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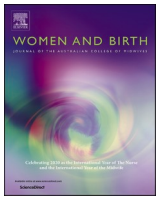

Original research

Pandemic-related prenatal maternal stress, model of maternity care and postpartum mental health: The Australian BITTOC study

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ABSTRACT

Problem: Women pregnant during the COVID-19 pandemic may be at risk of elevated postpartum mental health problems.
Background: Social support protects maternal mental health during a pandemic. It is possible that formal supports, such as continuity maternity models of care, may also support maternal wellbeing.
Aim: To investigate whether model of care moderates the association between prenatal maternal stress from the COVID-19 pandemic, and postpartum (a) depression and (b) anxiety.
Methods: Women in Australia, pregnant during the COVID-19 pandemic ($n = 3048$), completed a survey detailing their COVID-19-related objective hardship and subjective distress during pregnancy and completed depression and anxiety measures at birth to six weeks ("Early"), seven to 21 weeks ("Moderate"), and/or 22–30 weeks ("Late") postpartum.
Findings: Higher subjective distress was associated with elevated depression and anxiety at all timepoints. Model of care did not moderate the association of objective hardship or subjective distress and depression or anxiety at any timepoint. Compared with Standard Care, women receiving private midwifery care had a 74 % reduction in the odds of elevated anxiety in early postpartum.
Discussion: Women receiving private midwifery may have experienced lower anxiety due to a greater duration of postpartum in-home care, fewer changes to service delivery, and the option of homebirth. Women pregnant during a pandemic should be screened for higher subjective distress about the event.
Conclusion: These results suggest that continuity of private midwifery care may be beneficial for supporting postpartum mental health during a pandemic, with implications for practice and policy for the current and future pandemics.

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Statement of Significance

Problem or Issue:	Maternal postpartum mental health is a public health issue with great importance. Women pregnant during the 2019 coronavirus pandemic were at risk of elevated postpartum depression and anxiety compared with pre-pandemic times.
What is Already Known:	Research suggests that continuity models of care may be associated with lower postpartum anxiety and depression amongst women experiencing higher prenatal maternal stress due to a natural disaster.
What this Paper Adds:	Women who received care from a private midwife reported 74 % reduced odds of elevated anxiety during early postpartum. This may have been due to this model offering more in-home postpartum support, fewer changes to service delivery, and the option of homebirth.

Introduction

The COVID-19 pandemic has seen a global increase in perinatal mental health concerns, including anxiety and depression [1]. Identifying protective factors for perinatal wellbeing during a pandemic has important implications for the prevention of postpartum mental health concerns. One such factor is greater perceived social support from family and friends [2,3].

Formal sources of social support may also be protective. Continuity of maternity care from a midwife or other maternity care providers may offer protection for women experiencing stress in pregnancy due to a natural disaster. Kildea, Simcock [4] found, in a sample of Australian women pregnant during a catastrophic flood, that those who reported greater objective hardship (i.e., the degree to which they experienced threat, losses and changes) or greater subjective distress (i.e., the intensity of emotional distress they felt during and after the flood) reported greater maternal depression and anxiety at 6-weeks postpartum, but only if they received Standard Care (any of the nine routine public hospital or General Practitioner (GP) shared care models). For women receiving midwifery group practice continuity of midwifery care across pregnancy, birth and up to 6-weeks postpartum through a primary midwife within a small team of backup midwives, the association between flood-related prenatal maternal stress (PNMS) and symptoms of depression and anxiety at 6-weeks postpartum was buffered [4]. The authors proposed that the protective effect offered by midwife-led continuity of care (COC) may be due to the greater "relational continuity" (facilitation of a trusting relationship), the 24/7 phone contact available from their midwife and social support afforded by this model of care [5], including a greater intensity and duration of postnatal support compared with Standard Care.

While the Kildea et al. [4] study focused on midwife-led COC compared with standard care, in Australia there are many models of care (MOC) banded together into 11 major models, which vary in the relational continuity offered [6]. Overall, 29 % of models of maternity care in Australia involve COC across the whole maternity period, that is, the antenatal, intrapartum, and postpartum periods [6]. These include the major model categories of midwifery group practice (referred to here as "Continuity with a public midwife"), private midwifery care (PPM) and private obstetrician/private midwife joint care, while 90 % of private obstetrician care models involve continuity across the whole maternity period [6]. The two largest models of maternity care are public hospital maternity care (41 % of models, referred to here as "standard care") and care shared between the GP and the public hospital maternity care team ("GP shared care"; 15 % of models), which both involve intrapartum care provided by hospital midwives working shift work, hence COC is low [6]. The length and type (telehealth, in home or hospital/clinic based) of postpartum care also varies across the MOC and were impacted differently during the pandemic [7].

It is yet to be determined whether COC models of maternity care may protect the wellbeing of women birthing during a pandemic. Cummins et al. [8] found that women receiving full COC during COVID-19 were less likely to report changes to pregnancy care, and more likely to view any changes as neutral or positive, when compared to women receiving partial or no COC. However, in the same cohort, there was no association between COC and symptoms of prenatal depression, anxiety or stress. No research to our knowledge has examined the role of model of maternity care for influencing maternal mental health in the postpartum period during the pandemic.

We aimed to determine whether the model of maternity care moderates the association between severity of pandemic-related PNMS and postpartum maternal depression and anxiety. We hypothesised that greater prenatal objective hardship or subjective distress will be associated with a higher likelihood of postpartum depression or anxiety for women receiving low continuity MOC (GP shared care, standard care), but that this association will be buffered for women receiving high continuity models of care (continuity with a public midwife, PPM or private obstetrician). We tested this hypothesis at early (birth to six weeks), moderate (seven to 21 weeks) and late (22–30 weeks) postpartum periods due to the time-sensitive findings of Kildea et al. [4]. We expected the protective effect of COC to be particularly evident in the early postpartum period, whilst maternity care continues to be provided.

Methods

Participants and procedure

The Birth in the Time of COVID-19 (BITTOC) study is a mixed-method, longitudinal study investigating the pandemic-related experiences and mental health of birthing women during the pandemic. The BITTOC study included English-speaking Australian women over 18 years of age who were pregnant and/or birthed a live singleton child at any time during the first and second waves of the COVID-19 pandemic in Australia (i.e., after 20 March 2020). The current study was restricted to women responding up to approximately 6-months postpartum (maximum 30 weeks). Participants were recruited through social media, maternity and parenting websites to complete an online survey using the Qualtrics platform. Survey responses were carefully scrutinised and potential fraudulent responses excluded. An initial recruitment survey was administered from August 2020 to March 2021 and was relaunched from August 2021 to April 2022. After submitting informed consent, participants were presented with questions regarding their COVID-19-related experiences during their pregnancy to date and their current mental health symptoms. A follow-up survey was administered approximately two months after each woman's due date to obtain information about her maternity care experiences across her entire pregnancy and birth, and to assess her postpartum mental health. Women who indicated on the recruitment survey that they had already given birth were administered a combination of the recruitment survey and the two-month follow-up survey at the initial assessment. All participants were invited to participate in a follow-up survey at approximately 6-months postpartum (maximum 30-weeks). Due to the novelty of this study, it was not possible to conduct sample size calculations, however, the final sample size exceeded existing guidelines for events per variable for logistic regression [9].

Measures

Prenatal Maternal Objective Hardship was assessed after the birth, from either the recruitment survey (if administered postnatally), or from the 2-month survey (for prenatal recruitments). Participants completed an instrument developed to assess objective hardship during pregnancy due to COVID-19 (the BITTOC Assessment of Stress Due to COVID; BASC150). The BASC150 has three main pandemic-related subscales: Threat50 (level of threat of COVID-19 infection), Loss50 (financial losses) and Change50 (changes to daily life and pregnancy care). Each subscale is worth a maximum of 50 points, and scores are summed to create a total objective hardship score (BASC150). Higher scores indicate greater objective hardship, with negative scores reflecting improvements due to the pandemic. Refer to [10] for scale items and scoring.

Prenatal Maternal Subjective Distress levels were assessed at the same time as the BASC150. The SubjectiveDistress200 (SD200) scale was developed to assess the degree to which women experienced distress due to various aspects of the pandemic, based on previous natural disaster research, as detailed above. The SD200 is comprised of two subscales: Pregnancy-related Subjective Distress (degree of distress experienced due to changes to her maternity care and birth plans, and concerns about potential impacts of the pandemic on the birth and postpartum care) and Non-Pregnancy Subjective Distress (degree of distress regarding other pandemic concerns such as changes in finances, loneliness, and sleep). The two subscales are summed with total scores ranging from −15–200; higher scores reflect greater intensity of subjective distress, while negative scores indicate positive changes. Refer to [10] for scale items and scoring.

Maternal Postpartum Depression was assessed in the postnatal recruitment survey, and at the two-month and six-month follow-up surveys. The Edinburgh Postnatal Depression Scale (EPDS) is a 10-item scale developed to assess symptoms of depression during the postpartum period [11]. The EPDS has a maximum score of 30 and shows good psychometric properties [11]. EPDS scores were dichotomised, with scores $\geq$13 reflecting elevated depressive symptoms [11,12].

Maternal Postpartum Anxiety was assessed in the postnatal recruitment survey, and at the two-month and six-month follow-up surveys. The Depression Anxiety and Stress Scales Short Form contains 21 items, including an anxiety subscale (DASS Anxiety) comprising seven items assessing the severity of anxiety over the preceding week. The DASS-21 possesses strong validity and reliability in clinical and non-clinical samples [13–15], including postpartum samples [16]. We used the cut-off for "mild" symptoms [>8; 13] to identify participants experiencing "elevated" anxiety symptoms in our analyses.

Model of Maternity Care was determined from data provided after the birth, whether from the recruitment survey or the two-month postpartum survey. Participants identified their maternity care provider and MOC, which was coded according to the categories and characteristics set out in Table 1 and described previously [6,17]. Only participants who identified a MOC were included in the current study. Participants also provided information on postnatal care received (see Table S1).

Potential covariates were assessed in the recruitment survey, whether completed during or after pregnancy. Women reported on their demographics (education, household income), antenatal factors (parity, presence of serious antenatal medical risk factors), and mental health treatment history.

Statistical analysis

Data were analysed using SPSS v28.0 and Stata 16 [18]. Descriptive analyses were conducted for demographic and study variables using Spearman correlations, chi-square test for association and Welch's ANOVA. Variables associated with the outcome variables and/or with significant differences between MOC groups were included as covariates in the main analyses. Absence of multicollinearity of predictor variables was confirmed through inspection of Spearman correlation matrix and variance inflation factor. Hierarchical multivariable logistic regression analyses were run to test the association of the predictors with each dichotomised postpartum outcome (EPDS, DASS Anxiety). At Step 1, objective hardship (BASC150) and subjective distress (SD200), MOC (standard care, continuity with a public midwife, continuity with a doctor, GP shared care and PPM) and potential covariates (no university/university education, household income above $100,000/below $100,000, past mental health treatment = no/yes, primiparity/multiparity and serious antenatal medical risk factors = no/yes) were entered at Step 1. At Step 2, the PNMS x MOC interaction terms ("objective hardship x MOC" and "subjective distress x MOC") were entered into two separate models, due to the small size of some MOC categories. Accordingly, for each of the three postpartum periods and two outcomes, two interactions were tested, resulting in 12 models in

Table 1
Coding and characteristics of models of maternity care.

Model of care category	Specific models coded within category	Characteristics of models in this category
Standard care	– Public hospital maternity care; – Public hospital high-risk maternity care; – Remote area maternity care; – Aboriginal and Torres Strait Islander Maternity Services; – Other.	– Antenatal care provided in hospital outpatient clinics by midwives and/or doctors; – Women seen by a different care provider on each occasion, including at the birth.
Continuity with a public midwife	– Midwifery group practice caseload care (continuity of care with midwife); – Aboriginal and Torres Strait Islander Maternity Services (continuity of care).	– Antenatal care is provided by a known primary midwife or small team of midwives; – Intrapartum care is provided in a hospital or birth centre by a known midwife; – Postnatal care provided in the home or community up to 6 weeks post-birth.
Continuity with a doctor	– Private obstetrician; – General practitioner (GP) obstetrician care (attends birth); – Private obstetrician and privately practicing midwife joint care.	– Antenatal care is provided by a private specialist obstetrician or GP obstetrician and may include collaboration with a privately practicing midwife; – Intrapartum care provided in hospital by private specialist obstetrician/GP obstetrician and hospital midwives, including privately practicing midwife where applicable; – Postnatal care provided in the hospital by private specialist obstetrician/GP obstetrician and hospital midwives.; – Postnatal care may continue in the home or community.
General practitioner shared care	– GP Shared care (doesn't attend birth)	– Antenatal care provided by a General Practitioner in collaboration with hospital care; – Intrapartum care provided by hospital midwives and doctors.
Private midwife	– Privately practising midwife	– Antenatal, intrapartum and postnatal care provided by a single midwife or group of midwives; – Can be provided in a range of locations.

Note. Adapted from [6] and [17]

Table 2
Participant characteristics across models of maternity care.

Variable	Standard care (n = 1052)	Continuity of care with midwife (n = 595)	Continuity of Care with Doctor (n = 983)	GP Shared Care (n = 243)	Private Midwife (n = 175)	Total[a] (n = 3048)	p-value
	N (%)	*N* (%)	*N* (%)	*N* (%)	*N* (%)	*N* (%)	
Maternal demographics							
Household income							
Less than $100,000	347 (34.4 %)	161 (28.3 %)	119 (13.1 %)	67 (29.0 %)	61 (36.1 %)	755 (26.2 %)	<0.001
More than $100,000	663 (65.6 %)	408 (71.7 %)	787 (86.9 %)	164 (71.0 %)	108 (63.9 %)	2130 (73.8 %)	
Maternal education							
TAFE or Diploma and below	405 (38.7 %)	188 (31.7 %)	183 (18.6 %)	70 (28.8 %)	405 (38.7 %)	889 (29.3 %)	<0.001
Undergraduate or Postgraduate	641 (61.3 %)	405 (68.3 %)	799 (81.4 %)	173 (71.2 %)	641 (61.3 %)	2148 (70.7 %)	
University							
Previous mental health treatment							
No treatment	545 (54.1 %)	348 (60.0 %)	541 (58.0 %)	136 (57.6 %)	79 (47.3 %)	1654 (56.5 %)	0.022
Previous treatment	462 (45.9 %)	232 (40.0 %)	392 (42.0 %)	100 (42.4 %)	88 (52.7 %)	1274 (43.5 %)	
Antenatal Factors							
Parity							
Primiparous	531 (50.5 %)	300 (50.5 %)	471 (47.9 %)	141 (58.0 %)	54 (31.0 %)	1497 (49.1 %)	<0.001
Multiparous	521 (49.5 %)	294 (49.5 %)	512 (52.1 %)	102 (42.0 %)	120 (69.0 %)	1549 (50.9 %)	
Antenatal risk factors							
None/mild risk factors	841 (79.9 %)	556 (93.4 %)	856 (87.1 %)	214 (88.1 %)	167 (95.4 %)	2634 (86.4 %)	<0.001
Serious risk factors	211 (20.1 %)	39 (6.6 %)	127 (12.9 %)	29 (11.9 %)	8 (4.6 %)	414 (13.6 %)	

Note. [a] sample sizes vary due to missing values on some variables.

total. Any significant interactions were probed by running separate models for high and low objective hardship and/or subjective distress groups, and Firth's penalised logistic regression [19] was used due to small model of care group size in some analyses.

Results

Participant characteristics

A total of 3048 women provided valid and complete data on MOC and at least one outcome variable (EPDS or DASS Anxiety). Women birthed between 21st March 2020 and 27th March 2021, with 398 women (13.1 %) recruited during pregnancy and 2650 (86.9 %) recruited postnatally. Maternal demographics and background variables according to MOC are reported in Table 2. Participants were mostly over 35 years old, married or in a de facto relationship, and born in Australia. Most reported a tertiary education and household income over $100,000 per annum. Women receiving continuity from a doctor were more likely to report higher income and education, whilst women cared for by a PPM were more likely to be multiparous and report previous mental health treatment. Women receiving standard care were more likely to have been told that they have serious antenatal medical risk factors. In terms of postpartum care, most women (73.2 %) receiving care from a PPM reported receiving visits at home from a midwife up to six weeks post-birth (Table S1). Most women across models reported receiving home visits for fewer than two weeks, with 31.8 % of women reporting no post-birth home visits from a midwife.

The BITTOC study was designed as a longitudinal, repeated measures study, but with a cross-sectional recruitment process, inviting women across the perinatal period to provide information about their COVID-19 experiences. Most women only completed the survey once during the first six months postpartum (n = 2110, 69.2 %), with 540 (17.7 %) women completing both the postpartum recruitment and six-month follow-up survey. Of women recruited prenatally (n = 398), 119 (3.9 % of the sample) completed the two-month follow-up measure only, with 279 (9.2 %) completing both two-month and six-month follow-up surveys.

As women completed surveys at different postpartum stages, data were grouped according to infant age at time of completion of the outcome measures, as follows: Early ("0–6 weeks", M = 3.38 weeks, SD = 1.88, n = 761), Moderate ("7–21 weeks", M = 12.67 weeks, SD = 3.98, n = 2119) and Late postpartum ("22 – 30 weeks", M = 25.85 weeks, SD = 2.10, n = 830). When categorised in this way, some women provided outcome data at more than one time-period; 220 women provided mental health data at both Early and Late postpartum periods, and 599 women provided data at both Moderate and Late postpartum periods. No participants provided mental health data at all three postpartum periods.

Table S2 presents the Spearman correlations among the primary predictor, outcome variables and covariates for the three postpartum time periods. Objective hardship and subjective distress showed moderate to strong correlations, and anxiety and depression were highly correlated at each time point.

Main analyses

Early Postpartum Period. As shown in Table 3, 19.7 % (n = 150) scored above the cut-off for elevated depression during the first six weeks postpartum. In the multivariable logistic regressions at Step 1 (Table 4), greater odds of elevated depression were associated with greater subjective distress after controlling for maternal characteristics. Women having their first baby and those reporting a previous mental health treatment also had greater odds of elevated depression. The interactions of objective hardship (χ^2 (4) = 8.028, p = 0.091) and subjective distress (χ^2 (4) = 3.256, p = 0.516) with MOC at Step 2 were nonsignificant.

A similar rate of elevated anxiety (17.7 %; n = 131) was found for women during early postpartum. In the multivariable logistic

Table 3
Pandemic-related prenatal maternal stress and mental health according to model of care.

Variable	Standard care	Continuity of care with midwife	Continuity of Care with Doctor	GP Shared Care	Private Midwife	Total	*p*-value
	Mean (SD) or *N* (%)	Mean (SD) or *N* (%)	Mean (SD) or *N* (%)	Mean (SD) or *N*(%)	Mean (SD) or *N*(%)	Mean (SD) or *N* (%)	
Prenatal maternal stress							
Objective hardship (BASC150)	24.87 (15.38)	22.47 (14.26)	21.18 (13.62)	24.12 (14.47)	22.13 (15.76)	22.99 (14.64)	<0.001
Subjective Distress (SD200)	73.36 (30.24)	67.37 (30.84)	68.39 (30.09)	75.09 (31.02)	63.27 (36.85)	70.15 (30.94)	<0.001
Postpartum maternal mental health							
Early (0–6 weeks)							
Elevated depression	62 (23.8 %)	25 (15.9 %)	48 (20.5 %)	10 (17.2 %)	5 (9.6 %)	150 (19.7 %)	0.095
Elevated anxiety	57 (22.6 %)	24 (15.9 %)	33 (14.4 %)	14 (24.6 %)	3 (6.0 %)	131 (17.7 %)	0.013
Moderate (7–21 weeks)							
Elevated depression	149 (20.3 %)	58 (14.2 %)	105 (15.3 %)	34 (19.7 %)	26 (22.6 %)	372 (17.6 %)	0.018
Elevated anxiety	149 (20.8 %)	82 (20.7 %)	94 (14.1 %)	39 (22.5 %)	24 (21.2 %)	388 (18.8 %)	0.006
Late (22–30 weeks)							
Elevated depression	56 (20.7 %)	26 (17.8 %)	41 (14.0 %)	13 (18.6 %)	8 (16.0 %)	144 (17.4 %)	0.347
Elevated anxiety	20 (7.1 %)	9 (6.2 %)	12 (4.2 %)	4 (6.9 %)	4 (8.2 %)	49 (6.0 %)	0.591

Note. Elevated depression (EPDS≥13); Elevated anxiety (DASS Anxiety≥8)

Table 4
Multivariable logistic regression predicting depression and anxiety in early postpartum (0–6 weeks).

	Early postpartum maternal mental health							
	Depression (n = 698)				Anxiety (*n* = 677)			
	Odds Ratio	95 % C.I.		*p*-value	Odds Ratio	95 % C.I.		*p*-value
		Lower	Upper			Lower	Upper	
Covariates								
Maternal university education	0.627	0.389	1.010	0.055	0.583	0.356	0.953	0.031
Household income > $100,000	0.713	0.445	1.143	0.160	0.740	0.456	1.201	0.223
Previous mental health treatment	1.966	1.300	2.973	0.001	1.841	1.187	2.856	0.006
Multiparous	0.458	0.302	0.693	<0.001	0.429	0.276	0.666	<0.001
Serious antenatal risk factors	1.080	0.614	1.900	0.790	1.741	0.993	3.053	0.053
Prenatal maternal stress								
Objective Hardship	0.995	0.979	1.012	0.588	1.009	0.992	1.026	0.321
Subjective Distress	1.029	1.020	1.037	<0.001	1.021	1.013	1.030	<0.001
Model of care								
Continuity with public midwife[a]	0.755	0.419	1.360	0.349	0.873	0.482	1.583	0.655
Continuity with doctor[a]	1.181	0.709	1.965	0.523	0.688	0.391	1.210	0.194
GP shared care[a]	0.649	0.287	1.468	0.299	1.201	0.568	2.541	0.632
Private midwife[a]	0.441	0.148	1.315	0.142	0.260	0.069	0.975	0.046
Constant	0.064			<0.001	0.074			<0.001
Omnibus test	χ^2 (11) = 123.137, p <0.001				χ^2 (11) = 112.855, p <0.001			

[a] Reference group = Standard care. Only significant steps in the model are presented here.

regressions at Step 1 (Table 4), elevated anxiety was significantly associated with greater subjective stress, and there was a main effect for PPM care; women receiving care through a PPM had ~74 % reduction in the odds of elevated anxiety symptoms compared with women receiving standard care. Of the covariates, lower maternal education, previous mental health treatment and primiparity were also associated with elevated anxiety at this timepoint. At Step 2, MOC did not moderate the association between objective hardship or subjective distress and anxiety.

Moderate postpartum period

For women reporting when their infants were between 7 and 21 weeks old, 17.5 % (n = 372) reported elevated depression symptoms. At Step 1 (see Table 5), elevated depression was significantly associated with greater subjective distress during pregnancy after controlling for maternal background variables, of which previous mental health treatment and serious antenatal risk factors were also associated with greater odds of depression. At Step 2, MOC did not moderate the association between objective hardship (χ^2 (4) = 3.724, p = 0.445) or subjective distress (χ^2 (4) = 6.520, p = 0.164) and maternal postpartum depression during this period.

Of women who reported on their anxiety and MOC at 7–21 weeks, 18.8% (n = 388) scored in the elevated range. Elevated anxiety was significantly associated with greater prenatal subjective distress in the multivariable model, along with lower maternal education and previous mental health treatment. MOC did not moderate the association between objective hardship (χ^2 (4) = 3.851, p = 0.427) or subjective distress (χ^2 (4) = 1.954, p = 0.744) and anxiety.

Late postpartum period

Women who provided MOC and outcome data when their infants were 22–30 weeks showed a rate of elevated depression of 17.4 % (n = 144). In the multivariable model, elevated depression was significantly associated with greater subjective distress during pregnancy at Step 1,

Table 5
Multivariable logistic regression predicting depression and anxiety in moderate postpartum (7–21 weeks).

	Moderate postpartum maternal mental health							
	Depression (n = 1922)				Anxiety (n = 1874)			
	Odds Ratio	95 % C.I.		p-value	Odds Ratio	95 % C.I.		p-value
		Lower	Upper			Lower	Upper	
Covariates								
Maternal university education	0.843	0.639	1.112	0.228	0.705	0.538	0.924	0.011
Household income > $100,000	0.826	0.619	1.102	0.194	0.785	0.591	1.042	0.094
Previous mental health treatment	2.041	1.586	2.627	<0.001	2.297	1.786	2.954	<0.001
Multiparous	1.024	0.797	1.315	0.854	0.944	0.736	1.210	0.649
Serious antenatal risk factors	1.447	1.037	2.020	0.030	1.347	0.960	1.890	0.085
Prenatal maternal stress								
Objective Hardship	0.999	0.990	1.009	0.864	0.999	0.990	1.009	0.913
Subjective Distress	1.022	1.017	1.027	<0.001	1.022	1.017	1.027	<0.001
Model of care								
Continuity with public midwife[a]	0.784	0.545	1.127	0.188	1.278	0.908	1.798	0.160
Continuity with doctor[a]	0.886	0.646	1.214	0.450	0.897	0.649	1.240	0.510
GP shared care[a]	0.948	0.594	1.512	0.822	1.140	0.722	1.801	0.574
Private midwife[a]	1.389	0.820	2.353	0.222	1.267	0.735	2.185	0.394
Constant	0.038			<0.001				<0.001
Omnibus test	χ^2 (11) = 187.310, p <0.001				χ^2 (11) = 213.193, p <0.001			

[a] Reference group = Standard care. Only significant steps in the model are presented here.

Table 6
Multivariable logistic regression predicting depression and anxiety in late postpartum (22–30 weeks).

	Late postpartum maternal mental health							
	Depression (n = 750)				Anxiety (n = 742)			
	Odds Ratio	95 % C.I.		p-value	Odds Ratio	95 % C.I.		p-value
		Lower	Upper			Lower	Upper	
Covariates								
Maternal university education	1.397	0.852	2.292	0.185	0.438	0.225	0.855	0.015
Household income > $100,000	0.635	0.397	1.015	0.058	0.934	0.462	1.888	0.848
Previous mental health treatment	2.115	1.408	3.177	<0.001	2.385	1.237	4.597	0.009
Multiparous	0.846	0.567	1.262	0.412	1.597	0.837	3.049	0.156
Serious antenatal risk factors	1.323	0.756	2.314	0.327	2.008	0.938	4.296	0.072
Prenatal maternal stress								
Objective Hardship	0.996	0.981	1.012	0.649	0.995	0.973	1.018	0.690
Subjective Distress	1.020	1.012	1.028	<0.001	1.018	1.006	1.030	0.002
Model of care								
Continuity with public midwife[a]	1.044	0.591	1.844	0.881	1.219	0.505	2.939	0.660
Continuity with doctor[a]	0.764	0.461	1.266	0.296	0.857	0.379	1.937	0.711
GP shared care[a]	0.711	0.309	1.638	0.423	1.358	0.417	4.418	0.611
Private midwife[a]	1.036	0.447	2.403	0.934	1.394	0.418	4.655	0.589
Constant	0.046	0.020	0.109	<0.001	0.014	0.004	0.051	<0.001
Omnibus test	χ^2 (11) = 69.908, p <0.001				χ^2 (11) = 41.029, p <0.001			

[a] Reference group = Standard care. Only significant steps in the model are presented here.

along with previous mental health treatment. At Step 2, MOC did not moderate the association between objective hardship (χ^2 (4) = 0.825, p = 0.935) or subjective distress (χ^2 (4) = 3.421, p = 0.490) and depression.

Women providing anxiety outcome data in this period reported elevated anxiety at a rate of 6 % (n = 49). At Step 1, elevated anxiety was significantly associated with greater subjective distress during pregnancy, after controlling for covariates (see Table 6). Of these, lower maternal education and previous mental health treatment were both associated with greater odds of elevated anxiety. At Step 2, MOC significantly moderated the association between prenatal objective hardship and elevated anxiety (χ^2 (4) = 11.864, p = 0.018); however, probing the interaction found no significant conditional effects (data not shown). There was also evidence of moderation of the association between subjective distress and maternal anxiety at 22–30 weeks by MOC (χ^2 (4) = 11.705, p = 0.020), again with no significant conditional effects (data not shown).

Discussion

The current study was the first to our knowledge to investigate whether model of maternity care may buffer the association of pandemic-related objective hardship and subjective distress during pregnancy with postpartum maternal depression and anxiety in a sample of Australian women birthing during the COVID-19 pandemic. Women receiving care from a PPM showed 74 % reduction in the odds of elevated anxiety compared with standard care, despite reporting the highest levels of previous mental health treatment (over 50 %) of any group. There was no association of MOC with maternal mental health in women reporting beyond the initial six postpartum weeks.

Unlike Kildea et al. [4], here we show no evidence of such a benefit (over standard care) for women receiving continuity with a public midwife. In the Kildea et al. study [4], undertaken in Queensland, women were discharged from the programme at six weeks post-birth, like most women receiving PPM care in the current study. In contrast,

most women receiving continuity with a public midwife in the current study reported fewer than two weeks of in-home postpartum care, with only 13.4 % receiving home visits up to six weeks. While some of these differences may be due to pre-existing inconsistencies across Australian jurisdictions in the delivery of public midwifery COC (for example, some areas transfer care child health nurses at approximately 2-weeks), when considered together with the findings of Davis, Sheehy [20], these results suggest that it may be the specific MOC, rather than COC per se, that is important for maternal postpartum mental health during the COVID-19 pandemic. For example, women receiving care during the pandemic from PPMs reported fewer changes to service delivery, including less replacement of visits with telehealth, in comparison to public midwives [7,21]. Reduced access to face-to-face in-home postnatal support from a known midwife in the first 6-weeks postpartum would reduce the quality of support available for breastfeeding and caring for new babies in the home. This may contribute to higher levels of anxiety, especially for women having their first baby. PPMs also offer the option of homebirth, which may have provided relief to women concerned about the safety of birthing in the hospital environment [7, 22,23]. With the autonomy to provide these options to women, PPM care providers may have minimised the changes, uncertainty, and anxiety for the women under their care.

The benefits of COC were not evident during the moderate or late postpartum period, a pattern consistent with the findings of Kildea et al. [4] that the mental health benefits of COC may be conferred only whilst active, face-to-face support is provided. Conversely, some studies show enduring benefits of extended early postpartum care for maternal mental health, with continuity of midwifery care providing three months of postpartum support associated with lower depression up to 12-months postpartum, beyond cessation of the active intervention [24, 25]. Similarly, extended nurse home-visiting models, such as the two-year "right@home" nurse home-visiting programme, shows promise for optimising the mental health of at-risk women up to one-year post-intervention [26]. It is possible that a dose greater than six weeks of postpartum care is required to provide enduring benefits to women's mental health.

Although in-home postpartum support from a midwife was limited in some MOC in the current study, 51 % of women reported being visited by a child and family health nurse since the birth, highlighting the important role that this service may also play in supporting mothers during the postpartum period. Women receiving care from a PPM were less likely (22 %) to have received a home visit from a child and family health nurse at the time of responding. Although it is possible that many women received care by telehealth or in the clinic, factors that may facilitate the successful transition from maternity care to child health services, particularly for women receiving PPM, warrants further investigation.

We found that women's greater prenatal subjective distress about the pandemic, including concerns about changes to maternity care, birth plans, postpartum care, and changes in finances, was associated with higher likelihood of depression and anxiety in each postpartum period after controlling for objective hardship. Consistent with other studies [2, 27], this finding highlights the importance of screening for pandemic-related distress amongst perinatal women to identify women at risk of postpartum mental health concerns. Almost half the cohort had received treatment for previous mental health conditions, and these women were more at risk of elevated anxiety and depression at every time point. With the benefits of extended postpartum care for maternal mental supported by previous studies [24–26], women with elevated risk of postpartum mental health concerns may benefit from being prioritised for maternity care models that provide the full six weeks of postpartum in-home care, such as with a PPM. These results also highlight the importance of addressing barriers to PPM care, including lack of an enabling policy environment in several jurisdictions and insurance barriers that do not cover women or midwives for labour and birth in the home. Additionally, the highest number of women reporting previous mental health treatment in this study attended PPMs. Further exploration of the factors influencing these women's choice to receive PPM care, and ways to facilitate access of women with mental health vulnerabilities to this MOC, will be important for capitalising on the benefits of this model for maternal mental health.

Our study has several strengths, including large sample size, assessment of distinct components of pandemic-related PNMS and three follow-up periods. We extend on the work of Davis, Sheehy [20] by examining the impact of maternity care on maternal wellbeing in the postnatal period, whilst also examining the role of specific model of care, beyond continuity alone. However, certain limitations should be acknowledged. The pandemic context required that an online survey with a convenience sample be utilised: potential selection bias cannot be ruled out, and rates of anxiety and depression in this study cannot be interpreted to reflect prevalence estimates of the population. Our sample had strong representation of lower frequency MOC (e.g., private midwifery), older women and those in higher socioeconomic categories; small group sizes of some MOC may have impacted findings, and replication with a more ethnically and socio-economically diverse sample is needed. As recruitment to the study was cross-sectional, open to women across the entire perinatal period, women who joined the study during pregnancy were invited to participate in more than one postnatal follow-up assessment, whilst some women joining the study during the late postnatal period provided only one mental health outcome assessment. To maximise study sample and include all valid participants, we grouped outcome data according to the number of postpartum weeks when the survey was completed. It is important to note that this does not reflect a longitudinal, repeated measures follow-up design, precluding firm conclusions regarding changes to mental health or associations over time. Replication that randomises model of care is recommended to validate and extend on the conclusions herein, including empirically testing our hypotheses regarding the mechanisms by which PPM offered the mental health benefits found here.

Conclusions

Pregnant women have faced stress and uncertainty during the COVID-19 pandemic impacting their postpartum mental health. Continuity of maternity care with a PPM shows potential as a preventive intervention for postpartum anxiety in the context of a pandemic. Possible mechanisms of impact include the development of a trusting and supportive relationship, and reduced maternity care changes during the pandemic, including longer duration of postpartum in-home care in the context of altered services due to public health restrictions. These findings have implications for the promotion and maintenance of women's postpartum mental health during future pandemics.

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Ethical Statement

Ethical approval was received from Western Sydney University (#H13825) and Charles Darwin University (#H21052).

CRediT authorship contribution statement

Belinda Lequertier (Conceptualisation, Methodology, Validation, Formal Analysis, Writing – Original Draft, Writing – Review and Editing), Mia A. McLean (Conceptualisation, Methodology, Validation, Writing – Review and Editing), Sue Kildea (Conceptualisation, Methodology, Validation, Resources, Funding Acquisition, Supervision, Writing – Review and Editing), Suzanne King (Conceptualisation, Methodology, Validation, Resources, Funding Acquisition, Supervision, Writing – Review and Editing), Hazel Keedle (Conceptualisation, Methodology, Validation, Project Administration, Writing – Review and Editing), Jacqueline A Boyle (Conceptualisation, Methodology, Supervision, Writing – Review and Editing), Hannah G Dahlen (Conceptualisation, Methodology, Validation, Resources, Funding Acquisition, Supervision, Writing – Review and Editing).

Declaration of Competing Interest

We have no conflict of interest to declare.

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Author Agreement

This article is our original work. We confirm that neither the manuscript is not currently under consideration nor published in another journal. All authors have approved the manuscript, and we agree to abide by the copyright terms and conditions of Elsevier and the Australian College of Midwives.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.wombi.2024.101827.

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