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The relationship between prematurity and maternal mental health during the first postpartum year

Semra Worrall [a], Sergio A. Silverio [b,*], Victoria M. Fallon [a]

[a] Department of Psychology, Institute of Population Health, University of Liverpool, Liverpool, L69 7ZA, UK
[b] Department of Women & Children's Health, School of Life Course & Population Sciences, King's College London, London, SE1 7EH, UK

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ABSTRACT

Studies concerning the effect of a premature birth on maternal mental health suggest symptoms of depression and anxiety are more prevalent in mothers of premature infants compared to mothers of term infants. However, most studies investigating depressive symptoms only relate to a few months postpartum, whilst no anxiety measures used have been postpartum-specific. Additionally, symptoms of anxiety and depression in mothers of extremely premature infants (<28 weeks' gestation) are relatively understudied. The aim of this study was to investigate the relationship between early gestational age and symptoms of anxiety and depression, with a secondary emphasis on mothers of extremely premature infants. 225 mothers of infants aged between birth and 12 months completed the Edinburgh Postnatal Depression Scale and the Postpartum Specific Anxiety Scale via an online questionnaire. Hierarchical regression models revealed that gestational age was associated with postpartum specific anxieties and was differentially associated with subscales of the PSAS. Furthermore, mothers of extremely premature infants experience specific subscales in the PSAS to a higher extent than mothers of term infants. There was no association between prematurity and depressive symptoms. These findings demonstrate the need for specific, targeted interventions for mothers of premature infants.

1. Introduction

New motherhood is often thought of as a time of great joy, however, unexpected problems during pregnancy, such as the birth of a premature baby, can be stressful for mothers. Prematurity can be defined as labour that occurs prior to the 37th week of pregnancy (WHO, 2018), and can be further sub-divided according to the WHO: extremely preterm (<28 weeks' gestation); very preterm (28-<32 weeks' gestation); and late preterm (32-<37 weeks' gestation), with most births falling into the latter two categories (Quinn et al., 2016). Approximately 1 in 10 babies are born prematurely worldwide (WHO, 2018). Prematurity can occur due to possible genetic factors, but no conclusive cause has yet been identified (WHO, 2018).

Mothers of premature infants commonly grieve the loss of a perceived 'ideal pregnancy', whilst coping with a sick baby in need of additional medical care (Aagaard et al., 2015). This can often be due to the unexpectedness of the premature birth (Blackburn and Harvey, 2019) and the prolonged period of mother-infant separation (Zamanzadeh et al., 2014). Approximately 56% of extremely preterm infants have severe physical morbidities (Ge et al., 2013) and will spend a significant amount of time in the neonatal intensive care unit (NICU) after birth, with stays ranging between 63 and 92 days in England (Seaton et al., 2019). However, NICU stays for earlier preterm infants are much longer (Manktelow et al., 2010).

The NICU has been reported to be a stressful place for parents and infant (Ionio et al., 2019), characterised by separation and uncertainty surrounding their babies' mortality (Silverio et al., 2021). Research has begun to investigate the effects of an extremely premature birth on maternal mental health, partly due to medical advances increasing survival rates of premature infants (Santhakumaran et al., 2018). Mothers of extremely premature infants experience a so-called *"emotional crisis"* during the postpartum period (Medina et al., 2018, p.327), and qualitative work has further demonstrated mothers' unique concerns which render them hypervigilant and uncertain about

Abbreviations: EPDS, Edinburgh Postnatal Depression Scale; NICU, Neonatal Intensive Care Unit; PSAS, Postpartum Specific Anxiety Scale; SES, Socio-economic Status; WHO, World Health Organization.

* Corresponding author. Department of Women & Children's Health, School of Life Course & Population Sciences, King's College London, Research Office 4, 10th Floor North Wing, St. Thomas' Hospital, Westminster Bridge Road, Lambeth, London, SE1 7EH, UK.
E-mail address: Sergio.Silverio@kcl.ac.uk (S.A. Silverio).

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motherhood (Petty et al., 2021).

Postpartum depression has been aptly described as *"the thief that steals motherhood"* (Beck, 1999), p.41), with estimates suggesting between 10% and 22% of mothers will experience postnatal depression within the first postpartum year (Gavin et al., 2005; National Health Service, 2018). A premature birth increases the likelihood of developing maternal depressive symptoms compared to mothers of full-term babies by approximately 40% (Gentile, 2017). The emotional stress associated with prematurity alongside reduced bonding between mother and infant as a consequence of NICU stays, may contribute to this disparity (Hemati et al., 2017). Despite extensive research into the relationship between prematurity and depression (de Paula Eduardo et al., 2019), most studies have only investigated symptoms for between three and six months postpartum (Bonacquisti et al., 2020), and further investigation is needed to assess the sustained effects of prematurity on depressive symptoms across the first postpartum year.

Likewise, postpartum anxiety has been acknowledged as being commonplace and a potential cause of atypical attachment styles into childhood (Brockington, 2004). Prevalence rates of postpartum anxiety range from between 13% and 40% of all mothers (Field, 2017), yet it has received less empirical attention compared to postpartum depression (Bell et al., 2016). Studies suggest mothers of premature infants have significantly increased levels of anxiety compared to mothers of term infants, especially after extended NICU stays (Bonacquisti et al., 2020). Typically, postpartum anxiety is characterised through increased fear for the infant's life, panic surrounding early separation, and uncertainty regarding health concerns (Gonçalves et al., 2020). As such, mothers may become less expressive, and feel less positive about their baby (Coppola et al., 2007). Anxious feelings may be an adaptive response in an adverse situation (Hall et al., 2017), but can become maladaptive when excessive and interfere with daily functioning and ability to care for the infant (Wenzel, 2016).

Psychological outcomes for mothers of extremely premature infants are understudied, but there is a heightened risk of developing severe mental health problems resulting from an overwhelming and demanding situation (Fowler et al., 2019). However, there is a distinct lack of quantitative research concerning extreme prematurity and maternal mental health.

The present study investigates the possible relationship between maternal mental health in the first postpartum year – specifically anxiety and depression – and gestational age. It does so using childbearing-specific measures of mental health. This study also aims to investigate whether maternal mental health (anxiety and depression) differs according to level of prematurity (extremely preterm, very preterm, late preterm). This will allow further understanding with the aim of supporting postpartum mental health following a premature birth. To this end the following hypotheses are investigated:

1. Earlier gestational age at delivery will be associated with higher levels of postpartum anxiety and depression.
2. Mothers of extremely premature infants will have higher levels of depression and anxiety than mothers of premature and term infants.

2. Methodology

2.1. Participants and recruitment

Mothers of infants aged between birth and twelve months were recruited through social media platforms, via an advertisement with a link to an on-line survey hosted on Qualtrics. Eligibility criteria included being over the age of 18, English-speaking, and having an infant up to twelve months of age. Mothers who did not fulfil eligibility criteria were directed to the end of the survey, via a screening question. Responses were anonymous, and all participants gave informed consent via a tick box. If desired, participants could enter their e-mail address to be entered into a prize draw, which was hosted in a separate survey from the data, to maintain anonymity. The study gained full ethical approval from the University of Liverpool Institute of Psychology, Health, and Society Research Ethics Committee (ref: IPH2014).

2.2. Design and procedure

The on-line survey was conducted as part of a wider investigation into maternal mental health and infant temperament. The survey was accessible from the September 9, 2020 to the December 23, 2020. Eligible participants completed a battery of psychometric measures, and once completed, were provided with a debrief page.

2.3. Measures

2.3.1. Demographics

Mothers were asked demographic questions including their age, ethnic origin and marital status (see Table 1 for all demographic variables). Questions regarding occupation, number of household occupants, educational attainment, and housing situation (e.g., rent) were asked to measure socio-economic status [SES], which were used during bivariate analyses to establish potentially confounding variables. Information regarding infant and gestational age, identified by week of birth, were also gathered.

2.3.2. Edinburgh Postnatal Depression Scale [EPDS]

The EPDS (Cox et al., 1987) is a self-report measure commonly used to screen for depressive symptoms in women during the postpartum period (Moraes et al., 2017). The questionnaire assesses depressive symptoms during the previous seven days. It features ten statements, with mothers answering on a 4-point Likert scale. Individual items are scored from 0 to 3. A score of over 13 is indicative of postpartum depression (Matthey et al., 2006). The scale has good validity (Eberhard-Gran et al., 2001), and reliability (Kernot et al., 2015).

2.3.3. Postpartum Specific Anxiety Scale [PSAS]

The PSAS (Fallon et al., 2016) consists of a 51-item scale measuring a variety of maternal and infant focused anxieties occurring in the last seven days. The scale has four dimensions, including maternal competence and attachment anxieties (15 items); infant safety and welfare anxieties (11 items); practical infant care anxieties (7 items) and psychosocial adjustment to motherhood (18 items). Mothers respond to statements on a Likert scale from 1 to 4 (1 = not at all, 2 = not very often, 3 = often, 4 = almost always). A score of 112 is indicative of postpartum anxiety. The scale has been shown to have excellent reliability and validity (Fallon et al., 2016).

2.4. Method of analysis

All data analyses were conducted on SPSS 26. Bivariate analyses were conducted to identify any potential confounders (see Table 1). These were computed between the confounder (e.g., marital status) the independent variable (IV; i.e., week of birth) and the dependent variable (DV; i.e., depression). As no potential confounders were found to be significant with both anxiety and depression, none were included in the final regression model.

2.4.1. Hypothesis one

A hierarchical regression was conducted to analyse the relationship between gestational age, and EPDS/PSAS scores. PSAS total scores were entered into block one and EPDS total scores were entered into block two.

2.4.2. Hypothesis two

Week of gestation was categorised into three groups: extremely premature (<28 weeks' gestation), premature (28–36 weeks' gestation) and term (37+ weeks' gestation). PSAS scores were further split

Table 1
Maternal and infant demographic characteristics.

Maternal Characteristic	Extremely Premature (<28 weeks' gestation) N = 22	Very Premature (28–32 weeks' gestation) N = 26	Late Premature (33–36 weeks' gestation) N = 31	Term (37-+42 weeks' gestation) N = 146
Maternal age (mean years ± SD)	29.23 ± 6.52	30.50 ± 5.76	30.13 ± 5.07	30.14 ± 5.82
Country of Residence (N/%)				
UK	9 (40.9)	12 (46.2)	15 (48.4)	139 (95.2)
USA	10 (45.5)	9 (34.6)	10 (32.3)	4 (2.7)
Other European	1 (4.5)	0 (0)	0 (0)	2 (1.4)
Other Non-European	2 (9)	5 (19)	6 (19.2)	1 (0.7)
Ethnicity (N/%)				
White	22 (100)	22 (84.6)	29 (93.5)	140 (95.9)
Pakistani	0 (0)	1 (3.8)	0 (0)	0 (0)
Black African	0 (0)	1 (3.8)	0 (0)	0 (0)
Black Other	0 (0)	0	1 (3.2)	0 (0)
Indian	0 (0)	1 (3.8)	1 (3.2)	0 (0)
Other	0 (0)	1 (3.8)	0 (0)	6 (4.1)
Marital status (N/%)				
Married	14 (63.6)	17 (65.4)	22 (71)	78 (53.4)
Living with partner	7 (31.8)	6 (23.1)	8 (25.8)	52 (35.6)
Single	1 (4.5)	3 (11.5)	1 (3.2)	15 (10.3)
Divorced	0 (0)	0 (0)	0 (0)	1 (0.7)
Occupation (N/%)				
Managers, directors, and senior officials	0 (0)	3 (11.5)	2 (6.5)	13 (8.9)
Professionals	9 (40.9)	9 (34.6)	10 (32.5)	52 (35.6)
Associate professional/ technical	0 (0)	0 (0)	4 (12.9)	4 (2.7)
Administrative and secretarial	2 (9.1)	3 (11.5)	4 (12.9)	11 (7.5)
Skilled trades	1 (4.5)	0 (0)	1 (3.2)	3 (2.1)
Caring, leisure and other service	0 (0)	3 (11.5)	4 (12.9)	36 (24.7)
Process, plant, and machine operative	1 (4.5)	0 (0)	0 (0)	0 (0)
Elementary occupations	0 (0)	0 (0)	1 (3.2)	0 (0)
Not in paid occupation	9 (40.9)	8 (30.8)	5 (16.1)	27 (18.5)
Educational attainment (N/%)				
Postgraduate education	5 (22.7)	7 (26.9)	10 (32.3)	34 (23.3)
Undergraduate education	7 (31.8)	8 (30.8)	7 (22.6)	60 (41.1)
A-levels or equivalent	5 (22.7)	6 (23.1)	7 (22.6)	26 (17.8)
GCSEs or equivalent secondary school	4 (18.2)	2 (7.7)	4 (12.9)	21 (14.4)
No qualifications	1 (4.5)	3 (11.5)	2 (6.5)	1 (0.7)
Other qualification	0 (0)	0 (0)	1 (3.2)	4 (2.7)
Housing Situation (N/%)				
Own	13 (59.1)	15 (57.7)	15 (48.4)	89 (61)
Rent Privately	6 (27.3)	8 (30.8)	12 (38.7)	33 (22.6)
Rent from the Local Authority	1 (4.5)	0 (0)	1 (3.2)	15 (10.3)
Live with Parents	2 (9.1)	2 (7.7)	3 (9.7)	8 (5.5)
Other	0 (0)	1 (3.8)	0 (0)	1 (0.7)
Occupant Number (incl. participant) (N/%)				
3	0 (0)	1 (3.8)	0 (0)	13 (8.9)
4	8 (36.4)	10 (38.5)	15 (48.4)	63 (43.2)
5	7 (31.8)	7 (26.9)	8 (25.8)	52 (35.6)
6	4 (18.2)	4 (15.4)	6 (19.4)	15 (10.3)
7 or more	3 (13.6)	4 (15.4)	2 (6.4)	3 (2.1)
Current clinical diagnosis of anxiety (N/%)				
Yes	8 (36.4)	7 (26.9)	9 (29.0)	46 (31.5)
No	13 (59.1)	19 (73.1)	21 (67.7)	95 (65.1)
Prefer not to say	1 (4.5)	0 (0)	1 (3.2)	2 (1.4)
Timing of anxiety diagnosis (N/%)[a]				
Before pregnancy	5 (62.5)	4 (57.1)	6 (66.7)	33 (71.7)
During pregnancy	0 (0)	0 (0)	0 (0)	4 (8.7)
Postpartum	3 (37.5)	3 (42.9)	3 (33.3)	9 (19.6)
Currently prescribed medication for anxiety (N/%)[a]				
Yes	5 (62.5)	3 (42.9)	1 (11.1)	22 (47.8)
No	3 (37.5)	4 (57.1)	8 (88.9)	24 (52.2)
Current clinical diagnosis of depression (N/%)				N = 143
Yes	5 (22.7)	6 (23.1)	5 (16.1)	37 (25.9)
No	16 (72.7)	20 (76.9)	25 (80.6)	106 (74.1)
Prefer not to say	1 (4.5)	0 (0)	1 (3.2)	0 (0)
Timing of depression diagnosis (N/%)[a]				
Before pregnancy	2 (40.0)	3 (50.0)	4 (80.0)	22 (59.5)
During pregnancy	0 (0)	0 (0)	0 (0)	2 (5.4)
Postpartum	3 (60)	3 (50.0)	1 (20.0)	13 (35.1)
Currently prescribed medication for depression (N/%)[a]				
Yes	4 (80.0)	5 (83.3)	2 (40.0)	25 (67.6)
No	1 (20.0)	1 (16.7)	3 (60.0)	12 (32.4)
Infant Characteristic				
Infant age (mean weeks ± SD)	29.73 ± 14.94	28.19 ± 13.25	28.32 ± 15.49	29.65 ± 16.40
Birth Order (N/%)				
First	11 (50.0)	18 (69.2)	22 (71.0)	78 (53.5)
Second	6 (27.3)	5 (19.2)	4 (12.9)	51 (34.9)
Third	5 (22.7)	2 (7.7)	4 (12.9)	9 (6.2)
Fourth and after	0 (0)	1 (3.8)	1 (3.2)	8 (5.5)
Multiple Birth (N/%)				
Yes	2 (9.1)	7 (26.9)	7 (22.6)	1 (0.7)
No	20 (90.9)	19 (73.1)	24 (77.4)	145 (99.3)
Planned mode of feeding (N/%)				N = 144
Exclusively breastfeeding	11 (50.0)	16 (61.5)	19 (61.3)	82 (56.9)
Combination feeding	7 (31.8)	6 (23.1)	10 (32.3)	41 (28.5)
Exclusively formula feeding	4 (18.2)	4 (15.4)	2 (6.5)	18 (12.5)
Other	0 (0)	0 (0)	0 (0)	3 (2.1)
Current mode of feeding (N/%)				
Exclusively breastfeeding	6 (27.3)	6 (23.1)	9 (29.0)	59 (40.4)
Combination feeding	1 (4.5)	4 (15.4)	5 (16.1)	23 (15.7)
Exclusively formula feeding	12 (54.4)	13 (50.0)	17 (54.8)	55 (37.7)
Other	3 (13.6)	3 (11.5)	0 (0)	9 (6.2)
EPDS Total (mean ± SD)	(N = 21) 14.76 ± 7.69	12.23 ± 5.84	12.71 ± 5.45	N = 138 11.86 ± 6.30
PSAS Total (mean ± SD)	N = 13 126.85 ± 24.09	N = 17 116.29 ± 27.61	N = 24 116.25 ± 22.40	N = 97 111.84 ± 24.67
Maternal Competence and Attachment Anxieties	N = 18 31.28 ± 8.58	N = 22 31.18 ± 9.66	N = 30 30.40 ± 6.98	N = 128 29.80 ± 7.92

(continued on next page)

Table 1 (*continued*)

Maternal Characteristic	Extremely Premature (<28 weeks' gestation) N = 22	Very Premature (28–32 weeks' gestation) N = 26	Late Premature (33–36 weeks' gestation) N = 31	Term (37-+42 weeks' gestation) N = 146
Infant Safety and Welfare Anxieties	N = 18 27.89 ± 6.65	N = 22 26.23 ± 6.00	N = 30 26.23 ± 5.45	N = 128 24.13 ± 6.67
Practical Infant Care Anxieties	N = 18 16.17 ± 4.94	N = 17 42.94 ± 10.92	N = 30 17.20 ± 5.01	N = 128 14.58 ± 4.08
Psychosocial Adjustment to Motherhood	N = 13 47.15 ± 9.11	N = 17 42.94 ± 10.92	N = 24 43.79 ± 9.06	N = 97 44.10 ± 9.90

Table 2
Hierarchical regression demonstrating postpartum specific anxiety and postpartum depression as a predictor of gestational age (N = 151).

Variables	Cumulative		Simultaneous	
	R^2-change	*F*-change	*β*	*p*
Block One				
PSAS	0.03	F (1, 149) = 4.04	−0.16	.046*
Block Two				
PSAS	0.00	F (1, 148) = 0.03	−0.18	.160
EPDS			0.02	.864

*p < .05.

dependent upon subscales.

Three 3 × 1 ANOVAs were conducted. The first two ANOVAs were between the categories of gestational age and two factors of the PSAS (infant safety and welfare anxieties; practical infant care anxieties), respectively. The decision to only include these two subscales was theoretical, as the items included in them are the most applicable to mothers of premature infants. The final ANOVA was between the total EPDS scores and the gestational age categories.

3. Results

3.1. Demographics

Of the 351 participants who accessed the survey, 126 (35.9%) were discounted from analyses as they did not fully complete either the EPDS or the PSAS. The final sample of 225 mothers were aged between 19 and 45 years (M_{Age} = 30.07, *SD* = 5.66). The number of participants who completed the measures necessary to test each hypothesis is listed before its respective findings.

Mothers were predominantly married (58.7%), professionals (35.7%) from the United Kingdom and Ireland (77.0%). Approximately a third had a current clinical diagnosis of anxiety (31.5%), almost half of which were taking prescribed medication (44.3%). Approximately a quarter had a current clinical diagnosis of depression (23.9%), with more than two thirds of those taking prescribed medication for this (67.9%).

Gestational age ranged from 24^{+0} to ≥42 weeks (*M* = 36.47, *SD* = 4.83). Infant age ranged from 0 to 52 weeks (*M* = 29.12, *SD* = 15.79). Seventy-nine infants were born prematurely (35.1%); of these, twenty-two (9.8%) were classified as extremely premature (<28^{+0} weeks' gestation), twenty-six (11.6%) were classified as very premature (28^{+0}-32^{+0} weeks' gestation) and thirty-one (13.7%) were classified as late premature (33^{+0}-<37^{+0} weeks' gestation). For analysis concerning hypothesis two only, very premature and late premature infants were combined and classified as premature (fifty-seven; 25.3%). The remaining 146 were classified as term (65.0%; ≥37^{+0} weeks' gestation), or extremely premature, as above.

4. Statistical analyses

4.1. H1: Hierarchical regression between gestational age and EPDS/PSAS scores (see Table 2)

A hierarchical regression was conducted to examine the effect of gestational age at delivery with both anxiety and depression scores. The entire regression model predicted approximately 3% of variance, but this was not significant (R^2 = 0.03, F(2, 148) = 2.02, p = .136).

Block one significantly predicted variance in anxiety scores as measured by the PSAS, accounting for approximately 3% of the variance (R^2 change = 0.03, F-change(1, 149) = 4.04, p = .046). Block two predicted approximately 0% of the variance in anxiety and depression scores and this was not significant (R^2 change = 0.00, F-change (1, 148) = 0.03, p = .864) (See Figs. 1 and 2).

4.1.1. Post-hoc analyses (see Table 3)

As PSAS scores were significantly associated with week of birth, the subscales of the PSAS were further examined in post-hoc analyses to explore their relationship with gestational age. The overall regression model significantly predicted approximately 14% of variance (R^2 = 0.14, F(4, 146) = 5.93, p < .001) (Table 3).

At block one, the model predicted approximately 1% of variance, but this was not significant (R^2 change = 0.01, F-change (1, 149) = 0.99, p = .321). Block two significantly predicted approximately 7% of variance (R^2 change = 0.07, F-change (1, 148) = 11.18, p = .001), as did block three (R^2 change = 0.06, F-change (1, 147) = 9.23, p = .003), predicting approximately 6% of variance (See Fig. 3).

Finally, block four predicted approximately 1% variance but was not significant (R^2 change = 0.01, F-change (1, 146) = 1.51 p = .222) (See Fig. 4).

4.2. H2: ANOVA between the subscales of the PSAS and gestational age (in weeks; N=198)

Subscale two and three of the PSAS (infant safety and welfare anxieties; practical infant care anxieties) were the only subscales analysed here. An ANOVA was conducted between the gestational groups and infant safety and welfare anxieties score. Homogeneity of variance is assumed, as Levene's test was non-significant (p = .363).

There was a significant main effect of category of prematurity and infant safety and welfare anxieties (F(2, 195) = 3.95, p = .021, η_p^2 = 0.04). Least Significant Difference [LSD] *post-hoc* tests revealed that there was not a significant difference between the extremely premature and the premature group (p = .346), but there was a significant difference between the extremely premature and term group (p = .021), with participants in the extremely premature group having higher infant safety and welfare anxieties (*M* = 27.89, *SD* = 6.65) compared to the term group (*M* = 24.13, *SD* = 6.67). Additionally, there was a significant difference between the premature and term group (p = .048), with those in the premature group scoring higher (*M* = 26.23, *SD* = 5.63) than the term group (*M* = 24.13, *SD* = 6.27).

An ANOVA was conducted between the gestational groups and practical infant care anxieties. Levene's test was non-significant (p = .242). There was a significant main effect of practical infant care anxieties score (F(2, 195) = 8.83, p < .001, η_p^2 = 0.08). LSD *post-hoc* tests revealed that there was no significant difference between the extremely premature group and the premature group (p = .249) or the extremely premature and term group (p = .148). However, there was a statistically significant difference between the premature and term group (p < .001), with those in the premature group scoring higher (*M* = 17.54, *SD* = 4.74) comparative to the term group (*M* = 14.58, *SD* = 4.08).

4.2.1. ANOVA investigating differences between prematurity groups and EPDS total scores. (N = 216)

An ANOVA was conducted between the categories of prematurity

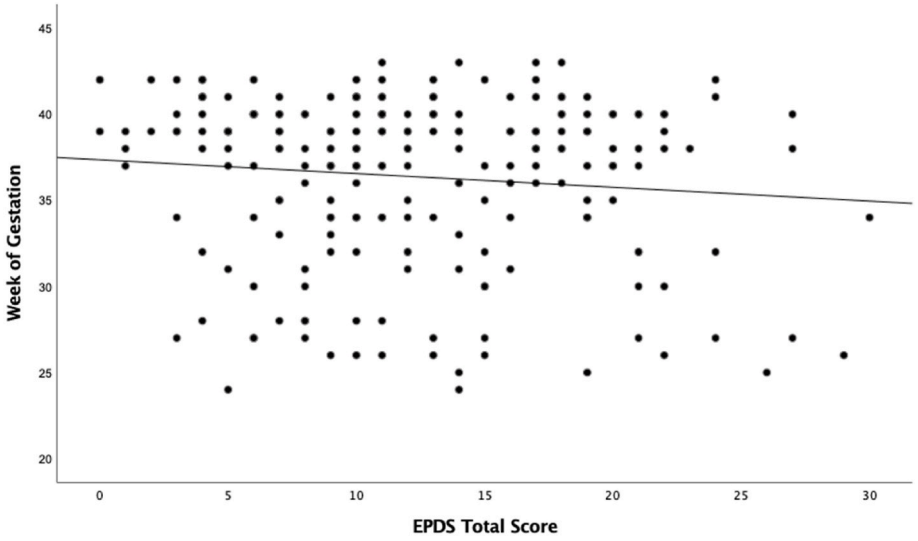

Fig. 1. Scatterplot demonstrating the relationship between EPDS total score and week of gestation.

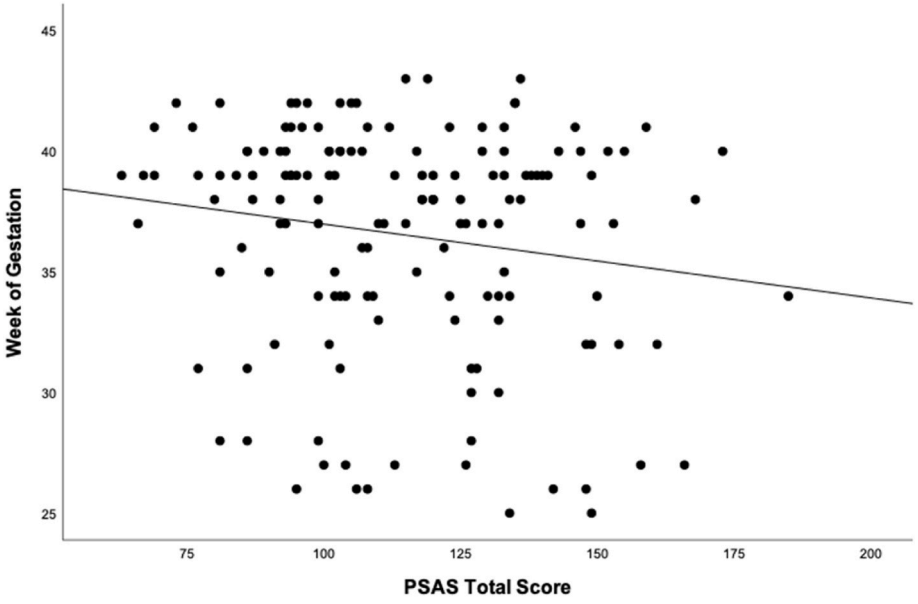

Fig. 2. Scatterplot demonstrating the relationship between PSAS total score and week of gestation.

and EPDS scores. Levene's test was non-significant ($p = .144$). There was no significant main effect ($F(2, 213) = 1.98$, $p = .140$, $\eta_p^2 = 0.02$).

5. Discussion

The aim of this research was to explore if symptoms of postpartum depression and anxiety were more prevalent in mothers of premature infants compared to term infants, with a secondary focus on mothers of extremely premature infants. As predicted in H1, earlier gestational age at delivery was significantly associated with higher levels of postpartum specific anxiety. This effect was not found with postpartum depression. As predicted in H2, gestational age at delivery was only significantly associated with infant safety and welfare anxieties and practical infant care anxieties. Specifically, mothers of extremely premature infants had significantly higher levels of anxiety than premature and term infants.

Studies concerning depression have found heightened levels following a preterm birth (de Paula Eduardo et al., 2019). Depressive symptoms may be exacerbated through poor social support and can continue after discharge from the NICU (Leahy-Warren et al., 2020). Additionally, this research accounts for the effects of anxiety and depression, as both were inputted into the regression model. Most studies demonstrating a relationship between prematurity and anxiety or depression have isolated their depression measures (Neri et al., 2015). Therefore, the above findings may be due to data analysis techniques. Furthermore, the PSAS is tightly linked to the lived experience of mothers and likely relates to specific experiences of prematurity, whereas the EPDS is a broad measure. Given this, it is unsurprising that this study was contradictory to existing literature. Future research may decide to isolate depression measures, to ascertain the sustained impact of depressive symptoms.

This study's findings in relation to anxiety align with that of previous research. Mothers of premature infants experience increased symptoms of anxiety postpartum (Roque et al., 2017). This is heightened when babies are in the NICU for an extended period (Gateau et al., 2021). Theoretically speaking, increased maternal stress can be related to the social ecological model (McLeroy et al., 1988), which posits

Table 3
Hierarchical regression demonstrating the subscales of the PSAS as predictors of gestational age (N = 151).

Variables	Cumulative		Simultaneous	
	R^2-change	*F*-change	*β*	*p*
Block One				
Maternal Competence and Attachment Anxieties	0.01	F(1, 149) = 0.99	−0.08	.321
Block Two				
Maternal Competence and Attachment Anxieties	0.07	F(1, 148) = 11.18	0.04	.647
Infant Safety and Welfare Anxieties			−0.29	.001**
Block Three				
Maternal Competence and Attachment Anxieties	0.06	F(1, 147) = 9.23	0.21	.039*
Infant Safety and Welfare Anxieties			−0.20	.028*
Practical Infant Care Anxieties			−0.33	.003*
Block Four				
Maternal Competence and Attachment Anxieties	0.01	F(1, 146) = 1.51	0.12	.371
Infant Safety and Welfare Anxieties			−0.23	.015*
Practical Infant Care Anxieties			−0.32	.003*
Psychosocial Adjustment to Motherhood			0.15	.222

psychological stressors relating to the environment of the NICU, leads to increased anxiety (Loewenstein, 2018). Applying psychological theory to mothers' experiences in this way can allow for more targeted interventions from the point of delivery.

Infant safety and welfare anxieties encompasses concerns over illness and cot death (Fallon et al., 2016). Results from this study demonstrate that mothers of extremely premature and premature infants experience these anxieties to a higher degree than term mothers. This may be exacerbated in mothers of extremely premature infants as infants are more likely to have worse health outcomes than their counterparts (Glass et al., 2015) and will spend a longer period in the NICU. In the UK, the average NICU stay for an extremely premature infant is 79 days (Lee et al., 2013), but for premature infants this is 30 days (Seaton et al., 2019). Furthermore, the heightened medical care given to extremely premature infants might be perceived as a safety net by mothers (Russell et al., 2014), which is removed upon discharge, invoking anxiety (Beck and Harrison, 2017).

It is possible that the findings of this study may result from longer NICU stays and more severe infant adversities. In terms of infant safety and welfare anxieties, it is imperative that healthcare professionals consider the effect of health adversities in extremely premature infants on emotional wellbeing.

Practical infant care anxieties relate to anxieties surrounding establishing and maintaining a routine with the infant (Fallon et al., 2016). Findings from this study demonstrated there was only a significant difference between the premature and term group in terms of practical infant care anxieties. This can be related to the amount of time spent in the NICU. Mothers of extremely premature infants may not experience heightened practical infant care anxieties compared to mothers of premature infants as their children spend a prolonged period in the NICU, so routine is already established before they are discharged home. Additionally, as premature babies are seen as less high risk than extremely premature infants, medical interventions will be less intensive and NICU stays shorter. Whilst studies highlight the importance of the relationship between mother and NICU nurse (Reis et al., 2010), their caretaker role means mothers may struggle to develop a routine with their infant, particularly due to constraints of the NICU (Fleury et al., 2014). Mothers can feel overshadowed and undervalued (Jubinville et al., 2012) contributing to increased practical infant care anxieties. However, it should be noted that NICU nurses are pivotal in providing care to premature infants, as well as educating parents for the transition home (Gilstrap, 2021), but in some circumstances, their role may be counterproductive to anxieties surrounding care.

This study particularly highlights the need for targeted interventions for mothers of premature infants. Further interventions involving healthcare professionals may include involving mothers in caring for their infant as well as establishing a routine alongside the mother to make the transition from NICU to home easier. For example, (Hall et al., 2020) demonstrates that parents of premature infants in the NICU should be encouraged to take an active role in care, by encouraging staff-family relationships and providing further education. The findings of this study further support the use of different interventions for specific categories of prematurity.

5.1. *Strengths, limitations and future directions*

Mothers were of high SES (35.7% professionals). Whilst this is not uncommon in an online design, further research could investigate a more diverse sample. This is important given that low-SES mothers face financial barriers in visiting their infants in the NICU (Hall et al., 2020).

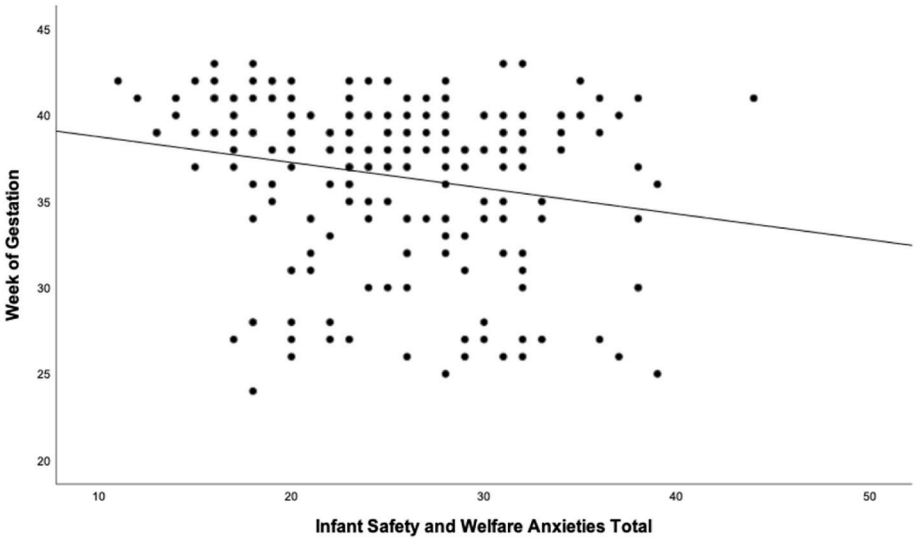

Fig. 3. Scatterplot demonstrating the relationship between infant safety and welfare anxieties score and week of gestation.

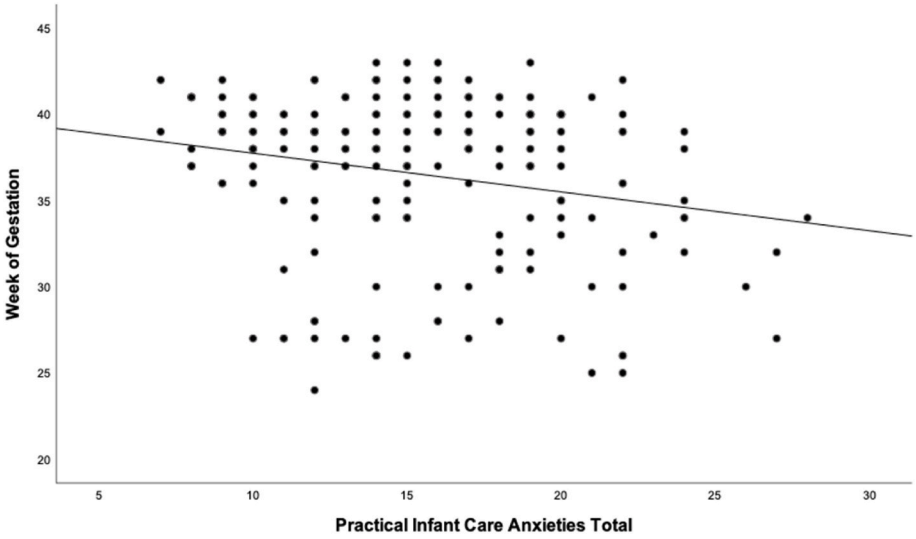

Fig. 4. Scatterplot demonstrating the relationship between practical infant care anxieties score and week of gestation.

Cross-sectional studies are prone to social-desirability bias and relatively high attrition rates (approximately 35% in this study), perhaps due to long measures.

Further research should focus on mothers of extremely premature infants as these findings demonstrate the disparities in symptoms of anxiety between those and premature infants. A future study may choose to adopt a qualitative design, with a particular emphasis on feelings relating to both practical infant care and infant safety and welfare anxieties.

5.2. Conclusion

In summary, this study has demonstrated that mothers of premature infants have significantly higher levels of postpartum-specific anxiety comparative to mothers of term infants. Specifically, mothers of both extremely premature and premature infants experience specific, differential anxieties as revealed by the PSAS. There was no relationship between prematurity and depression. This research highlights the need for healthcare professionals to offer specific, targeted interventions for mothers of premature infants from the point of delivery. Further research is required to investigate why mothers of extremely premature infants experience higher rates of anxiety.

Ethical approval and consent to participate

Ethical approvals were sought and granted by the University of Liverpool Institute of Psychology, Health, and Society Research Ethics Committee [reference: IPH2014]. Informed consent was obtained from all study participants, in writing before the date of the research, and participants were made aware of their right to withdraw.

Consent to publish

All participants consented to their data being published as part of this study's analysis.

Availability of data and materials

The datasets generated and/or analysed during this study are not publicly available due to the sensitive nature of the data. Summary data may be shared from the corresponding author upon reasonable request, when compliant with ethical regulations associated with this study.

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Authors' contribution

Conceptualization: [SW, VF]; Methodology: [VF, SW]; Validation: [SW, VF, SAS]; Formal Analysis: [SW]; Data Curation: [SW]; Writing – original draft: [SW]; Writing – review and editing: [SAS, VF]; Supervision: [VF]; Project Administration: [SW].

Declaration of competing interest

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