruct the higher-order interactions for depression and well-being across time. These analyses showed that, over time, higher density was associated with fewer depressive symptoms in the peripartum group, whereas it was associated with greater symptoms of depression in the non-peripartum control group (Fig. 3, Table S9). Simple slopes analyses showed no statistically significant association between density and well-being at any timepoints. The observed pattern showed that the association was positive at T1, became negative at T2 and strengthened at T3 (Table S10).

Interaction between Time, Group and Density in Adult Women

Exploratory analyses

To examine whether reduced social sensitivity persists beyond the peripartum, having children was included as a predictor in the model testing H1a. Results showed that the effect of Group remained significant and having children showed an independent main effect, with those reporting having children in the household, reporting lower social sensitivity than individuals without children (Table S11). Similarly, having children in the household showed a significant main effect on depressive symptoms, with those reporting having children in the household, reporting fewer symptoms of depression (Table S12).

Discussion

While the peripartum is a period marked by changes in social behaviour and social focus, little is known about the impact of these changes on maternal mental health and well-being. Here, longitudinal data on social networks and social sensitivity captured social re-orientation during the peripartum period and its association with mental health. Social re-orientation was reflected in reduced social sensitivity, and greater network density, emotional closeness and family:friends ratio of peripartum compared to non-peripartum control women. Analyses of the association of the social network characteristics with mental health and well-being showed that peripartum women reported on average lower levels of anxiety and depressive symptoms and greater well-being compared to non-peripartum control women. However, network indices only significantly interacted with group status to predict symptoms of depression when excluding adolescents from the sample.

These results provide preliminary evidence of a shift towards family-oriented environments and support the theoretical framework suggesting that as focus shifts towards the offspring, mothers seek contact with their child and stable close relationships (i.e. family) (15). Although social sensitivity is an individual trait, which is a risk factor for mental health across the lifespan (26), our findings show this might be reduced during the peripartum, conferring a protective advantage as women re-orient toward a novel source of social affection and valuation. The observed differences in mental health symptoms and well-being between the two groups align with previous research showing that maternal psychological well-being peaks from pregnancy to postpartum, remaining higher than that of nulliparous control in the same period of time, and then decreasing (58). Additionally, emotionally closer networks were associated with greater well-being and fewer symptoms of depression. This supports previous research showing that social connections are protective for well-being (59).

The finding that, when limiting the sample to adult women, higher density was associated with fewer depressive symptoms in the peripartum group and more symptoms in controls, suggests that the orientation towards a closely-knit, family-related environment can be protective during the peripartum but not outside this period. During the peripartum, contact with the offspring and stable close relationships can be a source of well-being (15, 32, 33). Outside the peripartum, instead, diverse group affiliations (i.e., lower interconnectedness/less dense networks) have been shown to be protective (60). The impact of COVID-related social restrictions on social interaction then, may have particularly affected those with very dense friendship networks, who were additionally excluded from their groups due to the same restrictions. This effect of density on depressive symptoms, is in line with social theories of depression (e.g., social rank theory; social risk hypothesis) that argue individuals at-risk of depression are particularly sensitive to social group in- and exclusion (61–63). Together, these findings suggest that network composition can promote or adversely impact mental health, in particular symptoms of depression, differently at different developmental stages.

Our exploratory analyses examining whether the observed reductions in social sensitivity lasted beyond the peripartum period showed that those who have children in the household report lower social sensitivity than those who do not. Although this effect is smaller than the effect of group, this result suggests that reduced social sensitivity may last beyond the peripartum. Moreover, analyses showed that those who reported having children in the household reported fewer symptoms of depression. These results

align with previous studies indicating that the experience of pregnancy, childbirth and caregiving can lead to fundamental long-lasting changes for women (e.g. (14, 64, 65)).

While the impact of the mother-child relationship on child health and development has been long investigated (66, 67), the present study highlights how the shift in social focus towards the child can impact maternal well-being as well. The finding that, on average, women in the peripartum group reported better mental health, does not challenge the well-documented vulnerability to mental health problems during this period (e.g. (55, 68)). Instead, it suggests that for many women the peripartum is also a period with potential mental health benefits. In a larger, cross-sectional sample from the CORAL study, it was found that although anxiety and depressive symptoms were lower in pregnant compared to matched case-control women, the effect of COVID stress on mental health was greater for the pregnant group (69), indicating greater susceptibility to mental health risk factors for peripartum women. In the same line, our findings can be understood in light of the heightened plasticity that characterises this period (9–11). Our results suggest that, as for adolescents, the impact of the introduction of a new social target during the peripartum may be two-fold. Although the peripartum increases the exposure to mental health risk factors and perinatal stressors (70), including many infant-related stressors such as crying (71) and sleep deprivation (72), it may also protect mental well-being when reducing the sensitivity to social rejection and leading to emotionally closer relationships and closely-knit social environments.

It is noteworthy that the data was collected during the COVID-19 pandemic, when social interactions were naturally disrupted and interfered with, making this social network analysis a representation of a very specific time. However, the inclusion of a control group allows for inferring differences in social orientation between peripartum and non-peripartum women. Future research should examine these associations across longer time intervals to understand whether reduced social sensitivity is a gain for women's well-being in the long term in line with the preliminary evidence of the present findings.

Conclusions

In sum, this study captures the social re-orientation process during the peripartum and provides a more nuanced picture of risks and opportunities during the peripartum period. The findings provide evidence that the shift in social focus towards the pregnancy and then the child might be protective for maternal well-being, by reducing sensitivity to peer rejection and leading to emotionally closer and closely-knit environments. As maternal mental health remains a global concern, using a clinical and developmental perspective to examine the impact of peripartum changes on maternal well-being, are essential to inform mental health prevention and intervention efforts.

Declarations

Ethics approval and consent to participate

All participants provided their consent to participate in the research. The study protocol was approved by the University of New South Wales Human Research Ethics Committee (HC200287) and was performed in accordance with the 1964 Declaration of Helsinki and its later amendments. Clinical trial number: not applicable.

Consent for publication

Not applicable.

Availability of data and materials

For the full list of study measures please refer to (39). The data and materials are currently not publicly available. De-identified data and analyses script will be made available upon publication, they are accessible for review through a private link here: https://tinyurl.com/y2n7vmf3.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

FC and SS conceptualized and designed the study. FC and MM analysed data and drafted results. FC drafted the manuscript and SS substantially revised it. All authors read and approved the final manuscript.

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Footnotes

1. We use the term woman to refer to birthing people, as this will be more parsimonious in terms of word count. However, we acknowledge that people of any gender can be birthing parents.

Figures

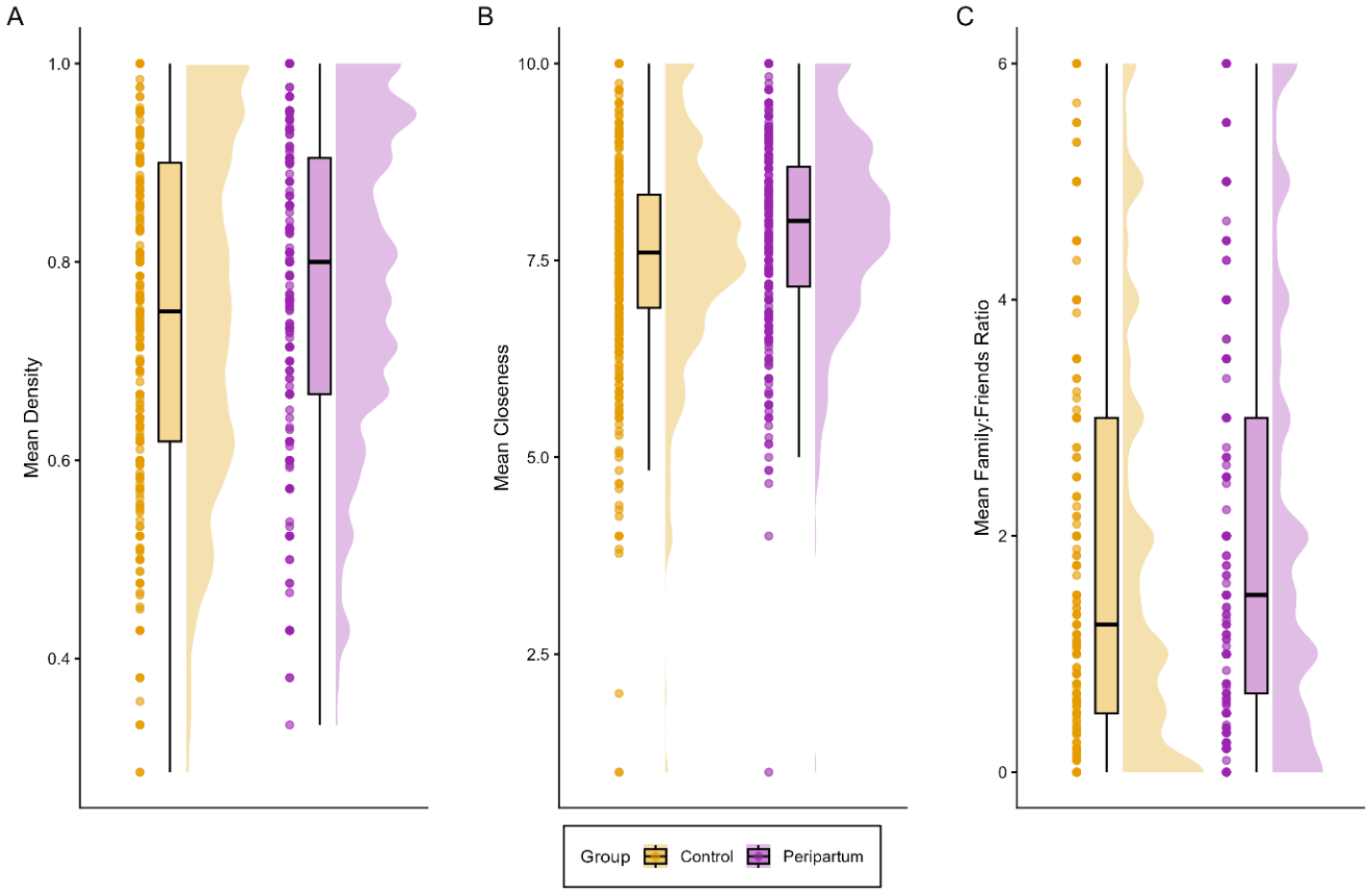


Figure 1

Distribution of mean Density, Closeness and Family:friends ratio among peripartum and non-peripartum controls

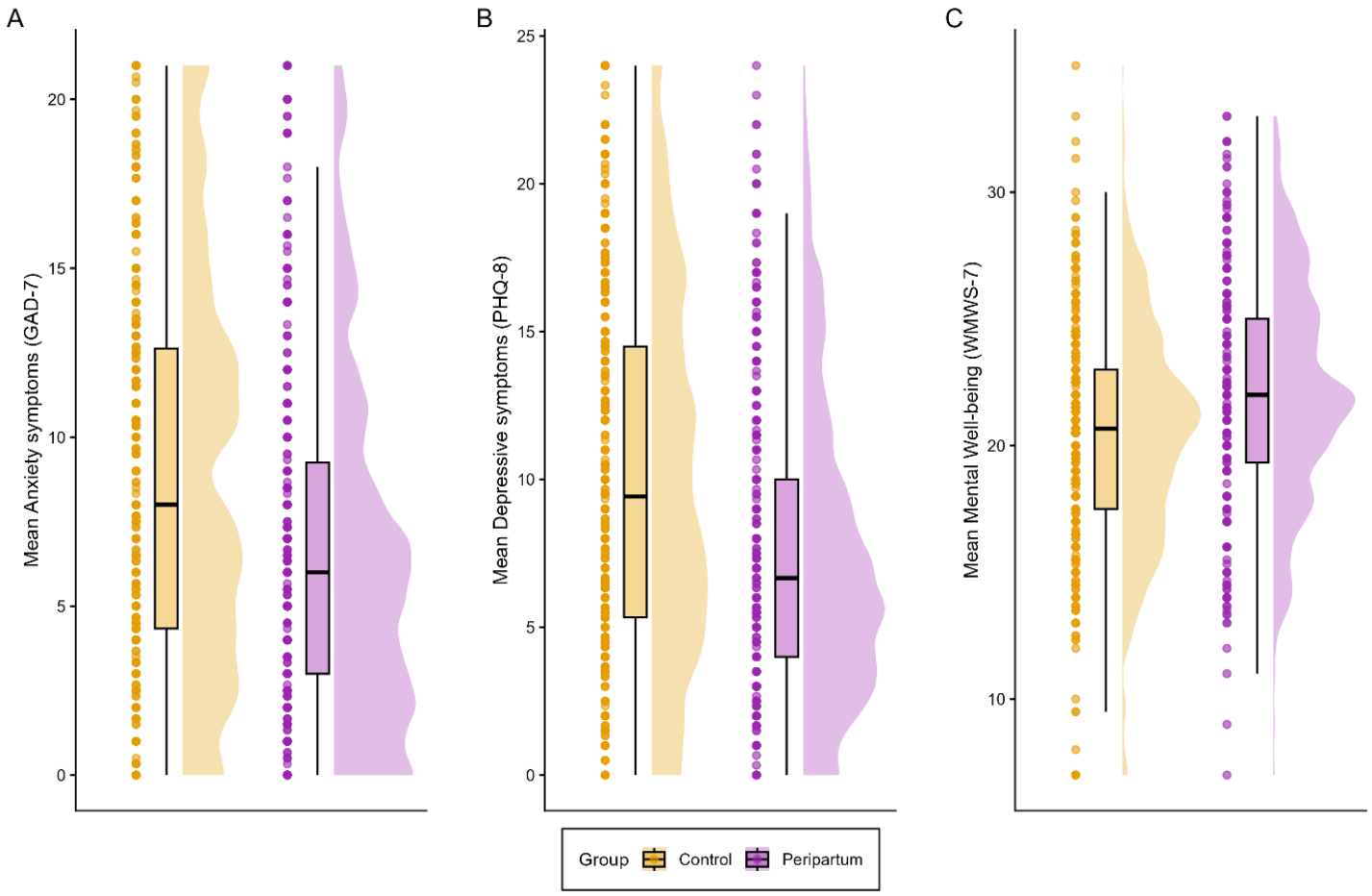


Figure 2

Anxiety and Depressive symptoms, and Mental Well-being among peripartum and non-peripartum controls

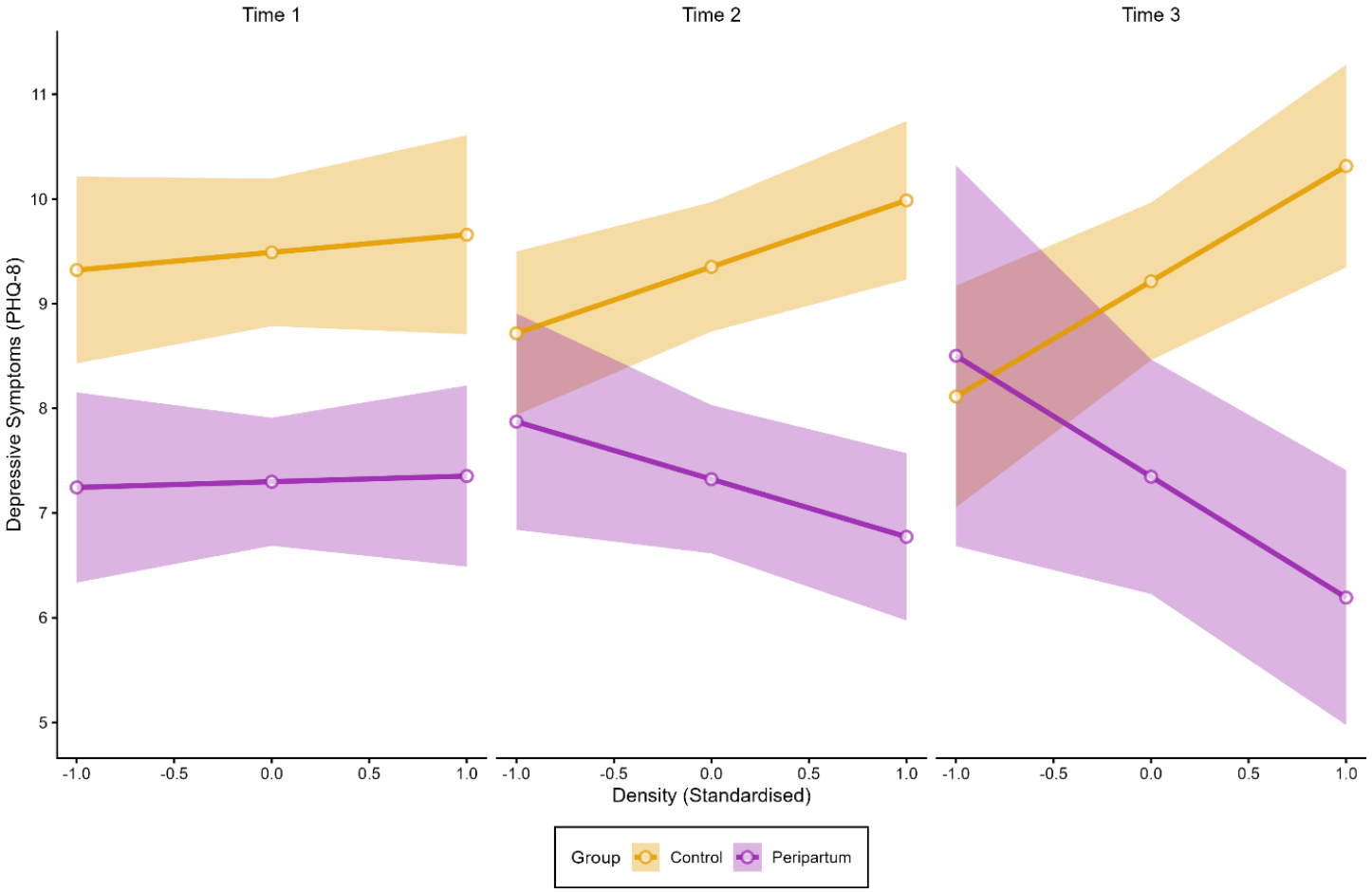


Figure 3

Interaction between Time, Group and Density in Adult Women

Supplementary Files

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