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Review article

Measures of suicidality in perinatal women: A systematic review

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ABSTRACT

Background: Suicide is a leading cause of death for perinatal women. Identifying women at risk of suicide is critical. Research on the validity and/or reliability of measures assessing suicidality in perinatal women is limited. This review sought to: (1) identify; and (2) evaluate the psychometric properties of suicidality measures validated in perinatal populations.

Methods: Nine electronic databases were systematically searched from inception to January 2022. Additional articles were identified through citation tracking. Study quality was assessed using an adapted tool, and the psychometric properties of measures were reviewed and presented using a narrative synthesis.

Results: A total of 208 studies were included. Thirty-five studies reported psychometric data on ten suicidality measures. Fifteen studies reported both validity and reliability data, 12 reported more than one type of validity, seven validated more than one measure and four only reported reliability. Nearly all measures primarily screened for depression, with an item or subscale assessing suicidal ideation and/or behaviours. Three measures were specifically developed for perinatal women, but only two were validated in more than one study. The Postpartum Depression Screening Scale (PDSS), suicidal thoughts subscale, was validated most frequently.

Limitations: Methodological differences and variability between the measures (e.g., suicidality construct assessed, number of items and administration) precluded direct comparisons.

Conclusion: Further validation of suicidality measures is needed in perinatal women. Screening for perinatal suicidality often occurs in the context of depression. The development of a standalone measure specifically assessing suicidality in perinatal women may be warranted, particularly for use in maternity care settings.

1. Introduction

Suicide is a leading cause of death in perinatal women (during pregnancy and up to one-year after birth). In high-income countries (HICs), perinatal suicide accounts for between 5 % to 44 % of all maternal deaths (Australian Institute of Health and Welfare (AIHW), 2020; Grigoriadis et al., 2017; Howard and Khalifeh, 2020; Perinatal and Maternal Mortality Review Committee (PMMRC), 2021; Trost et al., 2021; Walker, 2022), and in the UK, almost one in five women who die between six-weeks and one-year postnatal, die by suicide (Knight et al., 2021). In low and-middle income countries (LMICs), research suggests that suicide is a moderate contributor to perinatal deaths, although rates may be underestimated due to differing definitions and classifications of maternal mortality (Fuhr et al., 2014; Palfreyman, 2021). More violent methods are commonly adopted in perinatal suicide than in women at other times of life, potentially reflecting a higher level of intent (Khalifeh et al., 2016; Shigemi et al., 2021), and there are tragic cases where maternal suicide is accompanied by infanticide (Patrick, 2013; Spinelli and Bramante, 2022).

Pregnancy and the postpartum period are particularly sensitive periods in a women's life. During this time existing mental health problems may be triggered or exacerbated, or new concerns may arise. However, it is estimated that half of women with perinatal mental health issues and/or at risk of suicide are not identified despite regular routine contact with healthcare services, and still fewer receive treatment (Bauer et al., 2014; Grigoriadis et al., 2017; National Childbirth Trust (NCT), 2017). Identifying and treating perinatal women at risk of suicide is therefore vital for the health and wellbeing of new mothers, their infants, and families. This is now recognised in UK strategy and public health. The Cross-Government Suicide Prevention Plan (GOV UK, 2019), NHS England Five-Year Forward View and NHS Long Term Plan (NHS England Mental Health Taskforce, 2016; NHS England, 2019) aim to prioritise and reduce suicide in high-risk groups and promote mental health in key areas where people may be more vulnerable, one of which

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is perinatal mental health.

'Suicidality' is an umbrella term which is often used when referring simultaneously to suicidal ideation (the experience of thoughts and/or rumination about dying by suicide), suicide plans (acts conducted to prepare for a suicide attempt), suicidal behaviours and/or suicide attempts (acts of self-directed injury, conducted with an intent to die by suicide) (Crosby et al., 2011). However, it is important to recognise that these are distinct processes, with differing levels of risk and differing implications in terms of assessment and care provisions. In perinatal women, suicidality is associated with serious and enduring adverse effects on maternal health and obstetric outcomes (Shigemi et al., 2021; Zhong et al., 2018), neonatal health (Gelaye et al., 2019), child development (Martini et al., 2019; Mebrahtu et al., 2020) and mother-infant bonding (Faisal-Cury et al., 2021; Paris et al., 2009). Given the seriousness of these outcomes, it is crucial that research continues to examine the correlates and risk factors for perinatal suicidality so that appropriate and targeted methods for identifying suicidality are accessible and validated for this population (Gelaye et al., 2016; Kitsantas et al., 2021; Reid et al., 2022).

Evidence suggests that suicidal ideation, which involves specific and persistent thoughts about ending ones' life, is a risk factor for future attempts (Lindahl et al., 2005; Orsolini et al., 2016) and is experienced more frequently by perinatal women than those in the general population (Gelaye et al., 2016). However, perinatal suicidal ideation is not routinely assessed in the UK, nor is it universally screened for in other countries, despite some agreement that it should be implemented into maternity care (Arachchi et al., 2019; Maré et al., 2021; Tachibana et al., 2020). Perinatal suicidal ideation (and suicidality) may be identified through a clinical or diagnostic assessment (e.g., the Structured Clinical Interview for DSM-IV disorders, SCID, First and Gibbon, 2004), although these are typically conducted after a woman either discloses a history of mental health issues and/or suicidality, or if she is already in contact with psychiatric services and receiving specialist care. Likewise, measures specifically designed for assessing suicidal ideation and/or risk are available, such as the clinician-rated Columbia-Suicide Severity Rating Scale (C-SSRS, Posner et al., 2011) or the self-reported Suicidal Behaviours Questionnaire-Revised (SBQ-R, Osman et al., 2001), but there is limited evidence of their use in perinatal populations.

To date, no assessment measure has been specifically designed to screen for suicidality in perinatal populations. Usually, assessments of perinatal suicidal ideation and/or risk are conducted in the context of screening for depression (and/or other mental health disorders) because depression and suicidality are frequently comorbid (Howard and Khalifeh, 2020; Orsolini et al., 2016) and depression has been identified as a risk factor for subsequent suicide (Crump et al., 2014). Several depression measures which include items about suicidality/self-harm have been specifically developed for use with perinatal women, including the Edinburgh Postnatal Depression Scale (EPDS, Cox et al., 1987) and the Postpartum Depression Screening Scale (PDSS, Beck and Gable, 2000), but it is not uncommon for more general measures of depression, such as the Patient Health Questionnaire-9 (PHQ-9, Kroenke et al., 2001) to be administered.

Whilst screening for perinatal depression may act as a proxy for identifying suicidal ideation, this could lead to potential under detection in reported rates (Gelaye et al., 2016). Research indicates that perinatal depression and suicidality are overlapping but separate phenomena. Suicidal ideation can be a symptom of depression, and/or the two may co-occur, but suicidality can persist independently from depression (Garman et al., 2019a, 2019b; Iliadis et al., 2018). Hence, embedding a suicidal ideation question(s) into the scoring system for a perinatal depression screen, may mean that suicidality in women who do not meet the clinical threshold for depression are missed (Onah et al., 2017; Zhang et al., 2022). Likewise, if the endorsement of suicidality on a depression measure is used as a positive indicator for depression – irrespective of whether the recommended scale cut-off has been met or not – then some women may be misclassified (Kim et al., 2015).

There are also clear limitations of using a single question to capture the highly complex nature of suicidality and/or risk in perinatal women, which may lead to important dimensions of suicidality being overlooked (Lindahl et al., 2005; Na et al., 2018). In addition, the wording of some suicidality items on commonly used depression measures use vague language, do not necessarily distinguish between passive or active intent, nor adequately differentiate suicidal ideation from thoughts of self-harm which are often used interchangeably in both academic research and clinical practice (Mauri et al., 2012; Yawn et al., 2009; Zhong et al., 2015). For example, numerous studies have used item-10 from the EPDS to assess the prevalence of suicidal ideation in perinatal samples (e.g., Howard et al., 2011; Tabb et al., 2019). However, the question asks whether "the thought of harming myself has occurred to me", which may or may not reflect a desire to take one's own life (Lindahl et al., 2005; Palfreyman, 2021). Depending on the measurement item used and/or construct of interest, this discrepancy in wording could create false positive or false negative screening scores for suicidal and/or self-harm ideation, resulting in more cases being missed (Pope et al., 2013). There are also concerns about the language used in some suicidality measures (e.g., 'commit suicide') as certain expressions are associated with wrongdoing and/or inappropriate acts which may reinforce stigma and prevent people from responding to questions honestly. Terms such as 'die by suicide' or 'end ones' own life' may offer a more sensitive and appropriate alternative (Padmanathan et al., 2019).

In view of these issues, it is unsurprising that prevalence estimates for perinatal suicidality vary considerably. Recent data from two systematic reviews and meta-analyses indicated that the global prevalence of antenatal suicidal ideation was 10 % (Xiao et al., 2022), and 7 % to 12 % postnatally (Amiri and Behnezhad, 2021; Xiao et al., 2022) across various sample types and different suicidality assessment measures. Factors such as, sample type and/or characteristics, the construct assessed, the measure(s) used (including differing administration modes and cut-off thresholds) and the timing of assessment also affect reported rates (Chan et al., 2016; Coker et al., 2017; Martini et al., 2019) and underscore some of the challenges in making direct comparisons and/or generalising prevalence across and within samples.

Evidence regarding whether suicidality is more prevalent during pregnancy or after birth also remains inconsistent (Kitsantas et al., 2021; Kubota et al., 2020; Shi et al., 2018). Some research suggests that childbirth has a protective effect against suicidality in the postpartum (Appleby, 1991) and higher parity has also been associated with a decreasing trend in suicide mortality (Koski-Rahikkala et al., 2006). However, unplanned and/or unwanted pregnancies may increase the risk of antenatal suicidality (Frautschi et al., 1994; Ishida et al., 2010) as may anxiety and insecure attachment styles (Zhang et al., 2022). These variations in onset and prevalence emphasise the need to identify and/or monitor suicidality throughout pregnancy and after birth, although there are important implications regarding the most effective and feasible types of mental health assessment to conduct at different perinatal stages, particularly in terms of access and the pathways to appropriate care (National Collaborating Centre for Mental Health, 2018).

Given the adverse and serious consequences of perinatal suicidality, it is imperative that appropriate approaches to assessing suicidality are identified and validated in perinatal populations. One approach may be to use questionnaire measures. Since the current approach for assessing suicidality in perinatal women mainly relies on the use of items within depression measures, these measures need to be psychometrically robust and appropriate for use in either academic research and/or clinical practice. Previous research on the validity and/or reliability of measures assessing perinatal suicidality is limited, and the authors know of no systematic reviews in this area. Therefore, this review aims to systematically identify and evaluate measures of suicidality that have been validated in perinatal populations by answering the following questions:

Q1. What measures are used to assess suicidality in perinatal women?

Q2. What are the psychometric properties of suicidality measures that have been validated in perinatal populations?

2. Methods

2.1. Research integrity and transparency

This review was conducted in accordance with the PRISMA guidelines (Moher et al., 2009; Page et al., 2021) and was registered on PROSPERO prior to data extraction.

2.2. Eligibility criteria

Inclusion criteria were: (1) published studies with perinatal women that reported on a quantifiable measure of suicidality as either a main or secondary focus. Mixed method studies were included if they also reported on the above; (2) assessment of suicidality was via self-report or observer/clinician rated questionnaire, and/or diagnostic interview; (3) the sample were perinatal women, including pregnancy loss populations (i.e., stillbirth, miscarriage, or termination of pregnancy); and (4) the article was published in English. Studies were excluded if they: (1) reported on a measure of suicidality beyond the first postnatal year (e.g., a longitudinal study) and there was insufficient information to determine the time point of assessment(s) to extract the data from <12-months; (2) did not differentiate historical and/or lifetime suicidality from suicidality within the perinatal period; and (3) the article was an editorial, case report or conference proceeding.

Measures that had been used in three or more studies were included in Q1 (measures used to assess perinatal suicidality). The criteria of ≥3 did not apply for measures in Q2. To answer Q2 (psychometric properties), studies were included if they reported on the validity and/or reliability of the measure used to assess suicidality in a perinatal sample. Studies that reported construct validity for the EPDS were not included in this review because this has already been extensively examined (see Kozinszky et al., 2017, for examples). Studies that reported construct validity for any other measure but removed the suicide item from the final factor structure, were also excluded.

2.3. Data sources and search strategy

The following databases were systemically searched from their inception to March 2020, and then updated to January 2022: SCOPUS, MEDLINE, PsychINFO, PsychARTICLES, PubMed, Cochrane Library, Maternity and Infant Care, EMBASE and CINAHL. This was supplemented by forward and backward citation tracking.

The search strategy followed a modified PICO framework (Joanna Briggs Institute, 2014) (i.e., Population or Problem [perinatal women], Intervention [measure of suicidality], Comparison, Control or Comparator [not applicable], and Outcome [type of suicidality]). The keywords were combined using Boolean operators, and searches included both Subject Heading (e.g., MeSH) and Free-Text terms. An example search strategy is as follows: pregnan* OR *natal OR *partum OR matern* OR mother* AND measure* OR assess* OR diagnos* OR screen* OR questionnaire OR scale OR instrument OR method OR tool AND suicid* OR self-harm* OR self-injur* OR parasuicid* OR "ending own life" OR "taking own life" OR "thoughts of death" (see Supplementary Material 1 for the search strategies per database).

2.4. Article selection and data extraction

Retrieved articles were imported into ProQuest RefWorks and duplicate papers were removed. A three-stage screening process was then performed: (1) screening by 'title', with irrelevant items removed; (2) screening by 'abstract', with ineligible and/or irrelevant items removed; and (3) full-text screening, using the inclusion/exclusion criteria outlined in Section 2.2. The selection process was carried out by the first author, and an independent reviewer (AZ) screened 20 % of all retrieved articles, adhering to the same procedure. There were no discrepancies or disagreements.

Data from eligible studies were extracted by the first author into a standardised form, developed in Excel and included (where available): authors, publication year, country of study, study design, sample size, sample type, name of measure and/or suicidality item(s) used, suicidality constructs measured (e.g., suicidal ideation, suicide behaviour) or suicide risk, who administered the measure (e.g., self-report, clinician), method of administration (e.g., questionnaire, face-to-face interview), when it was administered (e.g., pregnancy, postnatal) and at which time points (e.g., 28-weeks pregnant, six-weeks postnatal), content of the measure (e.g., score range, number of items and/or cut off points), prevalence of suicidality identified, and any psychometric information reported.

2.5. Data quality assessment and synthesis

Studies included in Q1 were not assessed for quality, as the purpose was to present measures of suicidality that have been used in perinatal research.

The quality of studies in Q2 were assessed using an adapted appraisal tool, based upon relevant items from the Quality Assessment of Diagnostic Accuracy Studies (QUADAS, Whiting et al., 2003) and a checklist created by Mirza and Jenkins (2004).

The psychometric properties (e.g., reported validity and/or reliability) and useability of suicidality measures included within these studies were assessed using a checklist adapted from Batterham et al. (2015).

Study quality was evaluated against the following criteria: (1) explicit study aims; (2) adequate sample size; (3) clear inclusion/exclusion information; (4) sample characteristics reported in sufficient detail; (5) sample representative of the population receiving the test in practice; (6) use of an appropriate reference standard; (7) reliability reported; (8) validity reported; (9) dropouts and withdrawals specified; (10) data adequately described; and, (11) discussion of generalisability. These domains of interest were measured as being either present (+), absent (−) or unclear (?) for each paper.

The psychometric evidence of suicidality measures identified within these studies were combined in a narrative synthesis. We considered potential usefulness and suitability for identifying suicidality in perinatal populations, and were guided by the following criteria: (1) explicitly measures a construct of suicidality, using at least one item; (2) useability of measure (e.g., number of items, time taken to complete); (3) yields quantitative data; (4) has been scientifically scrutinised in perinatal populations (e.g., published in at least one peer-reviewed journal); (5) has demonstrated sound psychometric properties in perinatal populations, as detailed below; and (6) freely available for use.

Study quality and psychometric evidence assessments were performed by the first author. The second author also assessed over 50 % (19/35) of the studies, with a high level of agreement reached. Any minor discrepancies in scoring were resolved by discussion.

2.6. Psychometric evidence - validity and reliability

Types of validity and reliability data extracted for this review, are detailed in Table 1.

3. Results

3.1. Study selection

Following the removal of duplicates, a total of 14,690 unique articles were retrieved from the database searches, with 14,381 excluded after

Table 1
Psychometric properties of validity and reliability.

Psychometric property	Definition
Criterion validity	*Criterion validity* is determined by comparing the scores of a measure with those from a validated 'gold-standard' (e.g., a diagnostic clinical interview) (Greenhalgh, 2014) and is often reported in terms of sensitivity (%) (correctly identifying women with suicidality) and specificity (%) (correctly excluding women without suicidality) data.
Concurrent validity	*Concurrent validity* examines the extent that a measure correlates with another measure of the same phenomena, assessed at the same time.
Construct validity	*Construct validity* refers to the extent that a measure - or items therein - capture an underlying theoretical construct(s). It is usually assessed using factorial analysis or correlation methods (Strauss and Smith, 2009).
Discriminant validity	*Discriminant validity* refers to the extent that a measure can differentiate 'cases' from 'non-cases' (e.g., perinatal women with and without suicidality).
Predictive validity	*Predictive validity* is the extent that a psychological measure can predict a future outcome in relation to another variable or construct of interest.
Content validity	*Content validity* refers to the extent that items on newly developed measures capture targeted psychological dimensions. Often, both the conceptual and operational definitions of dimensions are assessed.
Cross-cultural validity	*Cross-cultural validity* refers to the extent that a measure developed in one culture, country and/or language can be meaningfully translated and applicable for use in another culture.
Internal consistency	*Internal consistency* is a measure of reliability and represents the level of homogeneity among item scores that purport to measure the same construct (often reported using Cronbach's alpha, α) (Kline, 2000).
Test-retest reliability	*Test-retest reliability* refers to the extent (correlation) that a measure produces consistent scores over time.
Item-total correlation	*Item-total correlation* is a measure of reliability. It refers to the extent of correlation between an individual item score (from a multi-item assessment measure) and the overall assessment score.

title and abstract screening. A further 23 articles were identified through forward and backward citation tracking, resulting in 325 full texts assessed for eligibility (seven articles could not be found). Two-hundred and five articles were included in Q1 (120 excluded), and 35 articles were included in Q2 (290 excluded). Thirty-two articles were included in both Q1 and Q2. A total of 208 unique articles were included in this review. The PRISMA flowchart is presented in Fig. 1.

3.2. Review question one: study characteristics

An overview of study characteristics is available in Supplementary Material 2. Of the 205 articles included, sample sizes ranged between $n = 18$ (Szpunar et al., 2021) to $n = 22{,}118$ (Kim et al., 2015) with 79 articles reporting on at least one measure of suicidality antenatally, 81 postnatally, 43 perinatally (e.g., in both antenatal and postnatal periods) and two in pregnancy loss populations. Twenty-two articles reported on more than one measure of suicidality. Publication dates ranged from 1992 to 2022, with 81 % published between 2012 and 2022. Articles came from 50 countries, with 52 studies identified from the USA, 23 from South Africa and 21 from Brazil. Samples included women recruited through primary care, clinical settings, in the community, population-based and purposive sampling. The most common settings were women recruited through maternity care services (e.g., during their antenatal or postnatal checks). Over 50 % of studies were cross-sectional, with the primary outcome being suicidality and/or depression prevalence rates.

3.2.1. Review question one: measures used to assess suicidality in perinatal women

Eleven measures of suicidality were identified across the 205 papers included for Q1. One-hundred and seven studies reported on the EPDS, item-10; 31 reported on the PHQ-9, item-9; 28 reported on the MINI-International Neuropsychiatric Interview, suicide module (MINI: Sheehan et al., 1998) and/or the MINI-International Neuropsychiatric Interview for Children and Adolescents, suicide module (MINI-KID: Sheehan et al., 2010); and 22 reported on the PDSS, suicidal thoughts scale (SUI). The remaining seven measures were reported eight times or fewer. Table 2 provides an overview of these measures, including the *n* range and reported prevalence rates by antenatal, postnatal, and perinatal samples. A descriptive summary of each suicidality measure (e.g., item development and content, recommended cut-offs etc.) is presented in Table 3.

As seen in Tables 2 and 3 the suicidality measures varied by the suicidality construct assessed, the incidence period for assessment (e.g., symptoms in the past seven-days, or month), the administration of the measure (e.g., self-report or clinician-rated assessment) and the number of items used (e.g., PHQ-9 examines suicidal and self-harm ideation using one item, whereas the PDSS has a five-item subscale). Likewise, the suicidality prevalence rates (%) presented in Table 2 varied. These should be viewed as an overall 'spectrum' of incidence during the perinatal period, whilst recognizing that prevalence rates differ depending upon numerous factors, such as, sample type, sample size, the suicidality construct assessed and/or differing measurement cut-off scores. Antenatal suicidality prevalence ranged from 1 % using the EPDS, item-10, in a retrospective sample of 178 women recruited through antenatal clinics in Australia (Boghossian et al., 2020) to 45.6 % using the Beck Depression Inventory, item-9 (BDI: Beck et al., 1961) in a clinical sample of 114 pregnant adolescents in Malaysia (Chan et al., 2016). Postnatally, suicidality prevalence ranged from 0.6 % using the EPDS, item-10, in a population-based cohort of 1278 Vietnamese women (Wesselhoeft et al., 2020) to 58.7 % using the PDSS, SUI in a sample of 155 Latina mothers (living in the USA) who were at high-risk for postnatal depression (Le et al., 2010).

3.3. Review question two: study characteristics

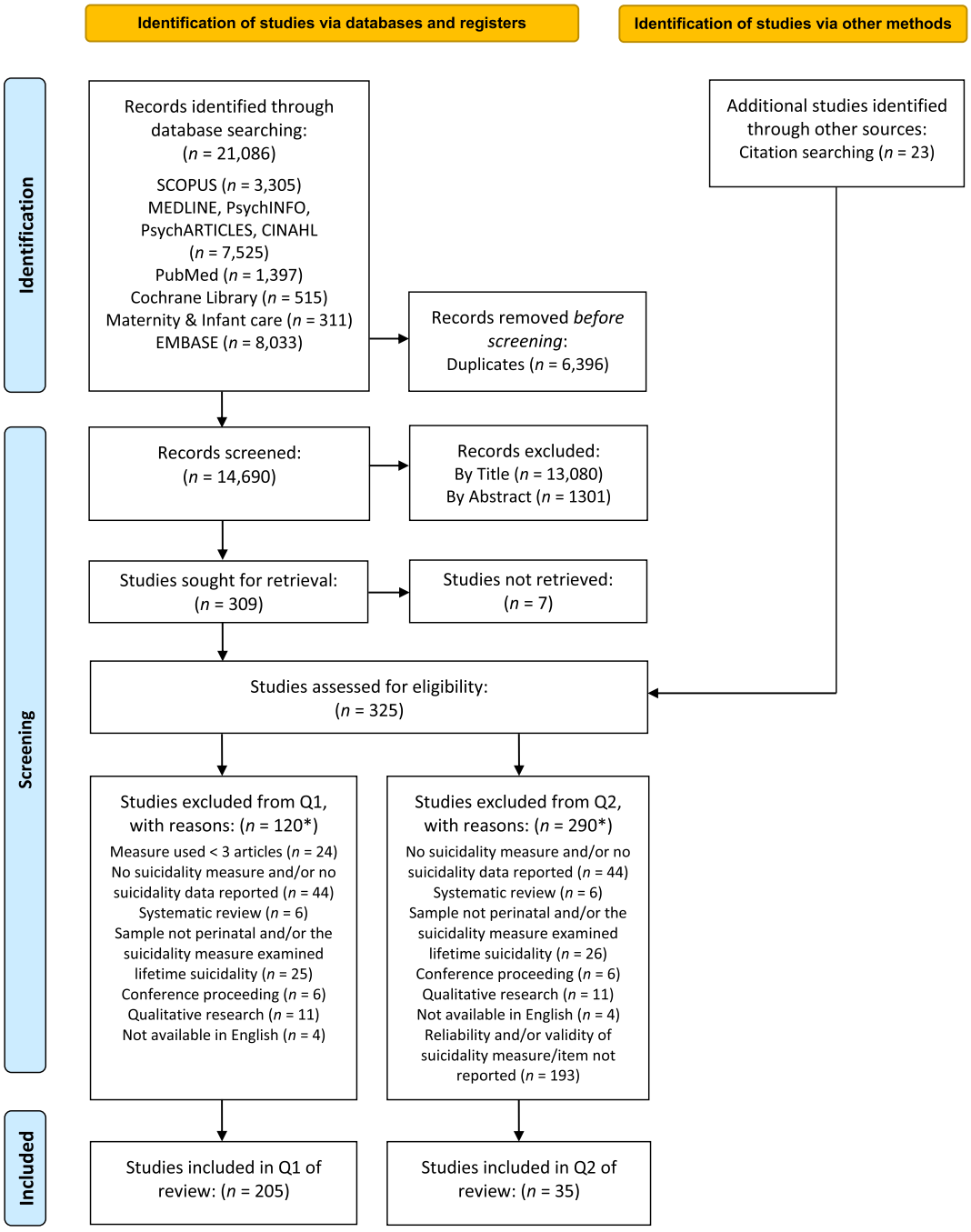
Thirty-five articles were included for Q2. An overview is provided in Table 4. Sample sizes for examining the psychometric properties of suicidality measures ranged from $n = 45$ (Koukopoulos et al., 2021) to $n = 8425$ (Paul et al., 2021), with ten studies antenatally, 21 postnatally and four perinatally. Publication dates ranged from 2000 to 2021, across 13 countries with 42 % from the USA. Measuring suicidality or the validation of a measure of suicidality was the primary focus in 34 % of the studies. The remainder focused on validating a depression measure, with suicidality included.

3.3.1. Review question two: study quality

Quality ratings for included studies are presented in Table 5. These are summarised as follows: 17 % of studies provided evidence for five (of the 11) assessment criteria; 9 % evidenced six criteria; 28 % evidenced seven criteria; 26 % evidenced eight criteria; 14 % evidenced nine criteria; and 6 % evidenced ten criteria. No studies provided evidence for all 11 assessment domains. Furthermore, sample size criteria were not present for 74 % of studies, an appropriate reference standard was either missing or unclear for 74 % of studies, and 51 % did not report on dropout/withdrawals. If no discussion or justification of sample size was provided, the study was marked as 'no' or 'unclear' for this criterion, regardless of whether an acceptable sample size for the validation method was used.

3.3.2. Review question two: measures validated to assess suicidality in perinatal women

The validity and/or reliability of ten suicidality measures were



*Some studies were excluded for multiple reasons, but only one has been specified here.

Fig. 1. PRISMA flow diagram.

reported. Fifteen studies validated the PDSS, SUI subscale; 11 validated the EPDS, item-10; six validated the PHQ-9, item-9; four validated the Beck Depression Inventory, item-9 (BDI: Beck et al., 1961) or the Beck Depression Inventory Short-Form, item-7 (BDI-SF: Beck et al., 1996), which uses the same wording; two validated the Hamilton Rating Scale for Depression, item-3 (HRSD: Hamilton, 1960); one validated the SCID, suicidality items; and four studies validated other measures. See Table 6 for a summary of the types of validity and/or reliability reported per measure.

Concurrent validity was reported most frequently (12 studies), followed by construct validity (ten studies), cross-cultural validity (ten studies), criterion validity (five studies), discriminant validity (three studies), content validity (three studies), and predictive validity (two studies). Eighteen studies reported internal consistency, seven reported item-total correlations and one reported test-retest reliability. Fifteen studies reported both validity and reliability data, 12 reported more than one type of validity, seven validated more than one measure, and four only reported reliability.

Nearly all the identified measures primarily screened for depression with an item or subscale assessing at least one suicidality construct. The electronic version of the Columbia-Suicide Severity Rating Scale (eC-SSRS: Posner et al., 2011) was the only exception as it specifically assesses suicidality. Three measures were specifically developed for perinatal women. Four measures used a single suicidality item, and five measures used a subscale and/or were clinician-led questions. Suicidal ideation was assessed most frequently, with a caveat that some items ask

Table 2
Summary of measures identified in Q1 of review.

Measure, item or subscale	Total No. of studies	Antenatal studies (No. studies & *n* range – min/max)	Postnatal studies (No. studies & *n* range – min/max)	Perinatal studies (No. studies & *n* range – min/max)	Pregnancy loss studies (No. studies & *n* range – min/max)	Antenatal suicidality prevalence (% Low/high, reference)	Postnatal suicidality prevalence (% Low/high, reference)	Perinatal suicidality prevalence (% Low/high, reference)	Suicidality construct measured (Incidence period)
BDI & BDI-II, item-9/ BDI-SF, item-7* Self-reported, 4-pt response scale	**8**	**4** *n* = 102 (Manber et al., 2008) *n* = 830 (Corbani et al., 2017)	**4** *n* = 317 (Pinheiro et al., 2008) *n* = 818 (Coker et al., 2017)[a]	**0**		1.3 %, S (Corbani et al., 2017) 45.6 %, SI (Chan et al., 2016)	8.3 %, S (Pinheiro et al., 2008) 16.1 %, SI/SH (Coker et al., 2017)[a]		SH/SI/SP/S (Past 7-days/ past 14-days)
BSSI Self-reported, 3-pt response scale	**4**	**3** *n* = 110 (Freitas et al., 2008) *n* = 835 (Abdelghani et al., 2021)	**0**	**1** *n* = 45 (Doherty et al., 2019)		16.3 %, SI (Freitas et al., 2008) 21.6 %, SI (Abdelghani et al., 2021)		5.6 %, SI (Doherty et al., 2019)	SI/SR/SA (Past 7-days)
CIDI & CIDI-V, Diagnostic Interview, suicide module Clinician assessed, presence or absence of symptoms	**7**	**3** *n* = 415 (Anbesaw et al., 2021) *n* = 2062 (Levey et al., 2019)	**0**	**4** *n* = 306 (Martini et al., 2019) *n* = 414 (Gelaw et al., 2020; Zewdu et al., 2021)[b]		2.7 %, SA; 11.8 %, SI (Belete et al., 2021) 22.6 %, SIBs (Levey et al., 2019)		Antenatal, 0.3 %, SIBs Postnatal, 1.1 %, SIBs (Martini et al., 2019) 8.2 %, SI (Gelaw et al., 2020; Zewdu et al., 2021)[b]	SI/SP/SA/ SIBs (Past month)
C-SSRS/eC-SSRS* Clinician assessed (self-reported for eC-SSRS)	**5**	**2** *n* = 46 (Na et al., 2018) *n* = 1000 (Palfreyman, 2021)	**1** *n* = 165 (Achtyes et al., 2020)	**2** *n* = 18 (Szpunar et al., 2021)[c] *n* = 28 (Szpunar et al., 2020)[c]		4.3 %, SIBs (Na et al., 2018) 7.4 %, SIBs (Palfreyman, 2021)	5.4 %, SIBs 26 %, SI (Achtyes et al., 2020)	Antenatal, 7.1 %, SI Postnatal, 0 %, SI (Szpunar et al., 2020)[c] Antenatal, 11.1 %, SI Postnatal, 7.7 %, SI (Szpunar et al., 2021)[c]	SI/SIBs/SP/ SA (Current/ recent)
EPDS, item-10* Self-reported, 4-pt response scale	**107**	**32** *n* = 20 (Tourtelot et al., 2021) *n* = 9192 (McCarthy et al., 2018)	**45** *n* = 72 (Cardillo et al., 2016) *n* = 17,648 (Nelson et al., 2013)	**29** *n* = 39 (Kalmbach et al., 2021) *n* = 22,118 (Kim et al., 2015)	**1** *n* = 182 (Mutiso et al., 2018)	1 % (Boghossian et al., 2020) 45 % (Tourtelot et al., 2021)	0.6 % (Wesselhoeft et al., 2020) 32.5 % (Phukuta and Omole, 2020)	Antenatal, 2.3 % Postnatal, 1.6 % (Gordon et al., 2019) Antenatal, 13.9 % Postnatal, 6.3 % (Enătescu et al., 2020)	SH/SI (Past 7-days)
HRSD/HDRS/HAM-D, item-3* Clinician assessed, presence or absence of symptoms	**7**	**3** *n* = 102 (Manber et al., 2008) *n* = 383 (Newport et al., 2007)[a]	**4** *n* = 72 (Cardillo et al., 2016) *n* = 842 (Coker et al., 2017)[a]	**0**		9.2 %, SI (Iyengar et al., 2020) 16.7 %, SI (Newport et al., 2007)[a]	6.1 %, SI (Pope et al., 2013) 13 %, SI (Lanczik et al., 1992)		SI/SIBs/SA (Past 7-days)
MINI/MINI Kid, suicide module Clinician assessed, presence or absence of symptoms and/ or a stratification for suicide risk according to score range	**28**	**16** *n* = 114 (Chan et al., 2016) *n* = 974 (Trettim et al., 2020)	**8** *n* = 190 (Pinheiro et al., 2012) *n* = 988 (Belete and Misgan, 2019)	**4** *n* = 384 (Garman et al., 2019a, 2019b)[d] *n* = 748 (Maré et al., 2021)		9.5 %, SI; 1.3 %, SA; 2.2 %, SIBs (Trettim et al., 2020) 23.5 %, SR (Castro e Couto et al., 2016)	5.7 %, SR 1.6 %, SA (Pinheiro et al., 2008) 9.5 %, SR (Pinheiro et al., 2012)	10.9 %, SR (de Avila Quevedo et al., 2021) Antenatal, 19.9 %, SIBs Postnatal, 22.6 %, SIBs (Maré et al., 2021)	SI/SH/SIBs/ SP/SA/SR/S (Past month/ lifetime SA)
PDSS, SUI* Self-reported, 5-pt response scale	**22**	**1** *n* = 503 (Pereira et al., 2011)	**21** *n* = 32 (Paris et al., 2009) *n* = 587 (	**0**			32 % (Quelopana et al., 2011) 58.7 % (Le et al., 2010)	–	SI/SH (Past 2-weeks)

(*continued on next page*)

Table 2 (*continued*)

Measure, item or subscale	Total No. of studies	Antenatal studies (No. studies & *n* range – min/max)	Postnatal studies (No. studies & *n* range – min/max)	Perinatal studies (No. studies & *n* range – min/max)	Pregnancy loss studies (No. studies & *n* range – min/max)	Antenatal suicidality prevalence (% Low/high, reference)	Postnatal suicidality prevalence (% Low/high, reference)	Perinatal suicidality prevalence (% Low/high, reference)	Suicidality construct measured (Incidence period)
			Saldaña et al., 2021)						
PHQ-9, item-9* Self-reported, 4-pt response scale	**31**	**20** *n* = 46 (Na et al., 2018) *n* = 19,515 (Yang et al., 2021)	**6** *n* = 215 (Tomlinson et al., 2020) *n* = 3147 (Azale et al., 2018)	**4** *n* = 29 (Velloza et al., 2020) *n* = 1362 (Sakowicz et al., 2021)	**1** *n* = 956 (Biggs et al., 2018)	2.6 % (Legazpi et al., 2022; Melville et al., 2010) 21.7 % (Na et al., 2018)	1.4 % (Azale et al., 2018) 29 % (Tomlinson et al., 2020)	Antenatal, 5 % Postnatal, 3.9 % (Knettel et al., 2020) Antenatal, 17 % Postnatal, 14 % (Sakowicz et al., 2021)	SI/SH (Past 2-weeks)
SCID, Diagnostic Interview, suicide item(s)* Clinician assessed, presence or absence of symptoms	**5**	**2** *n* = 109 (Rochat et al., 2011, 2013)[e]	**1** *n* = 208 (Kettunen et al., 2014)	**2** *n* = 568 (Fellmeth et al., 2021)		27.5 %, SI; 22 %, SP; 1.8 % SA (Rochat et al., 2011, 2013)[e]	12.5 %, SI (Kettunen et al., 2014)	5.3 %, SI (Fellmeth et al., 2021) 7.9 %, SH (Gordon et al., 2019)	SI/SH/SIBs/ SP/SA/SR (Recent)
SRQ-20, item-17 Self-reported, presence or absence of symptoms (yes/no)	**6**	**3** *n* = 188 (McKelvie et al., 2021) *n* = 831 (Huang et al., 2012)	**2** *n* = 118 (Monaghan et al., 2021) *n* = 426 (Ho-Yen et al., 2006)	**1** *n* = 951 (Ishida et al., 2010)		6.3 % (Huang et al., 2012) 26 % (McKelvie et al., 2021)	3.3 % (Ho-Yen et al., 2006)	1.8 % (Monaghan et al., 2021) Antenatal, 4.7 % Postnatal, 0.2 % (Ishida et al., 2010)z	SI (Past month)

Notes: (1) the same alphabet letter in superscript ([a,b,c]) represents the same sample or the sample was drawn from the same cohort; (2) twenty-two studies reported on more than one suicidality measure, hence the *total number of studies* (per measure) do not match the number of retrieved articles for Q1; (3) the prevalence rates presented are for the entire *antenatal, postnatal, perinatal* study sample and not just those with comorbid mental health disorders; (4) the *suicidality construct measured* refers to the constructs of interest that were examined across the studies, which may not necessarily be the same construct of interest (and/or *incidence period*) that the measure was originally developed to assess or identify; (5) later and/or adapted versions of a measure that uses the same item wording have been grouped together; (6) * measure has also been validated in perinatal populations.

Measures: BDI/BDI-SF = Beck Depression Inventory or Beck Depression Inventory Short-Form (Beck et al., 1961; Beck, 1996); BSSI = Beck Scale for Suicide Ideation (Beck et al., 1988); CIDI/CIDI-V = The World Mental Health (WMH) Survey Initiative Version of the World Health Organization (WHO) Composite International Diagnostic Interview (Kessler and Ustün, 2004); C-SSRS/eC-SSRS = Columbia-Suicide Severity Rating Scale or the electronic Columbia-Suicide Severity Rating Scale (Posner et al., 2011); EPDS = Edinburgh Postnatal Depression Scale (Cox et al., 1987); HRSD = The Hamilton Depression Rating Scale (Hamilton, 1960); MINI/MINI Kid = MINI-International Neuropsychiatric Interview (Sheehan et al., 1998) or MINI-International Neuropsychiatric Interview for Children and Adolescents (Sheehan et al., 2010); PDSS = Postpartum Depression Screening Scale (Beck and Gable, 2000); PHQ-9 = Patient Health Questionnaire-9 (Kroenke et al., 2001); SCID = Structured Clinical Interview for DSM-IV disorders (American Psychiatric Association, 1994; First and Gibbon, 2004); SRQ-20 = Self-Reporting Questionnare-20 (Harding et al., 1980).

Suicidality constructs: S = Suicidality (experiencing one or more suicide construct, including, suicidal ideation, suicidal behaviours, suicide attempts); SA = Suicide attempt(s) (previous attempts to take own life); SH = Self-harm ideation (persistent thoughts and/or rumination of self-harm); SI = Suicidal ideation (persistent thoughts and/or rumination of suicide); SIBs = Suicidal ideation and behaviours (persistent thoughts and/or rumination of suicide, including risky and/or harmful behaviours); SP = Suicide plans (making plans and/or preparations to take own life); SR = Suicide risk (may be at risk of taking own life, and may also be experiencing suicidal ideation and/or behaviours).

about 'thoughts of self-harm' which is not limited to suicidal ideation per se. Time taken to complete suicidality items varied. Where stated, the completion of self-report items or subscales ranged from one- to five-minutes. Clinician-led assessments took longer due to more open-ended questioning. Over half of the measures were freely available to use (55 %), although restrictions were unclear for four. A descriptive summary of each measure is provided in Table 3.

Each measure is outlined below, with a summary of reported validity and/or reliability in perinatal populations.

3.4. Postpartum Depression Screening Scale, suicidal thoughts subscale (PDSS, SUI)

Four studies reported concurrent validity for the PDSS, SUI, in perinatal populations, and all validated the SUI against a measure of depression. Postnatally, Beck and Gable (2001a) reported a medium effect size of $r^2 = 0.12$ between the SUI and a diagnostic classification of major/minor postnatal depression, using the SCID interview. There was a moderate significant agreement between the SUI and EPDS, $r = 0.55$ ($p < .0001$) and the SUI and BDI, $r = 0.60$ ($p < .0001$) (Karaçam and Kitiş, 2008), and a positive significant correlation between the SUI and BDI-II, both antenatally, $r_s = 0.221$ ($p > .001$) (Pereira et al., 2011), and postnatally $r_s = 0.162$ ($p \leq .001$) (Pereira et al., 2010). However, the discriminant validity of the SUI for differentiating between non-depressed and depressed mothers (assessed by diagnostic interview) was poor, $r = 0.36$ (Beck and Gable, 2001b) and $r = 0.41$ (Beck and Gable, 2005). It is also important to note that concurrent validity for the SUI has been established against measures of depression, which were not limited to suicidality questions. This may have implications for validity, especially when considering which psychological constructs were correlated.

Five studies reported construct validity for the SUI in the postnatal

Table 3
Descriptive summary of all measures reported in the review.

Measure	No. of suicidality items	Scale development	Self- or clinician-rated	Suicidality item(s) details (questions, response options, reporting period)	Suicidality construct measured	Item(s) cut-off
BDI* 21-item scale to screen for depression symptoms and severity	1	Based on the theory of negative cognitive distortions and clinical observations.	Self-reported	Item-9 BDI Assesses suicidal thoughts and plans over the past seven-days, on a four-point scale. Participants are asked to respond to one of the following statements: 0 = "I don't have any thoughts of killing myself', 1 = "I have thoughts of killing myself, but I would not carry them out", 2 = "I would like to kill myself', 3 = "I would kill myself if I had the chance".	SI, SP, S	≥ 1 / ≥ 2
BDI-SF* 13-item scale to screen for depression symptoms and severity		BDI-SF is an abbreviated version of the BDI (and BDI-II)	Self-reported	Item-7 BDI-SF Assesses suicidal thoughts and plans over the past two-weeks, on a four-point scale. Response statements are the same as the BDI (and BDI-II).	SI, SP, S	≥ 1 / ≥ 2
BSSI 19-item scale to assess the intensity, duration and specificity of suicidal thoughts, suicidal plans, and/or suicide attempts	19	Items partly clinically derived (observations/ interviews with suicidal people) and partly rationally derived. The scale was originally clinician rated but has also been validated for self-report.	Self-reported	Suicidality items Questions assess the intensity (e.g., "wish to die" – none, weak or moderate to strong), duration (e.g., "frequency of suicidal ideation" – brief/fleeting, longer periods or continuous/chronic) and specificity (e.g., "planning of suicide attempt" – not considered, considered but details not worked out or details are well formulated) of current suicidal ideation, suicide plans and suicide attempts. Response options range from 0 to 2, on a 3-point scale.	SI, SP, SA, SR	Not reported
CIDI Screening and/or diagnostic interview based on DSM-IV criteria CIDI-V A computer assisted version of CIDI	N/A	The WHO WMH-CIDI was developed to measure psychopathology using the DSM-IV[a] and ICD[d] criteria in both clinical and community settings.	Clinician-rated	Suicidality module Questions assess current suicidal ideation, suicide planning and suicide attempts. Examples include: "Have you seriously thought about committing suicide? Have you ever attempted suicide?" Response options are: YES/NO.	SI, SIBs, SP, SA, SR	YES
C-SSRS Suicide risk assessment usually conducted via interview to ascertain the level of risk and severity	N/A	Academic researchers in the USA developed the scale in response to a need for a screening tool that could accurately assess the full spectrum of suicidal thoughts, behaviours and risk.	Clinician-rated	Suicide risk assessment – the number and choice of questions asked depends on the responses given to preceding questions. Questions are asked regarding suicidal thoughts, suicidal actions/preparations and suicide attempts (both current – past month – and lifetime) to ascertain a person's risk of suicide based on a scoring of severity. Example questions include: "Have you wished you were dead or wished that you could go to sleep and not wake up?" and "Have you done anything, started to do anything, or prepared to do anything to end your life?". Response options are YES/NO.	SI, SIB'S SP, SA, SR	YES
eC-SSRS*	7	A shorter electronic version of the full C-SSRS.	Self-reported	Brief suicide risk assessment – Assesses current suicidal ideation, suicidal behaviours, suicide attempts and suicide risk using the following questions: (1) Have you wished that you were dead or wished you could go to sleep and not wake up? (2) Have you actually had any thoughts of killing yourself? (3) Have you been thinking about how you might kill yourself? (4) Have you had these thoughts and had some intention of acting on them? (5) Have you started to work out or worked out details of how to kill yourself? Do you intend to carry out this plan? (6) Have you	SI, SIB'S SP, SA, SR	YES

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Table 3 (*continued*)

Measure	No. of suicidality items	Scale development	Self- or clinician-rated	Suicidality item(s) details (questions, response options, reporting period)	Suicidality construct measured	Item(s) cut-off
				made a suicide attempt – purposely tried to harm yourself with at least some intention to end your life? (7) Have you taken any steps to prepare to kill yourself or actually started to do some to end your life and stopped or were stopped before you actually did anything? Response options are YES/NO.		
EPDS* 10-item scale to screen for postnatal depression symptoms and severity	1	Qualitative research with postnatal women and primary care workers. Some items also adapted from existing depression scales	Self-reported	Item-10 – "the thought of harming myself has occurred to me" Assesses self-harm thoughts over the past seven-days, on a four-point scale. Response options range from 0 to 3: 0 = "never", 1 = "hardly ever", 2 = "sometimes", 3 = "yes, quite often".	SH	≥ 1 / ≥ 2
HRSD* 17-item scale to screen for depression symptoms and severity	1	Originally developed to examine the severity and symptom types of people already diagnosed with an affective and/or depressive disorder	Clinician-rated	Item-3 Assesses suicidal and/or self-harm thoughts and attempts over the past seven-days, on a five-point scale. It is used for quantifying the results of a semi-structured interview. A clinician or practitioner asks the following questions: "have you had any thoughts that life is not worth living? That you'd be better off dead? Even thoughts of hurting or killing yourself? If yes, what have you thought about? Have you done anything to hurt yourself?". The clinician then rates the response(s) against the following criteria: 0 = "absent", 1 = "feels like life is not worth living", 2 = "wishes he/she were dead or any thoughts of possible death to self", 3 = "suicidal ideas or gestures", 4 = "attempts at suicide".	SI, SIBs, SA	≥ 1
IDAS* 64-item scale to screen for depression and anxiety symptoms	6 (Suicidality subscale)	Successor to the MASQ[c], designed to complement existing measures and address limitations. Several items also reflect the DSM-IV[a] symptom criteria for major depressive episode	Self-reported	Suicidality subscale Assesses suicidal thoughts the over past two-weeks, on a five-point scale. Response options range from 1 to 5: 1 = "not at all", 2 = "a little bit", 3 = "moderately", 4 = "quite a bit", 5 = "extremely". Item-7 = "I had thoughts of suicide", item-9 = "I hurt myself purposely", item-14 = "I thought about my own death", item-15 = "I thought about hurting myself', item-41 = "I cut or burned myself on purpose", item-43 = "I thought that the world would be better off without me".	SI, SH, SIBs, S	Not reported
KMDRS* 14-item scale to assess the different constructs of mixed depression	1	Developed to mirror the constructs of mixed depression in line with Koukopoulos specific criteria[e]	Clinician-rated	Item-12 Assesses suicidal impulsiveness over the past seven-days. A clinician or practitioner asks the following questions: "Have you had thoughts about killing or hurting yourself? Were these thoughts impulsive, coming on suddenly? Often in moments of anger? Have you actually done anything?" The clinician then rates the response(s) against the following criteria: 0 = "absent", 2 = "suicidal thoughts possibly impulsive", 4 = "impulsive suicidal thoughts definitely present", 6 = "impulsive suicidal attempt(s) (like trying to jump out of a car)". Rating scores are based on the clinicians' observations and self-	SIM	≥ 2

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Table 3 (*continued*)

Measure	No. of suicidality items	Scale development	Self- or clinician-rated	Suicidality item(s) details (questions, response options, reporting period)	Suicidality construct measured	Item(s) cut-off
				report information. Non-impulsive suicidal thoughts are rated as zero.		
MINI Brief diagnostic interview for identifying common psychiatric disorders. Answers to suicidality items can also be used to stratify suicide risk	N/A	The MINI was developed as a short psychiatric interview to mirror the criteria for diagnosing DSM disorders[a]	Clinician-rated	Suicide module - the number and choice of questions asked depends on the responses given to preceding question(s). Questions are asked regarding suicidal thoughts, suicidal actions/preparations and suicide attempts (both current – past month – and lifetime). A stratification of low, medium or high suicide risk can also be conducted, based on the question responses provided. Example questions include: "in the past month, have you thought you would be better off dead or wish that you were dead?" and "have you taken any active steps to prepare to injure yourself or to prepare for a suicide attempt in which you expected or intended to die?". Response options are YES/NO.	SI, SIB'S SP, SA, SR	YES
MINI Kid	N/A	The MINI Kid was developed for adolescence between ages 13–17 years old. It similarly mirrors the criteria for diagnosing DSM disorders[a]		Suicide Module – as above. The number and choice of questions asked depends on the responses given the preceding question(s).	SI, SIB'S SP, SA, SR	YES
Mothers of Preterm Babies Postpartum Depression Scale* 9-item scale to screen for postnatal distress in mothers of preterm babies	1	Literature review of postnatal depression, with consideration to existing, relevant measures	Self-reported	Suicidal thoughts item – "feel like ending it all for me or the baby to stop being a burden to others" Assesses current suicidal (and/or infanticidal) thoughts, on a five-point scale. Response options range from 1 = "not at all" or "never", to 5 = "most times" or "frequently experienced daily".	SI	Not reported
PDSS* 35-item scale to screen for postnatal depression symptoms	5 (Suicidal thoughts subscale)	Qualitative research with women experiencing postnatal depression	Self-reported	Suicidal thoughts subscale Assesses suicidal thoughts the over past two-weeks, on a five-point scale. Response options range from 1 = "strongly disagree" to 5 = "strongly agree". Item-7 = "started thinking that I would be better off dead", item-14 = "have thought that death seemed like the only way out of this living nightmare", item-21 = "wanted to hurt myself", item-28 = "felt that my baby would be better off without me", item-35 = "just wanted to leave this world".	SI, SH	≥ 1 on any item
PHQ-9* 9-item scale to screen for depression symptom prevalence and severity	1	Depression module from the PRIME-MD[b] diagnostic instrument for common mental disorders	Self-reported	Item-9 – "have you had thoughts that you would be better off dead, or of hurting yourself in some way"? Assesses suicidal and/or self-harm thoughts over the past two-weeks, on a four-point scale. Response options range from 0 to 3: 0 = "not at all", 1 = "several days", 2 = "more than half the days", 3 = "nearly every day".	SI, SH	≥ 1
SCID* Semi-structured interview guide for making DSM-IV diagnoses	N/A	The SCID was developed to mirror the criteria for diagnosing DSM disorders[a]	Clinician-rated	Suicidality items Question prompts/guides to identify and assess current suicidality. Examples include: "have you been thinking you would be better off dead? Have you been thinking about hurting yourself? Have you thought about or made plans about how you may hurt yourself? Have you ever attempted to harm yourself? If a person reports any suicidality, further questions may be asked.	SI, SH, SIBs, SP, SA, SR	Not applicable
	1				SI	YES

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Table 3 (*continued*)

Measure	No. of suicidality items	Scale development	Self- or clinician-rated	Suicidality item(s) details (questions, response options, reporting period)	Suicidality construct measured	Item(s) cut-off
SRQ-20 20-item scale to screen for mental disorders		Developed by WHO to screen for mental disorders, particularly in developing countries.	Self-reported	Item-17 – "has the thought of ending your life been on your mind?" Assesses suicidal thoughts over the past 30-days. Response options are YES/NO.		

Notes: * measure has also been validated in perinatal populations.
Measures: BDI/BDI-SF = Beck Depression Inventory or Beck Depression Inventory Short-Form (Beck et al., 1961; Beck, 1996); BSSI = Beck Scale for Suicide Ideation (Beck et al., 1988); CIDI/CIDI-V = The World Mental Health (WMH) Survey Initiative Version of the World Health Organization (WHO) Composite International Diagnostic Interview (Kessler and Ustün, 2004); C-SSRS/eC-SSRS = Columbia-Suicide Severity Rating Scale or the electronic Columbia-Suicide Severity Rating Scale (Posner et al., 2011); EPDS = Edinburgh Postnatal Depression Scale (Cox et al., 1987); HRSD = The Hamilton Depression Rating Scale (Hamilton, 1960); IDAS = Inventory of Depression and Anxiety Symptoms (Watson et al., 2007); KMDRS = Koukopoulos Mixed Depression Rating Scale (Sani et al., 2014); MINI/MINI Kid = MINI-International Neuropsychiatric Interview (Sheehan et al., 1998) or MINI-International Neuropsychiatric Interview for Children and Adolescents (Sheehan et al., 2010); Mothers of Preterm Babies Postpartum Depression Scale (Ishola et al., 2018); PDSS = Postpartum Depression Screening Scale (Beck and Gable, 2000); PHQ-9 = Patient Health Questionnaire-9 (Kroenke et al., 2001); SCID = Structured Clinical Interview for DSM-IV disorders (American Psychiatric Association, 1994; First and Gibbon, 2004); SRQ-20 = Self-Reporting Questionnare-20 (Harding et al., 1980).
Suicidality constructs: S = Suicidality (experiencing one or more suicide construct, including, suicidal ideation, suicidal behaviours, suicide attempts); SA = Suicide attempt(s) (previous attempts to take own life); SH = Self-harm ideation (persistent thoughts and/or rumination of self-harm); SI = Suicidal ideation (persistent thoughts and/or rumination of suicide); SIBs = Suicidal ideation and behaviours (persistent thoughts and/or rumination of suicide, including risky and/or harmful behaviours); SIM = Suicidal impulsiveness (sudden onset of suicidal thoughts and/or behaviours); SP = Suicide plans (making plans and/or preparations to take own life); SR = Suicide risk (may be at risk of taking own life, and may also be experiencing suicidal ideation and/or behaviours).
Superscript references: American Psychiatric Association (1994)[a]; Spitzer et al. (1994)[b]; Watson et al. (1995)[c]; Koukopoulos et al. (2007)[d]; World Health Organisation (1990)[e].

period. Confirmatory factor analysis (CFA) generated loadings of 0.70 to 0.92 for the original five-item subscale (Beck and Gable, 2000, 2003) and item response theory (IRT) techniques also confirmed a good item spread, with logit values for the Likert response categories steadily increasing from −2.72 (1 = "strongly disagree") to 1.23 (5 = "strongly agree"), indicating an ordered attitude continuum (Beck and Gable, 2000). One study (Karaçam and Kitiş, 2008) reported a six-factor solution for the PDSS (contrary to the seven-factor model proposed by Beck and Gable, 2000), with an 11-item SUI subscale (loadings ranged from 0.34 to 0.77) and two studies (Blucker et al., 2014; McCabe et al., 2012) determined a five-factor model, with all five items of the SUI loading between 0.60 and 0.88.

Fifteen studies reported reliability. Internal consistency for the SUI was generally high, ranging from $\alpha = 0.76$ (Cantilino et al., 2007) to $\alpha = 0.97$ (Le et al., 2010), with 93 % of studies reporting $\alpha > 0.80$. Correlation coefficients between each SUI item and their respective total subscale score were good, mostly above $r = 0.50$, ranging from $r = 0.67$ to $r = 0.88$, apart from one study (Karaçam and Kitiş, 2008) which reported a coefficient of $r = 0.44$. Test-retest reliability was reported by Karaçam and Kitiş (2008), with a stability coefficient of $r = 0.80$ ($p < .0001$) fifteen days after the original assessment.

Six studies demonstrated cross-cultural validity for the SUI, across four languages: Brazilian Portuguese (Cantilino et al., 2007); Portuguese (Pereira et al., 2010, 2011); Turkish (Karaçam and Kitiş, 2008); and Spanish (Beck and Gable, 2003, 2005). An alternate forms equivalence test between the English and Spanish versions, confirmed a strong correlation between the SUI subscales, $r = 0.97$ ($p < .01$).

3.5. Edinburgh Postnatal Depression Scale, item-10 (EPDS)

Three studies reported criterion validity for the EPDS, item-10, against suicidality questions from a gold standard measure (e.g., diagnostic/clinical interview). One study demonstrated good sensitivity (77 %, CI 57–89) and excellent specificity (92 %, CI 83–96) for item-10 antenatally, against the SCID (Rochat et al., 2013). However, van Heyningen et al. (2019) reported low sensitivity for item-10 (37 %) and high specificity (82 %) against the MINI Plus suicidality criteria in their antenatal sample, with 74 % of cases correctly classified. Postnatally, there was a significant association between item-10 and the revised computerised Clinical Interview Schedule (CIS-R) suicide items (chi^2 statistic = 145.81, $p < .001$), with a moderate agreement (kappa statistic = 0.42) seen in 79 % of cases (Howard et al., 2011).

Six studies reported concurrent validity for the EPDS, item-10. Perinatally, a partial overlap was seen between item-10 and the Mood Spectrum Self-Report (MOODS-SR, Dell'Osso et al., 2002) suicide items, although suicidality endorsement was significantly higher overall for item-10, compared to the MOODS-SR (Mauri et al., 2012). Antenatally, the period prevalence of suicidality assessed by item-10 was 12 %, and 6.9 % for the MOODS-SR. Postnatally, the period prevalence was 8.6 % and 4.3 % respectively. Likewise, higher rates of self-harm/suicidal ideation endorsement were reported postnatally for item-10 (22.3 %), compared to BDI, item-9 (16.1 %) and HRSD, item-3 (11.5 %) (Coker et al., 2017). Only 2.9 % of women who endorsed self-harm/suicidal ideation across these measures were missed by the EPDS. For participants assessed using all three items, 13.8 % only endorsed self-harm on the EPDS and/or BDI (self-report measures), whereas 2.4 % only endorsed the HRSD item (clinician rated), suggesting that self-report scales may have greater sensitivity for identifying self-harm ideation than clinician-rated scales. However, concurrent validity for item-10 of the EPDS may be at risk of bias due to differing conceptualisations of suicidal and self-harm ideation, e.g., item-10 asks about thoughts of self-harm – which may or may not be interpreted to include suicidal ideation – whereas other measures of suicidality are more specific.

Two studies demonstrated predictive validity for item-10. Iliadis et al. (2018) found that women who endorsed self-harm thoughts (SHTs) during the first six-months postnatally were at increased risk of somatic and psychiatric morbidity over a seven-year period (follow-up data retrieved from medical records) compared to women who screened positive for depression (EPDS cut-off ≥12, without SHTs) and/or healthy controls (women reporting no postnatal SHT's or depression). Paul et al. (2021) also found that the offspring of mothers who endorsed perinatal SHTs and depression (SHTsxD) were at increased risk for SHTs and depression at age 24. A significant interaction was seen ($p = .036$) at 18-weeks gestation between maternal SHTsxD and offspring SHTs, and at 32-weeks gestation, 8-weeks postnatal and 8-months postnatal the association between maternal SHTsxD and offspring depression were $p = .002$, $p = .035$ and $p = .028$, respectively. However, the construct of interest for these studies was 'self-harm thoughts' and not suicidal ideation. This may mean that the predictive value of EPDS item-10 is overestimated when only considering it in terms of suicidal ideation.

Table 4
Characteristics of studies included in Q2 of review.

Article citation	Country	*n*	Antenatal, postnatal, or perinatal	Sample	Measure, item, or subscale	Reference standard	Validity	Reliability	Suicidality construct measured, prevalence (%) and *n*
Beck and Gable (2000)	USA	525	Postnatal 2 weeks – 6 months	H, CL	PDSS, SUI	–	Construct, content	Internal consistency, item-total correlation	SI
Beck and Gable (2001a)	USA	150[a]	Postnatal 2–12 weeks	C	PDSS, SUI	SCID	Concurrent	Internal consistency	SI
Beck and Gable (2001b)	USA	150[a]	Postnatal 2–12 weeks	C	PDSS, SUI	SCID	Discriminant	Internal consistency	SI
Beck and Gable (2003)	USA	377	Postnatal 2–12 weeks	PC	PDSS, SUI – Spanish version	–	Construct, cross-cultural, content	Internal consistency, item-total correlation, alternate form equivalence	SI
Beck and Gable (2005)	USA	150	Postnatal 2–12 weeks	PC	PDSS, SUI – Spanish version	–	Discriminant, cross-cultural	Internal consistency	SI
Blucker et al. (2014)	USA	385 110[f]	Postnatal 2 weeks	H	PDSS, SUI	–	Construct	Internal consistency	SI, SH
Boyd and Worley (2007)	USA	76	Postnatal 2 weeks – 3 months	C	PDSS, SUI	–	–	Internal consistency	SI
Cantilino et al. (2007)	Brazil	120	Postnatal 2–26 weeks	H	PDSS, SUI – Brazilian Portuguese version	–	Cross-cultural	Internal consistency	SI
Coker et al. (2017)	USA	842[b]	Postnatal < 13 weeks	CL	EPDS, item-10; BDI, item-9; HRSD, item-3	–	Concurrent	–	EPDS SH = 22.3 %, 129/577 BDI SI/SH = 16.1 %, 132/818 HRSD SI/SH = 11.5 %, 85/738
Corbani et al. (2017)	Italy	830	Antenatal	H	EPDS, item-10; BDI-SF, item-7 – Italian version	–	Concurrent	–	EPDS S = 1.3 %, 11/830 BDI-SF S = 1.3 %, 9/691
Howard et al. (2011)	England	4150 331	Postnatal i. 6 weeks (screening) ii. 8–26 weeks (home-visit) iii. 4 weeks (after home-visit) iv. 18 weeks (after home-visit)	PC, CL	EPDS, item-10	CIS-R	Criterion	–	EPDS SH/SI = 9 %[1], 374/4150 SH/SI = 4 %[2], 166/4150 (6-weeks screening)
Iliadis et al. (2018)	Sweden	305	Postnatal i. 5 days ii. 6 weeks iii. 6 months	PB, SR	EPDS, item-10	–	Predictive	–	SH
Ishola et al. (2018)	Nigeria	124 152	Postnatal < 4 weeks	H, CL	Mothers of Preterm Babies Postpartum Depression Scale, suicidal thoughts item	–	Construct, content	Internal consistency	SI
Karaçam and Kitiş (2008)	Turkey	445	Postnatal 2–13 weeks	PC	PDSS, SUI – Turkish version	–	Construct, concurrent, cross-cultural	Internal consistency, item-total correlation, test-retest	SI
Knettel et al. (2020)	Tanzania	200	Perinatal Antenatal 2nd or 3rd trimester Postnatal 6 months	H	EPDS, item-10; PHQ-9, item-9	–	Concurrent	Item-total correlation	EPDS, antenatal SI = 18 %, 36/200 EPDS, postnatal SI = 3.9 %, 7/179

(*continued on next page*)

Table 4 (*continued*)

Article citation	Country	*n*	Antenatal, postnatal, or perinatal	Sample	Measure, item, or subscale	Reference standard	Validity	Reliability	Suicidality construct measured, prevalence (%) and *n*
									PHQ-9, antenatal SI = 6 %, 12/200 PHQ-9, postnatal SI = 3.9 %, 7/179
Koukopoulos et al. (2021)	Italy	45	Perinatal	CL	KMDRS, item-12	–	Discriminate, construct	–	SIM
Le et al. (2010)	USA	155	Postnatal 6–8 weeks	PC, CL	PDSS, SUI – Spanish version	–	–	Internal consistency	SH = 58.7 %, 91/155
Mauri et al. (2012)	Italy	1066	Perinatal Antenatal i. 3 months ii. 6 months iii. 8 months Postnatal i. 1 month ii. 3 months iii. 6 months iv. 9 months v. 12 months	H, SR	EPDS, item-10	–	Concurrent	–	EPDS, antenatal S = 12 %, point prevalence EPDS, postnatal S = 8.6 %, point prevalence
McCabe et al. (2012)	USA	111[f]	Postnatal > 14 days	H, SR	PDSS, SUI	–	Construct	Internal consistency	SI
Na et al. (2018)	USA	46	Antenatal	CL, SR	PHQ-9, item-9	eC-SSRS	Criterion	–	eC-SSRS SIBs = 4.3 %, 2/46 PHQ-9 SI/SH = 21.7 %, 10/46
Newport et al. (2007)	USA	383[b]	Antenatal	CL	BDI, item-9; HRSD, item-3	–	Concurrent	–	BDI SI = 27.8 %, 96/345 HRSD SI = 16.7 %, 51/305
Palfreyman (2021)	Sri Lanka	1000	Antenatal	H, C	eC-SSRS – English, Sinhala & Tamil versions	–	Cross-cultural	Internal consistency	SIBs = 7.4 %, 74/1000
Paul et al. (2021)	England	8425	Perinatal Antenatal i.18 weeks ii. 32 weeks Postnatal i. 8 weeks ii. 8 months	P	EPDS, item-10	–	Predictive	–	Antenatal SH = 4.23 % (i) SH = 2.24 % (ii) Postnatal SH = 1.52 % (i) SH = 2.24 % (ii)
Pereira et al. (2010)	Portugal	486[c]	Postnatal 3 months	H	PDSS, SUI – Portuguese version	DIGS	Concurrent, cross-cultural	Internal consistency, item-total correlation	SI
Pereira et al. (2011)	Portugal	503[c]	Antenatal 3rd trimester	H	PDSS, SUI – Portuguese version	DIGS	Concurrent, cross-cultural	Internal consistency, item-total correlation	SI
Pinheiro et al. (2008)	Brazil	317 368	Postnatal *n* = 317(CL) 30–120 days *n* = 368(PB) 6–12 weeks	PB, CL	BDI, item-9	MINI, suicide module	Criterion	–	MINI (SR sample) SR = 5.7 %, 18/317 SA = 1.6 %, 5/317 BDI (SR sample) S = 11.1 %, 35/317 BDI (PB sample) S = 8.3 %, 32/386
Quelopana et al. (2011)	Chile	163	Postnatal > 2 weeks	PC	PDSS, SUI – Spanish version	–	–	Internal consistency	SI = 32 %, 53/163
Rochat et al. (2011)	South Africa	109[d]	Antenatal 3rd trimester	PC	SCID, suicidality questions – IsiZulu version	–	Construct, cross-cultural	–	S = 27.5 %, 30/109 SP = 22 %, 24/109 SA = 1.8 %, 2/109

(*continued on next page*)

Table 4 (*continued*)

Article citation	Country	*n*	Antenatal, postnatal, or perinatal	Sample	Measure, item, or subscale	Reference standard	Validity	Reliability	Suicidality construct measured, prevalence (%) and *n*
Rochat et al. (2013)	South Africa	109[d]	Antenatal 3rd trimester	PC	EPDS, item-10	SCID	Criterion	–	SCID S = 27.5 %, 30/109 SP = 22 %, 24/109 SA = 1.8 %, 2/109
Rychnovsky and Beck (2006)	USA	109	Postnatal i. 1–3 days ii. 2 weeks iii. 6 weeks	H	PDSS, SUI	–	–	Internal consistency	SI
van Heyningen et al. (2019)	South Africa	376	Antenatal 1st antenatal visit	PC	EPDS, item-10; PHQ-9, item-9	MINI, suicide module	Criterion, cross-cultural	–	MINI SIBs = 18 %, 69/376
Watson et al. (2007)	USA	830	Postnatal < 4 months	C	IDAS, suicidality items	–	Construct, concurrent	Internal consistency	SI, SH, SIBs, S
Yawn et al. (2009)	USA	481	Postnatal 5–12 weeks	PC	EPDS, item-10; PHQ-9, item-9	–	Concurrent	–	SI
Zhong et al. (2014)	Peru	1520[e]	Antenatal ≤ 16 weeks	PC, SR	PHQ-9, item-9 – Spanish version	–	Construct, cross-cultural	–	SI
Zhong et al. (2015)	Peru	1517[e]	Antenatal ≤ 16 weeks	PC, SR	PHQ-9, item-9; EPDS, item-10	–	Concurrent	–	PHQ-9 SI = 15.8 %, 239/1517 EPDS SI = 8.8 %, 134/1517

Notes: (1) the same alphabet letter in superscript ([a,b,c]) represents the same sample or the sample was drawn from the same cohort; (2) Howard et al. (2011) looked at prevalence using two different cut-offs for EPDS, item-10. [1] = a response of hardly ever, sometimes or often, and [2] = sometimes or often; (3) the prevalence rates presented are for the entire *antenatal, postnatal, perinatal* study sample and not just those with comorbid mental health disorders; (4) the *suicidality construct measured* refers to the constructs of interest that were examined by a study, which may not necessarily be the same construct of interest (and/or *incidence period*) that the measure was originally developed to assess or identify.

Sample: C = Community; CL = Clinical (e.g., diagnosis of a mood disorder and/or experiencing self-reported mental health concerns); H = Hospital or medical clinic; PB = Population based; PC = Primary care; SA = Secondary analysis; SR = Sub-sample of wider research or ongoing cohort.

Measures: BDI/BDI-SF = Beck Depression Inventory or Beck Depression Inventory Short-Form (Beck et al., 1961; Beck, 1996); eC-SSRS = Electronic Columbia-Suicide Severity Rating Scale (Posner et al., 2011); EPDS = Edinburgh Postnatal Depression Scale (Cox et al., 1987); HRSD = The Hamilton Depression Rating Scale (Hamilton, 1960); IDAS = Inventory of Depression and Anxiety Symptoms (Watson et al., 2007); KMDRS = Koukopoulos Mixed Depression Rating Scale (Sani et al., 2014); MOODS-SR = Mood Spectrum Self-Report (Dell'Osso et al., 2002); Mothers of Preterm Babies Postpartum Depression Scale (Ishola et al., 2018); PDSS = Postpartum Depression Screening Scale (Beck and Gable, 2000); PHQ-9 = Patient Health Questionnaire-9 (Kroenke et al., 2001); SCID, = Structured Clinical Interview for DSM-IV disorders (American Psychiatric Association, 1994; First and Gibbon, 2004).

Reference standards: CIS-R = clinical interview schedule-revised (Lewis et al., 1992); DIGS = Diagnostic Interview for Genetic Studies (Nurnberger et al., 1994); eC-SSRS = electronic Columbia-Suicide Severity Rating Scale (Posner et al., 2011); MINI = MINI-International Neuropsychiatric Interview (Sheehan et al., 1998); SCID = Structured Clinical Interview for DSM-IV disorders (American Psychiatric Association, 1994; First and Gibbon, 2004).

Suicidality constructs: S = Suicidality (experiencing one or more suicide construct, including, suicidal ideation, suicidal behaviours, suicide attempts); SA = Suicide attempt(s) (previous attempts to take own life); SH = Self-harm ideation (persistent thoughts and/or rumination of self-harm); SI = Suicidal ideation (persistent thoughts and/or rumination of suicide); SIBs = Suicidal ideation and behaviours (persistent thoughts and/or rumination of suicide, including risky and/or harmful behaviours); SP = Suicide plans (making plans and/or preparations to take own life); SR = Suicide risk (may be at risk of taking own life, and may also be experiencing suicidal ideation and/or behaviours).

3.6. Patient Health Questionnaire-9, item-9 (PHQ-9)

Two studies reported criterion validity for the PHQ-9, item-9 antenatally. van Heyningen et al. (2019) reported low sensitivity for item-9 (28 %) and good specificity (72 %) against the MINI Plus criteria for detecting suicidality, with 64 % of cases correctly classified. Na et al. (2018) assessed item-9 against the electronic version of the Columbia-Suicide Severity Rating Scale (eC-SSRS). The sensitivity of item-9 for detecting suicide risk was 100 % (CI, 34.2–100) and specificity was 81 % (CI, 68–90.5), demonstrating some utility for identifying suicide risk in perinatal populations. The positive predictive value (PPV) of item-9 was low at 20 % and the negative predictive value was 100 % (CI, 90.4–100). However, the sample of pregnant women in this study was small (n = 46).

Three studies reported concurrent validity for item-9. Antenatally, a high concordance rate (e.g., both scores were "normal" or both scores were "elevated" – as opposed to discordance, where one score is "normal" and one is in the elevated range) was seen between PHQ-9 item-9, and EPDS item-10 (84.2 %) (Zhong et al., 2015). However, based on Cohen's kappa only a moderate agreement was demonstrated (0.42). This may be due to differences in wording and/or reporting periods for the two items. Suicidal ideation prevalence was higher when assessed by the PHQ-9 – compared to the EPDS – at 15.8 % vs 8.8 %. Similarly, a very high concordance between PHQ-9 item-9 and EPDS item-10 was seen postnatally (93.8 %), and suicidal ideation was again endorsed more frequently on the PHQ-9 than the EPDS (8.8 % vs 7.3 %) (Yawn et al., 2009). Knettel et al. (2020) also found a strong correlation in participant responses to PHQ-9 item-9, and EPDS item-10 antenatally ($r = 0.678$, $p < .001$) and at six-months postnatal ($r = 0.894$, $p < .001$). However, contrary to Zhong et al. (2015) and Yawn et al. (2009), 14 % of participants endorsed suicidal ideation using only EPDS item-10, 5 % endorsed suicidal ideation using both the PHQ-9 and EPDS items, but none endorsed suicidal ideation using only PHQ-9, item-9.

One study reported construct and cross-cultural validity for the

Table 5
Quality assessment for studies in Q2 of review.

Article citation	Study aims	Sample size	Inclusion/ exclusion	Sample characteristics	Representative sample	Reference standard	Validity reported	Reliability reported	Dropouts specified	Data description	Generalisability
Beck and Gable (2000)	+	?	−	−	+	−	+	+	?	+	−
Beck and Gable (2001a)	+	?	+	+	?	+	+	+	−	+	−
Beck and Gable (2001b)	+	?	+	+	+	+	+	+	−	+	−
Beck and Gable (2003)	+	?	+	+	+	−	+	+	−	+	−
Beck and Gable (2005)	+	?	+	+	+	−	+	+	−	+	−
Blucker et al. (2014)	+	?	+	−	−	−	+	+	+	+	+
Boyd and Worley (2007)	+	?	+	+	+	−	−	+	+	+	+
Cantilino et al. (2007)	+	?	+	+	+	−	+	+	?	+	−
Coker et al. (2017)	+	+	+	+	+	−	+	−	?	+	+
Corbani et al. (2017)	+	?	−	+	−	−	+	−	−	+	+
Howard et al. (2011)	+	+	+	+	+	+	+	−	+	+	+
Iliadis et al. (2018)	+	?	+	+	+	−	+	−	+	+	+
Ishola et al. (2018)	+	?	+	+	?	−	+	+	−	+	+
Karaçam and Kitiş (2008)	+	?	+	+	+	−	+	+	−	+	−
Knettel et al. (2020)	+	+	+	+	+	−	+	+	+	+	+
Koukopoulos et al. (2021)	+	−	?	+	−	−	+	−	−	+	+
Le et al. (2010)	+	?	+	+	+	−	−	+	+	+	+
Mauri et al. (2012)	+	+	+	+	?	−	+	−	+	+	+
McCabe et al. (2012)	+	?	+	+	+	−	+	+	+	+	+
Na et al. (2018)	+	−	?	?	?	+	+	−	?	+	+
Newport et al. (2007)	+	?	−	+	+	−	+	−	?	+	−
Palfreyman (2021)	+	+	+	+	−	−	+	+	+	+	+
Paul et al. (2021)	+	+	+	+	+	−	+	−	+	+	+
Pereira et al. (2010)	+	?	+	−	+	+	+	+	+	+	?
Pereira et al. (2011)	+	?	?	+	+	+	+	+	+	+	+
Pinheiro et al. (2008)	+	?	?	+	−	+	+	−	−	+	+
Quelopana et al. (2011)	+	?	+	+	+	−	−	+	−	+	−
Rochat et al. (2011)	+	?	+	+	−	−	+	−	+	+	+
Rochat et al. (2013)	+	?	+	+	+	+	+	−	+	+	+
Rychnovsky and Beck (2006)	+	?	+	+	?	−	−	+	−	+	−

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Table 5 (*continued*)

Article citation	Study aims	Sample size	Inclusion/ exclusion	Sample characteristics	Representative sample	Reference standard	Validity reported	Reliability reported	Dropouts specified	Data description	Generalisability
van Heyningen et al. (2019)	+	?	+	+	+	+	+	−	?	+	+
Watson et al. (2007)	+	+	?	−	?	−	+	+	?	+	+
Yawn et al. (2009)	+	?	+	+	+	−	+	−	+	+	−
Zhong et al. (2014)	+	+	+	+	+	−	+	−	+	+	?
Zhong et al. (2015)	+	+	?	+	+	−	+	−	+	+	?

Notes: + = present; − = no;? = unclear.

Table 6
Number of studies reporting psychometrics for each measure in Q2 of review.

Measure, item, or subscale	Content Validity (no. of studies)	Criterion Validity (no. of studies)	Concurrent Validity (no. of studies)	Construct Validity (no. of studies)	Discriminant Validity (no. of studies)	Predictive Validity (no. of studies)	Cross-cultural Validity (no. of studies)	Internal Consistency (no. of studies)	Test-retest Reliability (no. of studies)	Item-total Correlation (no. of studies)
BDI, item-9 or BDI-SF, item 7		X ($n = 1$)	X ($n = 3$)							
eC-SSRS							X ($n = 1$)	X ($n = 1$)		
EPDS, item-10		X ($n = 3$)	X ($n = 6$)			X ($n = 2$)	X ($n = 1$)			X ($n = 1$)
HRSD, item-3			X ($n = 2$)							
IDAS, suicidality subscale			X ($n = 1$)	X ($n = 1$)				X ($n = 1$)		
KMDRS, item-12				X ($n = 1$)	X ($n = 1$)					
Mothers of Preterm Babies Postpartum Depression Scale, Suicide item	X ($n = 1$)			X ($n = 1$)				X ($n = 1$)		
PDSS, SUI	X ($n = 2$)		X ($n = 4$)	X ($n = 5$)	X ($n = 2$)		X ($n = 6$)	X ($n = 15$)	X ($n = 1$)	X ($n = 5$)
PHQ-9, item-9		X ($n = 2$)	X ($n = 3$)	X ($n = 1$)			X ($n = 2$)			X ($n = 1$)
SCID, Suicidality questions				X ($n = 1$)			X ($n = 1$)			

Notes: (1) seven studies validated more than one suicidality measure; (2) later and/or adapted versions of a measure that uses the same item wording have been grouped together.
Measures: BDI/BDI-SF = Beck Depression Inventory or Beck Depression Inventory Short-Form (Beck et al., 1961, Beck, 1996); eC-SSRS = Electronic version of Columbia-Suicide Severity Rating Scale (Posner et al., 2011); EPDS = Edinburgh Postnatal Depression Scale (Cox et al., 1987); HRSD = The Hamilton Depression Rating Scale (Hamilton, 1960); IDAS = Inventory of Depression and Anxiety Symptoms (Watson et al., 2007); KMDRS = Koukopoulos Mixed Depression Rating Scale (Sani et al., 2014); Mothers of Preterm Babies Postpartum Depression Scale (Ishola et al., 2018); PDSS = Postpartum Depression Screening Scale (Beck and Gable, 2000); PHQ-9 = Patient Health Questionnaire-9 (Kroenke et al., 2001); SCID = Structured Clinical Interview for DSM-IV disorders (American Psychiatric Association, 1994; First and Gibbon, 2004).

Spanish version of the PHQ-9, item-9 by demonstrating evidence of unidimensionality, local independence and acceptable fit to a Rasch Item Response Theory model (Zhong et al., 2014). The four original response categories were disordered in the Spanish version. Model fit was improved by collapsing these categories into a three-point Likert scale in which "more than half the days" and "nearly every day" were combined. Further research is needed to validate the three-point scale version.

3.7. Beck Depression Inventory, item-9 (BDI) and Beck Depression Inventory Short Form, item-7 (BDI-SF)

One study reported criterion validity for the BDI, item-9. When compared to the MINI, a cut-off score of 0/1 on BDI item-9 provides greater sensitivity (83.3 %) but lower specificity (93.3 %) for identifying suicidal ideation, rather than a cut-off of 1/2 (44.4 % sensitivity; 99 % specificity) (Pinheiro et al., 2008).

Two studies reported concurrent validity for the BDI, item-9 and one study reported concurrent validity for the BDI-SF, item-7. Antenatally, item-9 has shown greater sensitivity for identifying suicidal ideation, relative to item-3 of the HRSD (77.8 % vs 44.9 %) with suicidal ideation endorsement being significantly higher on the BDI ($z = 3.39$ ($p < .0007$)) (Newport et al., 2007). Similarly, postnatal rates of self-harm/ suicidal ideation endorsement were higher using the BDI than the HRSD, as previously stated in Section 3.5 (Coker et al., 2017). A low agreement between item-7 of the BDI-SF and EPDS item-10 has also been demonstrated antenatally (kappa statistic = 0.253) (Corbani et al., 2017).

3.8. Hamilton Rating Scale for Depression, item-3 (HRSD)

Two studies reported concurrent validity for the HRSD item 3, with the EPDS item-10, and BDI item-9 (Coker et al., 2017; Newport et al., 2007) – as stated in Sections 3.5 and 3.7.

3.9. Structured Clinical Interview for DSM-IV diagnoses (SCID), suicidality items

One study examined the cross-cultural and construct validity of the SCID, suicidality items (Rochat et al., 2011). Exploratory factor analysis was performed on dichotomised scores producing one principal component, with eight variables representing six symptoms of depression. Suicidal and self-harm thoughts had the highest factor loading (0.32), followed by self-harm plans (0.29). Suicidal ideation prevalence was very high in this sample (28 %), with 90 % of those endorsing suicidal thoughts antenatally, also diagnosed with depression.

3.10. Other measures

Four studies validated other suicidality measures. Watson et al. (2007) reported on the construct and concurrent validity of the Inventory of Depression and Anxiety Symptoms (IDAS), suicidality subscale in a sample of postnatal women. The subscale demonstrated an acceptable loading onto the principal factor (0.51). No further psychometrics of the six items that formed the suicidality subscale were reported. The suicidality subscale correlated significantly with the total scores of both the EPDS, and HRSD ($r = 0.34$). Internal consistency for the subscale was good, $\alpha = 0.74$. However, similarly to the PDSS SUI, concurrent validity for the IDAS suicidality subscale was established against two full depression measures (EPDS and HRSD).

Koukopoulos et al. (2021) reported on the discriminate and construct validity of the Koukopoulos' Mixed Depression Rating Scale (KMDRS) suicidal impulsiveness item (item-12) in a small sample of perinatal women ($n = 45$). KMDRS item-12 was found to distinguish mixed depression symptoms (MxD) from non MxD symptoms ($p < .0001$) and demonstrated a good loading of 0.679 onto the 'dysphoric impulsiveness and aggressiveness factor'. However, it is important to note that KMDRS item-12 assessed suicidal impulsiveness, which excluded non-impulsive suicidal thoughts.

Another study reported content and construct validity for the Mothers of Preterm Babies Postpartum Depression Scale, suicidal thoughts item (Ishola et al., 2018). Exploratory factor analysis generated a three-factor solution with 14-items, five items comprised the 'hopelessness and suicidal thought' (HST) factor. HST factor loadings were good, ranging from 0.80 to 0.92, and internal consistency was $\alpha = 0.92$. CFA was also performed. Several items were removed to improve model fit, resulting in a nine-item scale, three-factor solution. The HST factor comprised three items with loadings of 0.73, 0.90 and 0.92, and the internal consistency was $\alpha = 0.87$.

Lastly, one study reported cross-cultural validity (Sinhala and Tamil language) and reliability for the eC-SSRS in an antenatal sample (Palfreyman, 2021). The internal consistency of the eC-SSRS was strong, $\alpha = 0.91$.

4. Discussion

The purpose of this systematic review was to (1) identify; and (2) evaluate the psychometric properties of suicidality measures used in perinatal populations. Two-hundred and eight unique articles reported on a measure of suicidality in the antenatal and/or postnatal period. Thirty-five of these reported on psychometric properties, across 10 measures of suicidality. Fifteen studies reported both validity and reliability data, 12 reported more than one type of validity, seven validated more than one measure and four only reported reliability. Over two-thirds of the studies that validated a suicidality measure used a postnatal sample. Three measures were specifically developed for perinatal women, but only two were validated in more than one study. Across all measures, the PDSS, SUI, was validated most frequently, followed by item-10 of the EPDS.

For a measure of perinatal suicidality to be useful, it needs to be thoroughly validated in that population and effective at reliably discriminating between women who may require acute care, or care in the community so that appropriate pathways are established early (e.g., referrals to specialised perinatal mental health services). Usually, this involves testing its robustness using several different validation types (e.g., concurrent, discriminant, predictive validity) with an appropriate sample (e.g., antenatal, postnatal) in differing contexts (e.g., different countries, sample types). Likewise, in clinical practice where time and financial constraints exist, a measure also needs to be appropriate for use with perinatal women, easy to administer, brief to complete and accessible (and validated) in different languages.

The validity and reliability of measures identified in this review were limited, and nearly all were either an item or subscale on a measure assessing depression symptoms. It is also noteworthy that only 12 out of the 35 studies reporting psychometric data examined suicidality in perinatal women as a primary focus. Therefore, given the scarcity of research in this area, recommendations about the use of each measure in perinatal populations have been provided tentatively, with consideration to their advantages, disadvantages and usability in clinical practice. Key issues and the wider implications of these findings follow thereafter.

The PDSS, SUI was validated the most, in both antenatal and postnatal samples, with 15 studies reporting on its validity and/or reliability. The SUI demonstrated good concurrent and construct validity, although criterion validity for the SUI is yet to be determined using a gold standard measure of suicidality in perinatal populations. Furthermore, the SUI has shown excellent internal consistency and has been validated in four languages, making it accessible in different contexts. Content validity for the SUI (and PDSS as a whole) was based upon extensive qualitative research with postnatal women, with items worded in relation to the experience of being a new mother (Beck, 1992, 1993; Beck, 1996). Hence, it is both relevant and appropriate for use in this population. However, the authors of the PDSS contend that the SUI cannot be used as a standalone measure of suicidality in clinical practice, meaning it has limited utility outside of screening for perinatal depression symptoms more generally.

The EPDS item-10 is a commonly used measure of suicidal ideation. It has shown good sensitivity and specificity in some antenatal and postnatal samples (established against suicidality questions from a gold standard measure) (Howard et al., 2011; Rochat et al., 2013). However, item-10 of the EPDS asks about thoughts of 'self-harm' which may not necessarily be interpreted to include suicidal ideation. This discrepancy could affect its validity, although research suggests that self-harm is a risk factor for suicide in postnatal women (Johannsen et al., 2019) so there may be benefit in asking this type of question for the early identification of at-risk women. Furthermore, whilst there are clear limitations of using a single item to capture complex phenomena, an advantage of item-10 is its brevity and ease of completion, which is particularly important in clinical settings. Therefore, EPDS, item-10 may have some utility for stepped care in perinatal populations (e.g., endorsement could lead to a fuller assessment of suicidality), although consideration should be given to the screening need and construct under investigation.

As opposed to the PDSS and EPDS, the PHQ-9 was not specifically developed for use with perinatal women, and there are a limited number of studies validating item-9 in antenatal and postnatal samples. A high concordance was observed between PHQ-9 item-9, and item-10 of the EPDS, but only a moderate agreement was demonstrated (Zhong et al., 2015). This might be due to differences in question wording as item-9 asks about both passive 'thoughts you would be better off dead' and active 'thoughts of hurting yourself'. However, the use of both active

and passive language in a single screening item may also lead to a high rate of false positives because it is difficult to discern exactly 'what' is being endorsed – which is a key clinical consideration. Similar to EPDS item-10, the PHQ-9 item-9, is quick to administer – which is important in busy maternity care settings – although further research and validation in perinatal samples is required before any recommendations can be made.

Psychometric evidence concerning BDI item-9 and BDI-SF item-7 (which ask the same question) in perinatal populations is lacking. There is some support for the items' sensitivity relative to the MINI suicide items (Pinheiro et al., 2008) and HRSD item-3 (Newport et al., 2007), but inferences about its utility are not possible given the limited number of studies reporting psychometric data. Likewise, for HRSD item-3, only concurrent validity has been examined, with item-3 showing less sensitivity for identifying suicidal ideation than alternative suicidality measures. This may in part be due to how the HRSD is administered, as it is a clinician-rated measure rather than self-report. Some women may feel more reluctant to endorse suicidal ideation face-to-face (as opposed to recording it on paper), and similarly, some clinicians may feel reluctant to report and/or document that a woman is feeling suicidal (Newport et al., 2007). More research is needed to validate the suicidality items on both the BDI and HRSD as they may not currently be appropriate and/or effective for use in perinatal samples.

Of the remaining suicidality measures identified, only one study per measure reported psychometric data, and most showed little evidence to support their wider use with perinatal women at this time.

Considering these findings, several key issues have been identified. It is apparent that measures of suicidality have not been extensively validated in perinatal samples, and even those which may have some clinical utility (e.g., PDSS, EPDS) are not without limitation in their current form. It is also important to note that measures such as the PDSS or EPDS were developed over 20 years ago, meaning there is a greater abundance of literature examining their psychometric robustness than newer measures. Newer measures may be effective for identifying possible depression and/or suicidality in perinatal women, but more validation of these is needed. Furthermore, nearly all the suicidality measures identified were either items or subscales on a depression measure, and to date, no measure has been specifically developed to identify suicidality in this population. This raises important questions, particularly if a woman does not meet the clinical cut-off threshold for depression on a specific screening measure. Likewise, of all the available suicidality measures that are used in the general population, only the eC-SSRS has been validated antenatally (Palfreyman, 2021). Given that depression and suicidality are not always comorbid, it may be necessary to screen for suicidality outside of the depression context to prevent cases from being missed. Equally, screening for suicidality in conjunction with other common symptoms of perinatal mental health disorders may maximise sensitivity, provide a more comprehensive picture of a woman's mental health, and lead to faster and more suitable care pathways. However, the administration of routine full mental health screens is costly, time-consuming, and not appropriate in over-burdened primary care services where brief and effective screening methods are required, with high specificity.

Only three of the suicidality measures identified in this review were specifically designed for use with perinatal women. When evaluating the validity of suicidality measures, it is necessary to also consider their content acceptability and appropriateness to perinatal women. Outdated and/or unfavourable language use could reinforce stigma, leading to a reluctance to answer honestly, whereas contextualising items in terms of pre- and post-motherhood may be more meaningful, and have the opposite effect. Likewise, there may also be implications in terms of self-report vs clinician-rated suicidality measures in perinatal populations. For example, self-report may lead to over identification of cases (e.g., where a women may feel more comfortable ticking a box and/or writing something on paper) or it may also lead to underreporting given the sensitivity of the topic (e.g., a women may feel more willing to talk about suicidality face-to-face where there is opportunity for open and supportive conversation). Therefore, further research with antenatal and postnatal women is needed to address, understand, and overcome disclosure barriers regarding suicidality measures, which may be specific to this population.

4.1. Limitations

Due to the small number of studies that have validated and/or reported psychometric data for measures of suicidality in perinatal samples, it is difficult to draw firm conclusions about their utility or make recommendations about their use in clinical and/or research settings. The studies also differed significantly in terms of their methodological approaches, sample types, constructs of interest and administration/purpose which meant they were not easily comparable. Furthermore, the scope of this review was restricted to measures of suicidality that have been validated during the perinatal period (pregnancy and up to one-year postnatally), so studies that were conducted with postnatal women beyond this time frame were omitted. Likewise, studies were also excluded if the construct of interest was historic suicidality (e.g., prior to pregnancy) and there was insufficient information to differentiate this from suicidality identified within the perinatal period. Future research should consider examining the linkage between historic suicidality and suicidality in the perinatal period, especially when developing screening or assessment measures to identify cases in this population. Lastly, only papers written in English were included which may have resulted in studies that validated measures of perinatal suicidality in other countries and/or languages being overlooked.

4.2. Conclusions

Further research is needed to validate measures of suicidality in perinatal populations, and particularly during the antenatal period. It is imperative that effective, appropriate, and acceptable measures of suicidality are available in research and clinical settings to identify at-risk women in early pregnancy, and across the entire perinatal period. This will help to reduce perinatal suicidality and improve outcomes for women, their infants, and families. Whilst both the PDSS, SUI and EPDS item-10 have shown some promise for identifying suicidal ideation and/or self-harm thoughts, utility in their current form is limited to the context of depression screening. Future research should continue to validate the measures identified in this review and validate alternative measures of suicidality that are currently used in the general population, in both antenatal and postnatal samples. The development and validation of brief, feasible and effective measures of suicidality that are specific to perinatal women are warranted.

5. Registration and protocol

This review was prospectively registered on PROSPERO (ID: CRD42020202780) on 01/09/2020. A protocol was prepared prior to registration, but this is not available online. Two amendments were made to the original PROSPERO record on 22/12/2020 and 01/04/2021. Both were extensions to the review completion date (due to disruption caused by the COVID-19 pandemic). Registration details are available at: https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42020202780

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Credit authorship contribution statement

Authors ED and RC were responsible for conceptualisation of the study. Author ED conducted the literature review, database searches, data extraction, quality assessment, synthesis of results and writing of protocol and original manuscript. Author RC assisted with quality assessment and reviewing and editing the protocol and manuscript drafts. Authors SA and RM reviewed and edited the protocol and manuscript drafts. All authors contributed to and approved the final manuscript.

Conflict of interest

All authors declare that they have no conflicts of interest.

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