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SYSTEMATIC REVIEWS

Mental health impact on Black, Asian and Minority Ethnic populations with preterm birth: A systematic review and meta-analysis

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Abstract

BACKGROUND

Preterm birth (PTB) is one of the main causes of neonatal deaths globally, with approximately 15 million infants are born preterm. Women from the Black, Asian, and Minority Ethnic (BAME) populations maybe at higher risk of PTB, therefore, the mental health impact on mothers experiencing a PTB is particularly important, within the BAME populations.

AIM

To determine the prevalence of mental health conditions among BAME women with PTB as well as the methods of mental health assessments used to characterise the mental health outcomes.

METHODS

A systematic methodology was developed and published as a protocol in PROSPERO (CRD420-20210863). Multiple databases were used to extract relevant data. I^2 and Egger's tests were used to detect the heterogeneity and publication bias. A trim and fill method was used to demonstrate the influence of publication bias and the credibility of conclusions.

RESULTS

Thirty-nine studies met the eligibility criteria from a possible 3526. The prevalence rates of depression among PTB-BAME mothers were significantly higher than full-term mothers with a standardized mean difference of 1.5 and a 95% confidence interval (CI) 29%-74%. The subgroup analysis indicated depressive symptoms to be time sensitive. Women within the very PTB category demonstrated a significantly higher prevalence of depression than those categorised as non-very PTB. The prevalence rates of anxiety and stress among PTB-BAME mothers were significantly higher than in full-term mothers (odds ratio of 88% and 60% with a CI of 42%-149% and 24%-106%, respectively).

CONCLUSION

BAME women with PTB suffer with mental health conditions. Many studies did not report on specific mental health outcomes for BAME populations. Therefore, the impact of PTB is not accurately represented in this population, and thus could negatively influence the quality of maternity services they receive.

Key Words: Preterm labor; Preterm birth; Black, Asian, and Minority Ethnic; Mental health; Women's health; Wellbeing

Core Tip: Preterm birth is a multi-etiological condition and a leading cause of perinatal mortality and morbidity. This study demonstrates the mental health impact due to preterm birth among the Black, Asian and Ethnic minority women. There is minimal research available at present around this subject matter, and this important disease sequelae.

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INTRODUCTION

Preterm birth (PTB) is a multi-etiological condition and a leading cause of perinatal mortality and morbidity[1]. PTB can be categorized as per the World Health Organization classification methods as extreme preterm (gestational age < 28 wk), very preterm (gestational age of 28-32 wk) and moderately preterm (32-37 wk). Most preterm infants are at risk of developing respiratory and gastrointestinal complications[2]. The PTB rates are higher in most developed regions of the world, despite advances in medicine. PTB are at the highest level in the US for between 12%-15% and 5%-9% in Europe. In comparison, PTB rates in China range between 4.7%-18.9% (1987-2006) and Taiwan 8.2%-9.1%[3]. The prevalence of PTB increased from 9.8% in 2000 to 10.6% by 2014 and has become a global public health

issue[1]. However, the mental health impact associated with PTB is not extensively examined, despite it potentially may exacerbate the patient's experience of a distressing birth. Furthermore, clearly pronounced risk of PTB among Black women have been reported in studies from United States or United Kingdom[4,5], with limited data on the risk among other ethnic groups. While health disparities, social deprivation are recognised risk factors for PTB that are also frequently associated with Black, Asian, and Minority Ethnic (BAME) populations, the available data on ethnic disparities associated with PTB remains limited.

In the United Kingdom, health disparities within Caribbean and West African populations demonstrate a significant risk of very PTB in comparison to Caucasians. Similar risks within the South Asian community appear to be less consistent in comparison to Caucasian PTB women[11]. In the United Kingdom, National Health Service (NHS) England reports improvements to maternity services are a priority as part of the NHS 10-year plan[12]. As per the 2018 Public Health England report on maternity services, 1 in 4 of all births within Wales and England were to mothers born outside the United Kingdom[12]. Additionally, 13% of all infants born between 2013-2017 are from the BAME population[12]. Importantly, Black women were 5 times more at risk of death during parturition and Asian babies are 73% more likely to result in neonatal death compared to Caucasian women[12], therefore, the mental health impact experienced by PTB mothers is vital to evaluate particularly in the BAME population. A number of socio-economic, genetic and obstetric causes have been proposed to explain mental health disorders among PTB women, but these theories do not fully explain the aetiology. Furthermore, they also exclude the bidirectional relationship between PTB, and mental health conditions demonstrated by some studies[13,18,19].

This available evidence demonstrates a need to explore the mental health impact on BAME women with PTB. We believe that gathering this evidence would inform the forthcoming evidence-based women's health strategy in the United Kingdom to explore both the physical and mental health components, and to be inclusive using cultural adaptations where appropriate.

MATERIALS AND METHODS

An evidence synthesis methodology was developed using a systematic protocol that was developed and published on PROSPERO (CRD42020210863). The aims of the study were to determine the prevalence of mental health conditions among BAME women with PTB as well as the mental health assessments used to characterise the mental health outcomes.

Data searches

Multiple databases were used, including PubMed, EMBASE, Science direct, and The Cochrane Central Register of Controlled trials for the data extraction process. Searches were carried out using multiple keywords and MeSH terms such as "Depression", "Anxiety", "Mood disorders", "PTSD", "Psychological distress", "Psychological stress", "Psychosis", "Bipolar", "Mental Health", "Unipolar", "self-harm", "BAME", "Preterm birth", "Maternal wellbeing" and "Psychiatry disorders". These terms were then expanded using the 'snow-ball' method and the fully developed methods are in the supplementary section (Supplementary material).

Eligibility criteria and study selection

All eligible randomised controlled trials (RCTs) and non-RCTs published in English were included. The final dataset was reviewed independently. Multiple mental health variables were used alongside of the 2 primary variables of PTB and BAME.

Data extraction and analysis

The extraction and eligibility has been demonstrated using a PRISMA diagram. The data was collected using Endnote and Microsoft excel. Stata 16.1 was used as a way to complete the final statistical analysis. Standardized mean difference (SMD) and 95% confidence interval (CI) were extracted for analysis. Heterogeneity was assessed by way of funnel plots, χ^2-test (P value) and I^2. A sub-group analysis was conducted to determine the mental health symptomatologies identified and the geographical location.

Due to the unified use of mental health assessments, in order to standardize the mean differences reported within each study, the following mathematical method was used[25-27]:

$$\widehat{g_k} = (1 - \frac{3}{4n_k - 9}) \frac{\widehat{u_{ek}} - \widehat{u_{ck}}}{\sqrt{((n_{ek} - 1)s_{ek}^2 + (n_{ck} - 1)s_{ck}^2)/(n_k - 2)}}$$

$$\widehat{Var}(\widehat{g_k}) = \frac{n_k}{n_{ek} \cdot n_{ck}} + \frac{\widehat{g_k}^2}{2(n_k - 3.94)}$$

where, $n_k = n_{ek} + n_{ck}$, n_{ek}, $\widehat{u_{ek}}$, s_{ek} are the number, mean and standard variation of exposed group and n_{ck}, $\widehat{u_{ck}}$, s_{ck} are the number, mean and standard variation of control group. Then we can obtain the 95%

confidence interval by $\widehat{g_k} \pm 1.96 * S.E.(\widehat{g_k})$ where $S.E.(\widehat{g_k}) = \sqrt{\widehat{Var}(\widehat{g_k})}$.

Meta-regression and sub-group analysis

To eliminate heterogeneity, a meta-regression and sub-group analyses were conducted by mental health assessment timepoints and country.

Sensitivity analysis

To further analyse the heterogeneity of studies reporting depression and anxiety, a sensitivity analysis was conducted.

Risk of bias quality assessment

Studies included within this study were critically appraised individually using mental health variables. All studies appraised for methodological quality and risk of bias based on the Newcastle-Ottawa Scale (NOS), which is commonly used for cross-sectional and/or cohort studies as demonstrated by Wells *et al* [73]. These could be further modified using the adapted NOS version as reported by Modesti *et al*[74]. The NOS scale includes 8 items within 3 specific quality parameters of selection, outcome and comparability. The quality of these studies was reported as good, fair or poor based on the details below: Good quality score of 3 or 4 stars were awarded in selection, 1 or 2 in comparability and 2 or 3 stars in outcomes; Fair quality score of 2 stars were awarded in selection, 1 or 2 stars in comparability and 2 or 3 stars in outcomes; Poor quality score was allocated 0 or 1 star in selection, 0 stars in comparability and 0 or 1 star in outcomes.

Outcomes

The following outcomes were included within the meta-analysis: Prevalence of anxiety and depressive symptoms, and parenting stress; Clinical significance of the data identified; Critical interpretive synthesis of common mental health reported outcomes.

Outcomes such as post-partum depression could not be synthesised for the meta-analysis. Therefore, these aspects have been included in the narrative analysis only.

Publication bias

Publication bias is a concern to the validity of conclusion of a meta-analysis. As a result, several methods could be used to assess this aspect. An egger's test was used to report on publication bias. Additionally, a trim and fill (TAF) method was used to analyze the influence of publication bias. TAF estimates any missing studies due to publication bias within the funnel plot to adjust the overall effect estimate.

Patient and public involvement

A representative from a patient-public focus group associated with a multi-morbid project investigating women's physical and mental health sequelae was invited to review the protocol and the resulting paper. This is a vital facet of developing and delivering an authentic evidence synthesis to reduce the gap between evidence production, development of solutions to address the identified gaps and the implementation of the solutions into practice as well as their acceptability by patients.

RESULTS

Of the 3526 studies, 39 met the eligibility criteria. All 39 studies reported the mental health status of BAME women with PTB although it remained unclear if they reported mental health symptoms or clinical diagnoses. Figure 1 shows the PRISMA diagram. The mental health assessments and frequency of the data gathering varied across studies. The 39 studies primarily reported stress, anxiety and depression as indicated in Table 1 along with other characteristics. The quality assessment using the Newcastle Ottawa scale (NOS) and Risk of Bias identified within the pooled studies are shown in Tables 2 and 3 and Supplementary Table 1. Brief description of various scales used to assess depression, anxiety, and stress across studies is presented in the supplementary file on Mental Health Questionnaires.

Depression

Of the 39 studies, 36 primarily reported an association between the prevalence of depression and PTB. Fifteen studies only examined the differences of non-depressive symptoms as well other factors such as race, ethnicity, plurality across multiple assessment timepoints although, they were not compared to full-term birth mothers of BAME decent. The overall SMD was 0.4 and 95%CI of a range of 0.25-0.56, indicating the prevalence of depression in PTB mothers to be significantly higher than mothers who delivered at term. I^2 = 82.69% indicated high heterogeneity among the depression group.

Table 1 Key features of the studies included in the systematic review

ID	Ref.	Study type	Country	Symptoms			Outcome assessment[1]
1	Ballantyne *et al* [37]	Cross-sectional study	Canada	Depression		Stress	(1) CES-D; and (2) PSS: NICU
2	Baptista *et al*[48]	Cross-sectional study	Portugal	Psychological problem		Stress	(1) BSI; and (2) Daily hassles questionnaire
3	Barroso *et al*[38]	Cross sectional study	United States	Depression			EPD-S
4	Bener[60]	Hospital-based study (cross sectional study)	Qatar	Depression	Anxiety	Stress	(1) DASS-21; (2) DASS-21; and (3) DASS-21
5	Bouras *et al*[34]	Cross-sectional study	Greece	Depression	Anxiety		(1) BDI; and (2) STAI
6	Brandon *et al*[39]	Descriptive study	United States	Depression	Anxiety	Stress	(1) EPDS; (2) STAI-S; (3) PPQ; and (4) CHWS
7	Carson *et al*[49]	Cohort study	United Kingdom	Psychological problem			Modified RMI
8	Cheng *et al*[13]	Cohort study	United States	Depression			CES-D
9	Davis *et al*[57]	Cross-sectional study	Australia	Depression		Stress	(1) EPDS; and (2) DASS
10	Drewett *et al*[50]	Cross-sectional study	United Kingdom	Depression			EPDS
11	Edwards *et al*[58]	Cohort study	Australia	Depression		Parenting stress	(1) EPDS; and (2) PSI
12	Fabiyi *et al*[40]	Cross-sectional study	United States		(1) State anxiety; and (2) Trait anxiety		STAI
13	Gambina *et al*[33]	Case-control study	Italy	Depression	(1) State anxiety; and (2) Trait anxiety	Stress	(1) EPDS; (2) STAI-State and STAI-Trait; and (3) PSM
14	Gueron-Sela *et al* [30]	Cross-sectional study	Israel	Depression		Stress	(1) CES-D; and (2) PSS: NICU
15	Gulamani *et al* [24]	Cohort study	Pakistan	Depression			EPDS
16	Gungor *et al*[35]	Case-control study	Turkey	Depression	(1) State anxiety; (2) Trait anxiety		(1) BDI; and (2) STAI
17	Hagan *et al*[59]	Prospective, randomised, controlled study	Australia	Depression	Anxiety		(1) EPDS; and (2) BDI
18	Henderson *et al* [51]	Cross-sectional study	United Kingdom	Depression			EPDS
19	Holditch-Davis *et al*[44]	Cross-sectional study	United States	Depression	Anxiety	Stress	(1) CES-D; (2) STAI; and (3) PSS: NICU
20	Ionio *et al*[52]	Longitudinal study	Italy	Depression			Profile of mood states
21	Logsdon *et al*[41]	Descriptive study	United States	Depression			CES-D
22	Misund *et al*[53]	Longitudinal study	Norway	Psychological distress	Anxiety	Trauma-related stress	(1) GHQ likert sum and case sum; (2) STAI-X1; and (3) Impact of event scale (IES)
23	Misund *et al*[53]	Cohort study	Norway	Psychological distress	Anxiety	Trauma-related stress	(1) GHQ likert sum and case sum; (2) STAI-X1; and (3) IES
24	Pace *et al*[32]	Longitudinal, prospective, follow-up cohort study	Australia	Depression	Anxiety		(1) CES-D; and (2) Hospital anxiety and depression scale
25	Rogers *et al*[42]	Cohort study	United States	Depression	Anxiety		(1) EPDS; and (2) STAI
26	Sharan *et al*[61]	Cross-sectional study	Israel	Depression			EPDS
27	Shaw *et al*[43]	Cross-sectional study	United States	Depression	Anxiety	Stress	(1) BDI-II; (2) BAI; and (3) SASRQ

28	Trumello *et al*[54]	Longitudinal study	Italy	Depression	(1) State anxiety; and (2) Trait anxiety		(1) EPDS; and (2) STAI-State Y1 and Y2
29	Holditch-Davis *et al*[44]	Longitudinal study	United States	Depression	State anxiety	Stress	(1) CESD; (2) STAI; (3) PSS: NICU; and (4) PSS:PBC
30	Mautner *et al*[55]	Prospective, longitudinal study	Austria	Depression			EPDS
31	Gray *et al*[28]	Cross-sectional study	Australia	Depression		Parenting stress	(1) EPDS; and (2) PSI-SF
32	Gray *et al*[29]	Cross-sectional study	Australia	Depression		Parenting stress	(1) EPDS; and (2) PSI-SF
33	Howe *et al*[62]	Cross-sectional study	Taiwan			Parenting stress	PSI-Chinese version
34	Miles *et al*[45]	Longitudinal, descriptive study	United States	Depression			CES-D
35	Mew *et al*[46]	Correlational analysis	United States	Depression			CES-D
36	Madu and Roos [31]	Cross-sectional study	South Africa	Depression			EPDS
37	Suttora *et al*[36]	Descriptive study	Italy			(1) PTSD; and (2) Parenting stress	(1) PPQ-Modified version; and (2) PSI-SF
38	Korja *et al*[56]	Cross-sectional study	Finland	Depression			EPDS
39	Younger *et al*[47]	Descriptive correlational study	United States	Depression		Stress	(1) CES-D; and (2) MSI

[1]Outcome assessment scales: Edinburgh Postnatal Depression Scale; State-Trait Anxiety Inventory; Hospital Anxiety and Depression Scale; Centre for Epidemiological Studies Depression; Beck's Depression Inventory; Profile of Mood States; Parent Stress Index; Professional Personality Questionnaire; Perceived Stress Measure. EPDS: Edinburgh Postnatal Depression Scale; STAI: State-Trait Anxiety Inventory; HADS-A: Hospital Anxiety and Depression Scale; CES-D: Centre for Epidemiological Studies Depression; BDI: Beck's Depression Inventory; POMS: Profile of Mood States; PSI: Parent Stress Index; PPQ: Professional Personality Questionnaire; PSM: Perceived Stress Measure.

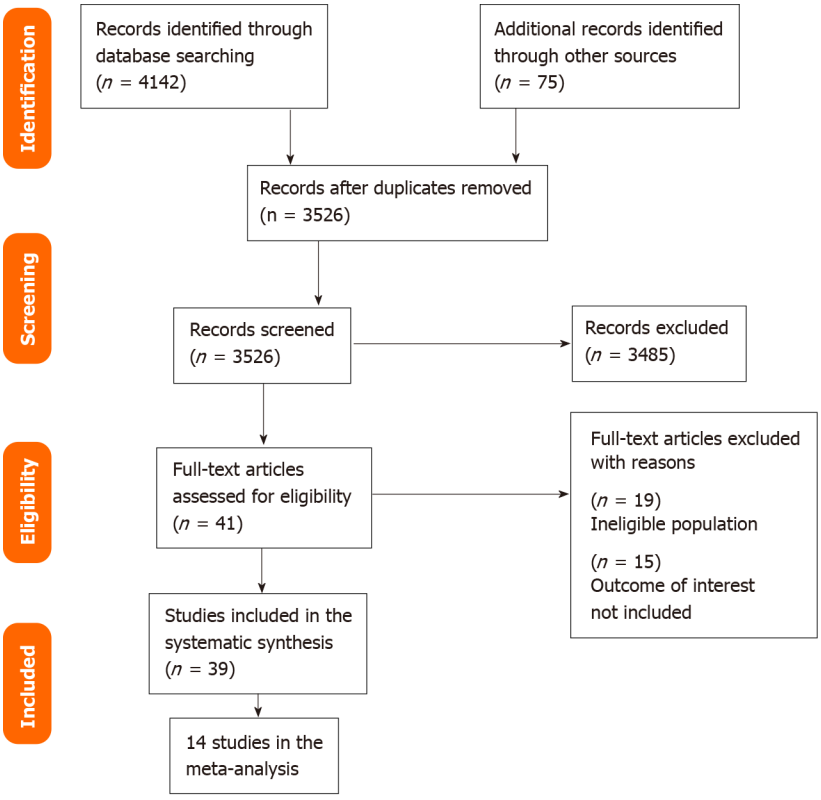

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Figure 1 PRISMA diagram.

Table 2 The quality assessment outcomes using the Newcastle-Ottawa Scale

ID	Ref.	Study type	Country	Symptoms			Outcome assessment	NOS score
1	Ballantyne *et al* [37]	Cross-sectional study	Canada	Depression		Stress	(1) CES-D; and (2) PSS: NICU	****** (6)
2	Baptista *et al* [48]	Cross-sectional study	Portugal	Psychological problem		Stress	(1) BSI; and (2) Daily hassles questionnaire	***** (5)
3	Barroso *et al* [38]	Cross sectional study	United States	Depression			EPD-S	****** (6)
4	Bener[60]	Hospital-based study (Cross sectional study)	Qatar	Depression	Anxiety	Stress	(1) DASS-21; (2) DASS-21; and (3) DASS-21	***** (5)
5	Bouras *et al*[34]	Cross-sectional study	Greece	Depression	Anxiety		(1) BDI; and (2) STAI	****** (6)
6	Brandon *et al* [39]	descriptive study	United States	Depression	Anxiety	Stress	(1) EPDS; (2) STAI-S; (3) PPQ; and (4) CHWS	******* (7)
7	Carson *et al* [49]	Cohort study	United Kingdom	Psychological problem			Modified RMI	***** (5)
8	Cheng *et al*[13]	Cohort study	United States	Depression			CES-D	***** (5)
9	Davis *et al*[57]	Cross-sectional study	Australia	Depression		Stress	(1) EPDS; and (2) DASS	***** (5)
10	Drewett *et al* [50]	Cross-sectional study	United Kingdom	Depression			EPDS	***** (5)
11	Edwards *et al* [58]	Cohort study	Australia	Depression		Parenting stress	(1) EPDS; and (2) PSI	***** (5)
12	Fabiyi *et al*[40]	Cross-sectional study	United States		(1) State anxiety; and (2) Trait anxiety		STAI	****** (6)
13	Gambina *et al* [33]	Case-control study	Italy	Depression	(1) State anxiety; and (2) Trait anxiety	Stress	(1) EPDS; (2) STAI-State and STAI-Trait; and (3) PSM	****** (6)
14	Gueron-Sela *et al*[30]	Cross-sectional study	Israel	Depression		Stress	(1) CES-D; and (2) PSS: NICU	******* (7)
15	Gulamani *et al* [24]	Cohort study	Pakistan	Depression			EPDS	**** (4)
16	Gungor *et al* [35]	Case-control study	Turkey	Depression	(1) State anxiety; (2) Trait anxiety		(1) BDI; and (2) STAI	****** (6)
17	Hagan *et al*[59]	Prospective,randomised, controlled study	Australia	Depression	Anxiety		(1) EPDS; and (2) BDI	****** (6)
18	Henderson *et al*[51]	Cross-sectional study	United Kingdom	Depression			EPDS	******* (7)
19	Holditch-Davis *et al*[44]	Cross-sectional study	United States	Depression	Anxiety	Stress	(1) CES-D; (2) STAI; and (3) PSS: NICU	****** (6)
20	Ionio *et al*[52]	Longitudinal study	Italy	Depression			Profile of mood states	***** (5)
21	Logsdon *et al* [41]	Descriptive study	United States	Depression			CES-D	****** (6)
22	Misund *et al* [53]	Longitudinal study	Norway	Psychological distress	Anxiety	Trauma-related stress	(1) GHQ likert sum and case sum; (2) STAI-X1; and (3) Impact of Event Scale (IES)	****** (6)
23	Misund *et al*	Cohort study	Norway	Psychological	Anxiety	Trauma-	(1) GHQ likert sum	***** (5)

	[53]			distress		related stress	and case sum; (2) STAI-X1; and (3) IES	
24	Pace *et al*[32]	Longitudinal, prospective, follow-up cohort study	Australia	Depression	Anxiety		(1) CES-D; and (2) Hospital anxiety and depression scale	****** (6)
25	Rogers *et al*[42]	Cohort study	US	Depression	Anxiety		(1) EPDS; and (2) STAI	***** (5)
26	Sharan *et al* [61]	Cross-sectional study	Israel	Depression			EPDS	****** (6)
27	Shaw *et al*[43]	Cross-sectional study	US	Depression	Anxiety	Stress	(1) BDI-II; (2) BAI; and (3) SASRQ	****** (6)
28	Trumello *et al* [54]	Longitudinal study	Italy	Depression	1) State anxiety2) Trait anxiety		(1) EPDS; and (2) STAI-State Y1 and Y2	******* (7)
29	Holditch-Davis *et al*[44]	Longitudinal study	US	Depression	1) State anxiety	Stress	(1) CESD; (2) STAI; (3) PSS: NICU; and (4) PSS:PBC	****** (6)
30	Mautner *et al* [55]	Prospective, longitudinal study	Austria	Depression			EPDS	****** (6)
31	Gray *et al*[28]	Cross-sectional study	Australia	Depression		Parenting stress	(1) EPDS; and (2) PSI-SF	****** (6)
32	Gray *et al*[29]	Cross-sectional study	Australia	Depression		Parenting stress	(1) EPDS; and (2) PSI-SF	****** (6)
33	Howe *et al*[62]	Cross-sectional study	Taiwan			Parenting stress	PSI-Chinese version	****** (6)
34	Miles *et al*[45]	Longitudial, descriptive study	United States	Depression			CES-D	***** (5)
35	Mew *et al*[46]	Correlational analysis	United States	Depression			CES-D	***** (5)
36	Madu and Roos[31]	Cross-sectional study	South Africa	Depression			EPDS	****** (6)
37	Suttora *et al* [36]	Decriptive study	Italy			(1) PTSD; and (2) Parenting stress	(1) PPQ-Modified version; and (2) PSI-SF	***** (5)
38	Korja *et al*[56]	Cross-sectional study	Finland	Depression			EPDS	****** (6)
39	Younger *et al* [47]	Decriptive correlational study	United States	Depression		Stress	(1) CES-D; and (2) MSI	****** (6)

*: Quality of the included cross-sectional studies was measured using the modified Newcastle-Ottawa Measurement Scale specific for Cross-sectional studies. We rated the quality of the studies (good, fair and poor) by allocating each domain with stars in this manner: A good quality score was awarded 3 or 4 stars in selection, 1 or 2 in comparability, and 2 or 3 stars in outcomes; A fair quality score was awarded 2 stars in selection, 1 or 2 stars in comparability, and 2 or 3 stars in outcomes; A poor quality score was allocated 0 or 1 star(s) in selection, 0 stars in comparability, and 0 or 1 star(s) in outcomes domain in line with the Newcastle-Ottawa Scale guidelines. NOS: Newcastle-Ottawa Scale; EPDS: Edinburgh Postnatal Depression Scale; STAI: State-Trait Anxiety Inventory; HADS-A: Hospital Anxiety and Depression Scale; CES-D: Centre for Epidemiological Studies Depression; BDI: Beck's Depression Inventory; POMS: Profile of Mood States; PSI: Parent Stress Index; PPQ: Professional Personality Questionnaire; PSM: Perceived Stress Measure.

Shaw *et al*[43] focused on the association between depression symptoms and the efficiency of Edinburgh Postnatal Depression Scale (EPDS), although the specificity of EPDS to the BAME population was not demonstrated. Since most of the studies reported mean and SD, we pooled mean differences and its 95%CI. Seven of the studies lacked information about mean score and SD, thus, were excluded from the meta-analysis. Gray *et al*[28,29] used the same dataset in two papers, therefore one of these was included into the meta-analysis. Therefore, a total of 12 studies were included in the meta-analysis as indicated by Table 4. Additionally, Gueron-Sela *et al*[30] studied two ethnicities, therefore it was used twice as reported in Table 4. Therefore, 13 items were reported in the meta-analysis for depression. The meta-analyses for anxiety and stress had 5 studies each, as demonstrated in Tables 5 and 6.

Anxiety

The 12 studies reporting anxiety utilised EDPS, the State-Trait Anxiety Inventory (STAI), Hospital

Table 3 Risk of Bias using the Newcastle-Ottawa Scale

	Selection (S)				Comparability (C)		Exposure/outcome E/O			Sub total assessment			Conclusion
	1	2	3	4	1a	1b	1	2	3	S[1]	C[2]	E/O[2]	
Ballantyne *et al*[37]	*	*	No	*	*	*	No	*	*	Good	Good	Good	Good
Baptista *et al*[48]	*	*	No	*	*	*	*	*	*	Good	Good	Good	Good
Barroso *et al*[38]	*	*	*	*	*	*	*	No	*	Good	Good	Good	Good
Bener[60]	*	No	*	*	*	*	*	*	*	Good	Good	Good	Good
Bouras *et al*[34]	*	*	*	*	*	*	*	*	*	Good	Good	Good	Good
Brandon *et al*[39]	*	*	*	*	*	*	*	*	*	Good	Good	Good	Good
Carson *et al*[49]	*	No	*	*	*	*	*	*	*	Good	Good	Good	Good
Cheng *et al*[13]	*	*	No	*	No	*	*	*	*	Good	Good	Good	Good
Davis *et al*[57]	*	*	No	No	*	*	*	*	*	Fair	Good	Good	Good
Drewett *et al*[50]	*	*	*	*	No	*	*	*	*	Good	Good	Good	Good
Edwards *et al*[58]	*	No	No	*	No	*	*	*	*	Fair	Good	Good	Fair
Fabiyi *et al*[40]	*	No	*	No	No	*	*	*	*	Fair	Fair	Good	Fair
Gambina *et al*[33]	*	No	*	*	*	*	*	*	*	Good	Good	Good	Good
Gueron-Sela *et al*[30]	*	*	*	*	*	*	*	*	*	Good	Good	Good	Good
Gulamani *et al*[24]	*	No	*	*	*	*	*	*	*	Good	Good	Good	Good
Gungor *et al*[35]	*	*	*	*	*	*	*	*	*	Good	Good	Good	Good
Hagan *et al*[59]	*	*	*	*	*	*	*	*	*	Good	Good	Good	Good
Henderson *et al*[51]	*	*	*	*	*	*	*	*	*	Good	Good	Good	Good
Holditch-Davis *et al*[44]	*	*	No	*	No	*	*	*	*	Good	Good	Good	Good
Ionio *et al*[52]	*	*	*	*	*	*	*	*	*	Good	Good	Good	Good
Logsdon *et al*[41]	*	No	No	*	No	*	*	*	*	Fair	Fair	Good	Fair
Misund *et al*[53]	No	*	*	*	*	*	*	*	*	Good	Good	Good	Good
Misund *et al*[53]	*	*	*	*	*	*	*	*	*	Good	Good	Good	Good
Pace *et al*[32]	*	*	*	*	*	*	*	*	*	Good	Good	Good	Good
Rogers *et al*[42]	*	*	*	*	*	*	*	*	*	Good	Good	Good	Good

Sharan *et al*[61]	No	*	*	*	*	*	*	*	*	Good	Good	Good	Good
Shaw *et al*[43]	*	*	*	*	*	*	*	*	*	Good	Good	Good	Good
Trumello *et al*[54]	*	*	*	*	*	*	*	*	*	Good	Good	Good	Good
Holditch-Davis *et al*[44]	*	*	*	*	*	*	*	*	*	Good	Good	Good	Good
Mautner *et al*[55]	*	No	*	*	*	*	*	*	*	Good	Good	Good	Good
Gray *et al*[28]	*	*	No	*	No	*	*	*	*	Good	Good	Good	Good
Gray *et al*[29]	*	*	No	*	No	*	*	*	*	Good	Good	Good	Good
Howe *et al*[62]	*	*	*	*	*	*	*	*	*	Good	Good	Good	Good
Miles *et al*[45]	*	No	No	*	No	*	*	*	*	Fair	Good	Good	Fair
Mew *et al*[46]	*	No	No	*	No	*	*	No	*	Fair	Fair	Good	Fair
Madu and Roos[31]	*	*	*	*	*	*	*	*	*	Good	Good	Good	Good
Suttora *et al*[36]	*	*	*	*	*	*	*	*	*	Good	Good	Good	Good
Korja *et al*[56]	*	*	No	*	No	*	*	*	*	Good	Good	Good	Good
Younger *et al*[47]	*	No	No	*	No	*	*	*	*	Fair	Good	Good	Good

[1]Domain scored: 0-1 (Poor); 2 (Fair); 3+ (Good).
[2]Domain scored: 0 (Poor); 1 (Fair); 2+ (Good).
*: Domain acceptable.

Anxiety and Depression Scale (HADS-A), Centre for Epidemiological Studies Depression, Beck's Depression Inventory and Profile of Mood States as their assessment tool. The total scores of these scales are different, and the mean difference of the studies are not compatible. Four studies reported on anxiety using STAI and HADS-A as their mental health assessment of choice. The overall SMD of Anxiety was 0.63 with 95%CI of 0.35-0.91. I^2 = 86.83% also indicated high heterogeneity among anxiety group.

Stress and parent stress index

Studies reporting stress used the Parent Stress Index assessment on three separate timepoints along with the Professional Personality Questionnaire and the Perceived Stress Measure. The total scores of these scales in each meta-analysis are different, and the mean difference of the studies are not compatible. The overall SMD of Stress was 0.47 with 95%CI 0.22-0.72. I^2 =77.55% indicated high heterogeneity among stress group.

Posttraumatic stress disorder

Suttora *et al* [36] was the only study reporting on posttraumatic stress disorder (PTSD). The reported

Table 4 Characteristics of the 12 studies included within the meta-analysis for depression

ID	Ref.	Study type	Country	Sample size	Outcome assessment
1	Brandon *et al*[39]	Descriptive study	United States	60	EPDS
2	Bouras *et al*[34]	Cross-sectional study	Greece	200	BDI
3	Cheng *et al*[13]	Cohort study	United States	5350	CES-D
4	Drewett *et al*[50]	Cross-sectional study	United Kingdom	10838	EPDS
5	Gambina *et al*[33]	Case-control study	Italy	84	EPDS
6	Gray *et al*[28,29]	Cross-sectional study	Australia	217	EPDS
7	Gueron-Sela *et al*[30]	Cross-sectional study	Israel	103 (Bedouin); 230 (Jewish)	CES-D
8	Gungor *et al*[35]	Case-control study	Turkey	299	BDI
9	Ionio *et al*[52]	Longitudinal study	Italy	50	Profile of mood states
10	Madu and Roos[31]	Cross-sectional study	South Africa	100	EPDS
11	Mautner *et al*[55]	Prospective, longitudinal study	Australia	61	EPDS
12	Pace *et al*[32]	Longitudinal, prospective cohort study	Australia	230	CES-D

EPDS: Edinburgh Postnatal Depression Scale; BDI: Beck's Depression Inventory; CES-D: Centre for Epidemiological Studies Depression.

Table 5 Characteristics of the 5 studies included within the meta-analysis for anxiety

ID	Ref.	Study type	Country	Sample size	Outcome assessment
1	Brandon *et al*[39]	Descriptive study	United States	60	STAI-S
2	Bouras *et al*[34]	Cross-sectional study	Greece	200	STAI-T; STAI-S
3	Gambina *et al*[33]	Case-control study	Italy	84	STAI-T; STAI-S
4	Gungor *et al*[35]	Case-control study	Turkey	299	STAI-T; STAI-S
5	Pace *et al*[32]	Longitudinal, prospective cohort study	Australia	230	HADS-A

STAI: State-Trait Anxiety Inventory.

Table 6 Characteristics of the 5 studies included within the meta-analysis for stress

ID	Ref.	Study type	Country	Sample size	Outcome assessment
1	Brandon *et al*[39]	Descriptive study	United States	60	PPQ
2	Gambina *et al*[33]	Case-control study	Italy	84	PSM
3	Gray *et al*[28,29]	Cross-sectional study	Australia	217	PSI-SF
4	Howe *et al*[62]	Cross-sectional study	Taiwan	420	PSI-Chinese version
5	Suttora *et al*[36]	Descriptive study	Italy	243	PSI-SF

PPQ: Professional Personality Questionnaire; PSM: Perceived Stress Measure; PSI: Parent Stress Index.

mean and SD of the symptoms of PTSD were transformed to SMD. The SMD was 1.12 with a 95%CI of 0.84-1.40 indicated significantly high PTSD symptoms among BAME PTB women than the term mothers.

Assessment of mental health at differing time-points for depression, anxiety and stress were evaluated between full term and PTB mothers. Different mean scores and SD values were reported across the included studies. The dataset was unified with converting the mean difference to the SMD and demonstrated in the forest plots (Figures 2-4).

This meta-analysis identified depression to be a primary mental health outcome among PTB mothers and significantly higher prevalence rates of depression was reported in PTB mothers compared with full-term mothers.

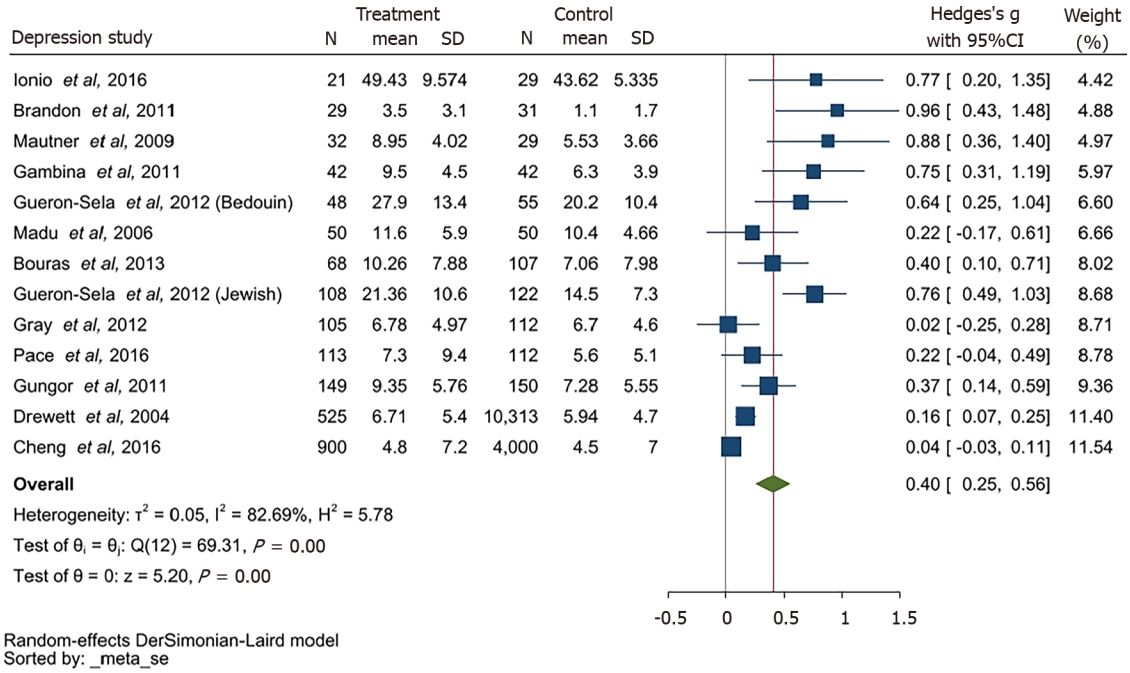

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Figure 2 Forest plot for depression (full term *vs* preterm birth). CI: Confidence interval.

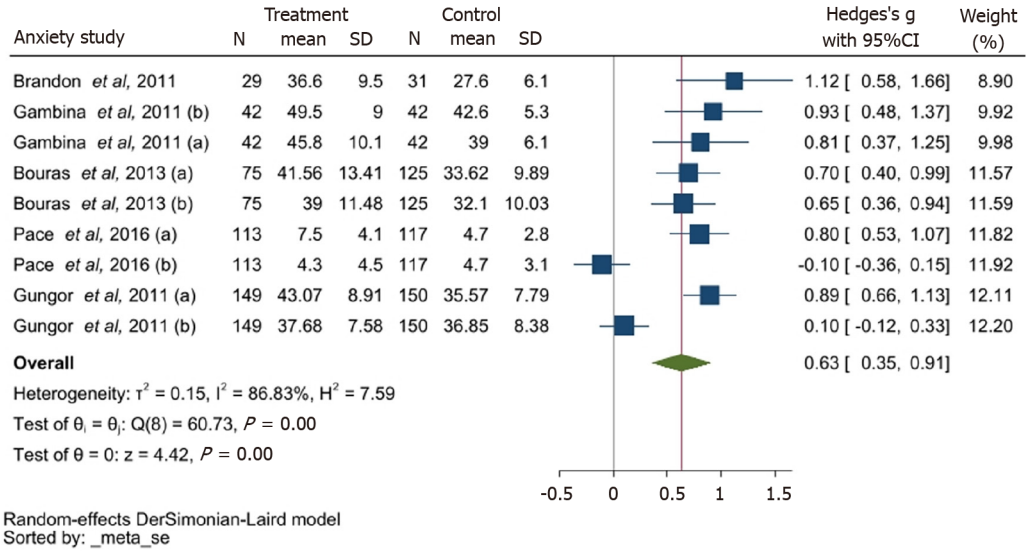

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Figure 3 Forest plot for anxiety (full term *vs* preterm birth). CI: Confidence interval.

Meta-regression analysis

Of the 16 studies included within the meta-regression analysis for depression, 5 reported mean scores and SD of the mental health questionnaires used at parturition. Four studies recorded the mean and SD at 1-mo post-delivery, while another four studies reported the same at 1 mo to 8 mo post-delivery. To eliminate the heterogeneity, these studies were adjusted by timepoints (Figure 5).

The estimated intercept for depression is 0.629 with a 95%CI of 0.455-0.804. This indicates the mental health assessment scores within the PTB group were significantly higher than full-term group at the birth. The coefficient of the covariate time was -0.061 with a 95%CI of -0.094, -0.028 indicating that the coefficients of time were significantly lower than 0. This is indicative of a reduction depression symptoms post-delivery. Heterogeneity decreased from 82.69% to 79.82%, and the differences of assessment time points could explain the 31.75% of the heterogeneity identified.

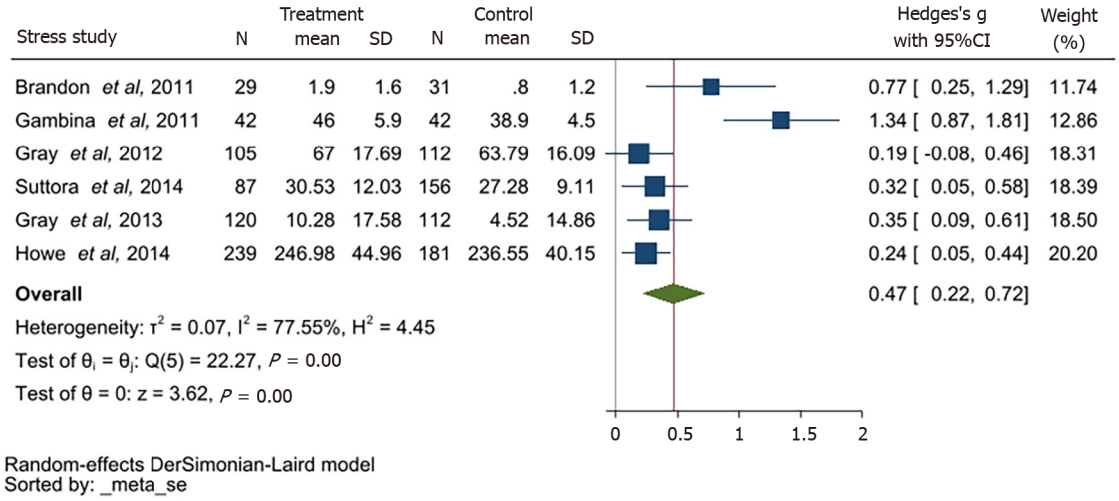

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Figure 4 Forest plot for stress (full term *vs* preterm birth). CI: Confidence interval.

```
Random-effects meta-regression                  Number of obs   =        16
Method: DerSimonian-Laird                       Residual heterogeneity:
                                                          tau2 =  0.04072
                                                       I2 (%)  =    79.82
                                                          H2   =     4.96
                                                R-squared (%)  =    31.75
                                                Wald chi2(1)   =    13.41
                                                Prob > chi2    =   0.0002
------------------------------------------------------------------------------
     _meta_es |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       tvalue |  -0.0609896   0.0166533    -3.66   0.000    -0.0936296   -0.0283497
        _cons |   0.6294887   0.0889261     7.08   0.000     0.4551968    0.8037807
------------------------------------------------------------------------------
Test of residual homogeneity: Q_res = chi2(14) = 69.38   Prob > Q_res = 0.0000
```

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Figure 5 Meta regression conducted by time for depression.

Nine studies that reported anxiety were included in the meta-regression (Figure 6). The estimated intercept was 0.772 with a 95%CI of 0.500-1.045 which indicates the mental health assessment scores of the PTB group are significantly higher than the scores of full-term group. The coefficient of the covariate time is -0.136 with 95%CI of -0.262, -0.010 indicating that the symptoms of anxiety gradually disappeared among PTB group following birth. Heterogeneity reduced from 86.83% to 80.29%. The differing time points in administering the mental health assessment could explain 34.91% of the heterogeneity (Figure 6).

Following the reduction of heterogeneity by way of the meta-regression method, the statistical conclusions demonstrate a statistical significance where the prevalence of depression among BAME women with PTB was higher in comparison to BAME women who delivered at full-term. The I^2 was almost 80% which indicates a high heterogeneity.

The pooled SMD within the studies using PTB mothers from United States was 0.46 with a 95%CI of -0.43 – 1.35. The pooled SMD within Australia was 0.44 with a 95%CI of 0.07-0.81. I^2 of these two subgroups indicated a high heterogeneity: 91.14% and 87.79% respectively. The assessment timepoints of these two groups have a significant difference, which could be the source of the high heterogeneity. As there were only 2 studies, a meta-regression of the timepoints could not be completed.

Subgroup analysis

A subgroup analysis of depression and anxiety was completed using geographical location as demonstrated in Supplementary Figures 1-3. For depression, the pooled SMD within Greece, Italy, Israel and Turkey was 0.57 with a 95%CI of 0.4-0.74. The pooled SMD within United Kingdom was 0.12 with a 95%CI of 0.03-0.21. I^2 was denoted to be indicating a lack of heterogeneity as demonstrated in Supplementary Figure 1.

```
Random-effects meta-regression                  Number of obs  =         9
Method: DerSimonian-Laird                       Residual heterogeneity:
                                                          tau2 =    0.1002
                                                       I2 (%)  =     80.29
                                                          H2   =      5.07
                                                  R-squared (%) =    34.91
                                                Wald chi2(1)    =      4.50
                                                Prob > chi2     =    0.0338
------------------------------------------------------------------------------
     _meta_es |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       tvalue |  -0.1359486   0.0640626    -2.12   0.034    -0.261509  -0.0103882
        _cons |   0.7723931   0.1391725     5.55   0.000     0.4996201    1.045166
------------------------------------------------------------------------------
Test of residual homogeneity: Q_res = chi2(7) = 35.51    Prob > Q_res = 0.0000
```

DOI: 10.5498/wjp.v12.i9.1233

Figure 6 Meta regression conducted by time for anxiety.

Although a meta-regression was not conducted for the pooled SMD within the studies with PTB mothers from United States, a subgroup analysis demonstrated that the high heterogeneity could be attributed to the differences of time points of the mental health assessments.

Of the 39 studies included in the systematic review, thirteen studies were from North America[1,3,6,8,12,19,21,25,27,29,34,35,39], thirteen from Europe[2,5,7,10,13,18,20,22,23,28,30,37,38], six studies from Australia[9,11,17,24,31,32], three from Asia[15,16,33], three from the Middle East[4,14,26] and one from South Africa[36]. These have been demonstrated in Table 1. Depression was the most frequently reported theme across all the studies, followed by anxiety and stress (Table 7). A variety of diagnostic tools were used across the studies, which reflects the diverse clinical practices across different countries.

Based on the identified data, PTB women from the Mediterranean region (Greece, Italy, Turkey and Israel) may be more prone to depressive symptoms in comparison to BAME women with PTB in Australia and the United States. The pooled odds ratio (OR) and its respective 95%CIs appear credible for PTB BAME women experiencing a significantly higher prevalence of depression post-parturition, although the mental health symptoms appear to reduce over time.

The pooled SMD of anxiety within United States was 1.12 with 95%CI of 0.58-1.66 whilst the pooled SMD of the Mediterranean region (Greece, Italy, Turkey) was 0.66 with a 95%CI of 0.37-0.95. The pooled SMD of Australia was 0.35 with a 95%CI of -0.54 -1.23 (Supplementary Figure 2). BAME women with PTB from Australia appear to have less symptoms of anxiety and the main source of the high heterogeneity in subgroup was still from the time points.

In relation to assessing stress, Gray *et al*[28,29] conducted mental health assessments at months 4 and 12, post-parturition. Whilst this appears to be useful follow-up data to evaluate, the outcome measures were analysing 2 different mental health variables of parenting stress and general stress. As shown in Supplementary Figure 4 four studies reported on parenting stress and 2 of them reported on the overall state of stress. The subgroup analysis conducted indicated a lack of heterogeneity between these studies. Mild heterogeneity was identified within the studies included in the stress group alone. The pooled SMD within the parenting group was 0.27 with a 95%CI of 0.15-0.39. In the stress group, the pooled SMD was 1.07 with a 95%CI of 0.51-1.62. Additionally, the symptoms of parenting stress were less severe within the PTB group (Table 7 and Supplementary Figures 4 and 5).

Sensitivity analysis

Studies reporting depression[32] demonstrated women with severe PTB indicated a high SMD at parturition indicating elevated levels of depressive symptoms (Supplementary Figure 6). A combination of worries about very premature babies and the trauma following parturition may further attribute to elevated depressive symptoms. Only Pace *et al*'s study conducted the assessment of questionnaires among the very PTB women group at the birth[32]. Women with a more severe PTB may indicate higher scores of depression, therefore this study was excluded from the sensitivity analysis. After removing Pace *et al*'s study, the heterogeneity in Australia reduced from an I^2 of 87.79% to 52.99%[32]. Therefore, conclusions were adjusted from a pooled SMD of 0.42 (with 95%CI: 0.28-0.56) to 0.34 (with 95%CI: 0.22-0.46). Despite this numerical change, an elevated level of depression among BAME PTB women were visible in comparison to those with a full-term pregnancy (Supplementary Figure 6).

Based on the anxiety studies, Gungor *et al*[35] in particular, reported extremely small OR and a sensitivity analysis was conducted excluding one possible outlier study, as indicated by Supplementary Figure 7. The heterogeneity identified without Gungor *et al*[35] was 0%. Therefore, this study in particular appears to have design and methodological issues limiting generalisability of the findings. As a result, conclusions were amended from an SMD of 0.63 (with 95%CI: 0.35-0.91) to 0.7 (with 95%CI: 0.42-0.98). Therefore, despite the amendment[35], a significantly high prevalence among BAME PTB

Table 7 The thematic synthesis

Themes	Population group
	Women who had a preterm birth
Depression	++++++++++++++++++++++++++++++++
Stress	++++++++++
Anxiety	++++++++++
Parenting stress	+++++
State anxiety	+++++
Trait anxiety	++++
Psychological distress	++
Trauma-related stress	++
Psychological problem	++
Post-traumatic stress disorder	+

women is observed (Supplementary Figure 7).

Publication bias

For studies with a small sample size, the pooled OR is significantly higher based on the funnel plots, therefore, these would be prone to publication bias. To assess this further, Egger's tests were conducted for all studies included within the meta-analysis.

Funnel plots developed within this sample intuitively revealed publication bias (Supplementary Figures 8-10. Egger's test of meta-analysis studies for depression (*P* value = 0.001), indicated the small sample sizes are a source of publication bias (Supplementary Figure 11). The pooled SMD 0.4 and associated CI (0.25-0.56) may have been overrated. Therefore, the TAF method was used to further improve the statistical conclusions (as indicated in Supplementary Figures 11 and 12). The asymmetry of the funnel plot demonstrates the studies could minimally impact publication bias.

Based on the findings demonstrated in Supplementary Figures 11, 3 further studies were imputed to correct the effect size of small studies. The small study effect was eliminated with using the imputation method, and publication bias was corrected (demonstrated in Supplementary Figure 12). The Hedge's g (Supplementary Figure 12) was significantly higher than 0 among the meta-analysis based and imputed studies. After imputing the 3 new studies and removing the publication bias, the statistical conclusion was adjusted from a SMD of 0.4 with 95%CI of 0.25-0.56 to 0.32 (95%CI of 0.18-0.47). Despite the adjustments of publication bias, there was significant evidence that the prevalence of depression among BAME PTB women were higher than those who gave birth at full-term (Supplementary Figures 12 and 13).

Egger's test *P* value for anxiety was 0.198, indicating no publication bias exists (demonstrated in Supplementary Figure 14). Egger's test *P* value for stress was 0.036, indicating a slight publication bias among the studies (demonstrated in Supplementary Figure 15).

Ascertainment bias was considered within the context of the meta-analysis. Due to the lack of required details such as the proportion of different ethnic groups and mental health assessments, it was not possible to assess this numerically. However, within the context of all the studies included in the systematic review portion of the study, it is evident, there could be ascertainment bias as the sampling methods used in the studies comprise of patients who may or may not have a higher or lower probability of reporting mental health symptomatologies. These studies may be subjected to selection bias due to the lack of consistency around frequency of administering the relevant mental health instruments. In essence, studies should have had samples with all ethnicities and races (including Caucasians) to better evaluate the true mental health impact due to PTB. Furthermore, the sample population should have received a standardised set of mental health assessments to determine anxiety, depression, PTSD and other mental illnesses at specific time points during the pre and post-natal period since it is common to have undiagnosed mental health conditions. In addition to this, some studies have had attempted to evaluate the mental health impact after birth at 8 mo although this lacks scientific justification and thereby, epidemiologically insignificant. Furthermore, due to the lack of consistency in assessing and reporting mental health outcomes post-natally, attrition bias may be present. However, a definitive conclusion could not be attained numerically due to limitations in the sample sizes reported.

DISCUSSION

In this meta-analysis, the prevalence rate of depression among PTB BAME mothers was identified to be significantly higher than in full-term mothers with an OR of 1.50 and 95%CI of 29%-74%. Depressive symptoms in mothers and fathers of premature infants were frequently reported in the post-natal period[13]. There may be many causes for this including the social support. Cheng *et al*[13] reported that mothers with non-resident fathers experienced higher rates of depressive symptoms, as did the non-resident fathers included in this study. Lack of social support is likely to be further exacerbated by prolonged hospitalisation of preterm infants and the unique challenges faced by infants the premature following hospital discharge. Additionally, mothers may be admitted to hospital prior to delivery, in some cases for weeks, due to conditions like severe preeclampsia or PROM associated with PTB and hence they may be more isolated than mothers of term infants.

This study defined three sub-groups; assessment timepoint < 1 mo, 1-8 mo and > 8 mo, and indicated that shorter the time after giving birth, the more significant was the depression. Therefore, the provision of mental health support following the immediate post-partum period would benefit patients. Within the first month after delivery, depressive symptoms were significant among PTB mothers; however, by 8 mo and after 8 mo, the increased prevalence of depression was only slightly significant among PTB mothers (OR of 1.17 with 95%CI of 8%-27%; OR of 1.06 with a CI of 1%-12%).

Separation of the infant and the mother is an important and frequent occurrence in PTB, which may explain why mothers of preterm infants are at increased risk of depression. Furthermore, maternal co-morbidities including preeclampsia or recovery from an obstetrics intervention such as a caesarean section may also impact on a mother's ability to bond with her new-born, who maybe in a neonatal intensive care unit (NICU) or special care unit. One study from South Africa[31] demonstrated a high prevalence of depression in mothers of both full term and preterm infants from lower socioeconomic groups. Women from lower socioeconomic groups are likely exposed to greater stressors relevant to the scarcity of resources[31], affecting their mental health.

Adjusting to parenthood is important for all parents. In the case of PTB mothers may not have sufficient time to prepare, which may lead to maternal stress[47]. Familiarity with the situation, possibly by having had a previous preterm infant, and predictability of birth outcome have been found to reduce stress and anxiety[47]. Medically indicated preterm delivery may have been planned, for example, in multiple pregnancies or mothers with diabetes and thus, predictable. Therefore, it is possible that those mothers experience less stress than those who give birth following an acute spontaneous onset preterm labor. In addition to mental preparation, the former group of parents of preterm infants may have had time to visit the NICU and speak with neonatologists to gain further information and this may reduce anxiety following birth.

Parenting stress is found to be higher in mothers of preterm infants at one year[29]. This relationship may by predicted by maternal depression as well as impaired parent and infant interactions[29]. Interestingly, parenting stress is not significantly different in mothers of preterm or full-term infants in early infancy[28], suggesting all mothers require support in the immediate post-partum period to reduce parental mental health but prolonged provision of such support is important in managing PTB mothers.

Increased and unexpected medical interventions associated with PTB, including painful corticosteroid injections or the use of magnesium sulphate. Mothers may have additional intimate examinations and the need for emergency procedures such as caesarean sections, which may negatively impact a mother's physical and mental health. These may exacerbate the underlying stress faced by a PTB mother and her partner; their feelings of anxiety and stress are compounded in some circumstances by the lack of preparedness and loss of control. Together, these experiences may explain why mothers and fathers of preterm infants have greater levels of stress[29] and depression[13].

Cheng *et al*[13] conducted the comparison between fathers and mothers suffering as a result of PTB among Hispanic, Non-Hispanic White, Non-Hispanic Black and Non-Hispanic as well as other races. Gueron-Sela *et al*[30] on the other hand focused on depression and stress symptomatologies among Bedouin and Jewish women. Based on Gueron-Sela *et al*'s findings, Bedouin women experienced the highest level of depression[30]. In comparison to these, Rogers *et al*[42] compared the Caucasian and African American PTB patients that indicated a lack of significant differences between the two groups. Ballantyne *et al*[37] conducted their study on Canadian PTB women which included immigrant women. However, immigrant's status had no contribution to the differences in mental health disorders or symptomatologies.

The mental health impact on those with PTB could be exacerbated due to understandable feelings of helplessness and hopelessness, and low mood is commonly reported by these women. On the contrary, Jotzo and Poets[14] demonstrated PTB could lead to traumatising effects on parents with 49% of mothers reporting traumatic reactions even after a year. Muller-Nix *et al*[15] demonstrated this correlation of traumatic stress and psychological distress between mother and child. Pierrehumbert *et al*[16] indicated post-traumatic stress symptoms after PTB was a predictor of a child's eating and sleeping problems. Similarly, Solhaug *et al*[17] found that parents, who had hospital stays following a PTB requiring NICU, demonstrated high levels of psychological reactions that required treatment.

Perinatal mental health around suicidality or suicidal ideation should be considered as a priority to be addressed among BAME women, which is vital in particular within the United Kingdom. BAME women are at a higher risk of suffering from mental health disorder in comparison to Caucasian women in the United Kingdom and they are less likely to access healthcare support. This is particularly true for women of Pakistani and Indian background. Additionally, Anderson *et al*[63] reported prevalence and risk of mental health disorders among migrant women. These factors should be considered by those treating clinical groups. In addition to the timepoint, we also considered the impact of population. It remains unclear whether the prevalence rate of depression varies after PTB in different ethnic groups. Gulamani *et al*[64] have found the depressive symptoms of women with PTB may be associated with race and culture, but further evidence is lacking. Due to the higher risk of mental health symptoms around the time of PTB, this data may help the health service providers to focus on delivering timely support to the BAME mothers with PTB.

Interestingly, alcohol consumption and substance abuse that are linked to worsening of mental health and poor pregnancy outcomes were not identified within the literature pertinent to BAME population in the scope of this study[65-70].

Similarly, substance abuse among pregnant women increases the risk of PTB and the association of mental illness among the BAME population[71,72]. Holden *et al*[72] demonstrated self-reported depressive symptoms associated with a group of 602 BAME and Caucasian pregnant women that had substance abuse and were subjected to intimate partner violence. This study used the EPDMS which demonstrated elevated levels of depressive illness that required clinical diagnoses and treatments at a mental health care facility. Additionally, women abuse screening tool was used to evaluate relationship issues and those needing appropriate support was referred to social services[71,72]. There is limited information available around substance abuse and partner violence associated with mental health among BAME women. Research conducted within this area appears to lack consistency and this makes systematic evaluation of cultural paradigms relevant to BAME women and the direct association with PTB and mental health difficult, given the complexity of these issues.

Limitations

Heterogeneity of studies gathered within this review challenged the evidence synthesis. Studies identified reported on mental health outcomes without a clear distinction mostly between mental health symptomatologies and psychiatric comorbidities. Timelines for administering mental health instruments and other tools such as talking therapies were not unified across all studies. Collectively, these are design and methodological flaws influencing heterogeneity. Studies were excluded if they discussed quality of life as this does not demonstrate the identification or reporting of mental health outcomes such as pre or postnatal depression, anxiety, psychosis and other mood disorders.

CONCLUSION

PTB has a significant association with depression, anxiety and stress symptoms in new mothers during the immediate postpartum period. The mental health symptoms are more significant in very preterm mothers than non-very preterm mothers. However, the effect of PTB on the incidence of depression and other mental health outcomes is unclear among different ethnic groups and therefore more studies are needed to explore this.

This study identified a methodological gap to evaluate disease sequelae between PTB and mental health among BAME populations. This important facet should be considered in future research studies, which requires the involvement of multidisciplinary teams. Most included studies did not indicate a publicly available protocol, and availability of such would have assisted in reducing potential biases during study selection in this systematic review to improve sampling techniques and the subsequent data analysis. Future PTB research will be benefited by Population Intervention (s) Comparator and Outcome (s) based reporting to address true mental health impact within BAME populations. The evidence gap that exists from multi-stakeholder needs to be filled to improving patient care. The development of a classification framework for healthcare systems to better assess BAME women at risk with PTB and mental health outcomes would be beneficial. Including cultural adaptation methods as well as training of healthcare professionals will help to manage patients' expectations with the required sensitivities. Similarly, cost-effectiveness and long-term sustainability should be considered when developing a suitable framework.

It is also vital to acknowledge health inequalities and avoidable disparities should be addressed as a matter of urgency. Maternal care should have integrated methods of working with mental health care professionals and a culturally adapted and sensitive specialist service to support BAME women after a PTB may improve the patient outcomes. It is important to improve quality of care received by vulnerable BAME women such as those who are refugees or migrants and do not speak English. Equally, mental health services should work more cohesively within the women's health in the community setting and training should be offered to all healthcare professionals to provide a personalised care.

ARTICLE HIGHLIGHTS

Research background

Preterm birth (PTB) is a complex clinical condition contributing to significant maternal morbidity and a leading cause of neonatal morbidity and mortality. Therefore, potential mental health impact of PTB on women is an important clinical and social sequel that requires further understanding.

Research motivation

Existing research primarily reports the mental health impact of women with PTB within the Caucasian population. There remains a paucity of research on the ethnic minority populations. Thus, we aimed to assess the current research gap relevant to ethnic minorities to inform future research that could aid with improving patient and clinical reported outcomes.

Research objectives

(1) We aimed to describe the prevalence of mental health conditions and/or symptoms reported by women with PTB experiences within the ethnic minorities; and (2) We also extended our study to report the commonly used methods of mental health assessments to charactertise the identified mental health conditions and/or symptoms with the pooled sample.

Research methods

A systematic methods protocol was developed, peer reviewed and published in PROSPERO (CRD42040210863). Multiple databases were used to extract relevant data for a meta-analysis. A trim and fill method was used to report publication bias in addition to an Egger's test. I^2 was used to report heterogeneity.

Research results

From a total of 3516 studies identified, we included 39 studies that met the inclusion criteria. Depression was the most commonly reported mental illness among PTB mothers in comparison to those who had a full-term pregnancy. The subgroup analysis demonstrated depression to be time-sensitive relative to the PTB. Stress and anxiety were also prevalent among PTB mothers as opposed to full-term mothers.

Research conclusions

There appears to be a mental health impact among PTB mothers from ethnic minorities. This is an important aspect to consider for maternity care services to improve the quality care provided to PTB women.

Research perspectives

Future researchers should consider inclusion of all ethnicities and races to ensure generalizability of any findings to all mothers that could truly improve maternity care services.

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FOOTNOTES

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