

# Validity of the Edinburgh Postnatal Depression Scale for screening pregnant and postpartum adolescents: a systematic review

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## ABSTRACT

**Objective:** To examine the validity of the Edinburgh Postnatal Depression Scale (EPDS) for screening depression in pregnant and postpartum adolescents.

**Background:** The incidence of postpartum depression (PPD) in 15 to 19-year olds is double the rate reported among mothers older than 25 years. EPDS threshold scores that indicate possible depression among adolescents have not been established and may differ from those validated for adults.

**Study design and methods:** A systematic review of the literature between 1987 and 2020 was conducted using five databases: CINAHL, EMBASE, MEDLINE, MIDIRS and PsycInfo. Studies that sampled adolescent mothers in the perinatal period, that screened for depressive symptoms using the EPDS, and which assessed the validity of the tool were included. The studies were grouped according to their methodology with results presented as a narrative synthesis. Two researchers independently reviewed search results, study selection and data extraction, and undertook quality appraisals using the Quality Assessment of Diagnostic Accuracy Studies checklist.

**Results:** Five studies that sampled a total of 1,241 participants were included in the review: four validated the EPDS against diagnostic reference

standards and one against other depression screening tools. The EPDS demonstrated high levels of sensitivity and specificity although optimal cut-off scores for possible depression were between 2 and 7 points lower than that recommended for adult samples. Overall performance of the EPDS was equivalent or better when compared to other screening tools.

**Discussion:** The standard EPDS cut-off score ( $\geq 12$ ) does not identify all adolescents at high risk of depression during the perinatal period. Scores of  $\geq 9$  may be more appropriate. However, different reference standards and sampling methods used in the studies compromise the review's strength of evidence.

**Conclusion:** Despite development of the EPDS more than 30 years ago, research into its validity among adolescents is still in its infancy. This review makes an important contribution to that body of evidence by revealing its limitations and highlighting trends upon which further research can build.

**Implications for research, policy and practice:** Although Australian guidelines for perinatal depression screening are some of the most detailed in the world, limited guidance is offered for EPDS use among adolescents. The findings of this review

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raise important points for that guidance and for practitioners. Concerns for possible depression in adolescents should be triggered at an advisory EPDS cut-off score of  $\geq 9$ . Further research is needed to confirm or refute these findings.

### What is already known about the topic?

- Postpartum depression (PPD) among adolescents is prevalent and a recognised public health concern due to its significant association with morbidity.
- Perinatal screening for depression using validated instruments, including the Edinburgh Postnatal Depression Scale (EPDS), is recommended in national and international guidance.
- There is no validated version of the EPDS for adolescents although there is evidence to suggest that cut-off scores indicative of possible depression may need to be lower than those recommended for adults.

### What this paper adds:

- The paper synthesises evidence that demonstrates the EPDS is a valid scale for perinatal screening of depression in adolescents.
- It identifies lower cut-off scores for suspected depression among adolescents compared to adults, and also highlights score differences in the pre and postnatal periods.
- The paper provides advisory screening guidance for practitioners and emphasises the importance of monitoring for depressive symptoms in perinatal adolescents at every healthcare encounter.

**Key words:** Adolescent mothers, antenatal depression, postpartum depression, psychometric properties, rating scales.

## INTRODUCTION

Nearly 16 million adolescent women give birth every year, accounting for 11% of births worldwide.<sup>1</sup> However, they carry 23% of the overall disease burden from pregnancy and childbirth in terms of disability adjusted life years.<sup>2</sup> Common mental health problems during the perinatal period (prenatal to one year postnatal) include substance abuse, eating disorders, anxiety and depression.<sup>3</sup> The prevalence of depression is significantly higher in adolescent mothers compared to adult mothers, ranging from 14 to 53% and 6.9 to 16.7% respectively.<sup>3</sup> The probability of having used illicit drugs is also greater in adolescent mothers, as is smoking during pregnancy and suffering physical abuse from partners.<sup>4</sup>

Adolescence is often a tumultuous period in a person's life characterised by changes in hormones and neurotransmitter levels, which influence how we experience emotions. Mood can change rapidly and frequently, and strong emotions may emerge not previously experienced. Feeling depressed as an adolescent mother may therefore include different features compared to adult mothers such as fear, transition difficulties, feeling overwhelmed and confused, low self-esteem, rejection by peers and a sense of abandonment and isolation.<sup>5</sup> Postpartum depression (PPD) is a particularly common and frequent disorder among this group and is recognised as a public health concern due to its significant association with morbidity.<sup>3</sup>

Over the first two decades of this century, increasing attention has focused on perinatal mental health screening in Australia. The National Perinatal Depression Program was launched in 2001, followed by the Perinatal Mental Health Action Plan in 2008.<sup>6</sup> The first Australian national

guidelines for perinatal mental healthcare were published in 2011,<sup>7</sup> which recommended antenatal and postnatal screening for depression. Clinical practice guidelines issued in 2012 reiterated these recommendations, for which an update was published in 2017.<sup>8</sup> Between 2000 and 2017 the percentage of Australian women not screened for depression during the perinatal period fell from 40.6 to 1.7%, and the percentage who were screened in both the antenatal and postnatal periods increased from 21.3 to 79.3%.<sup>9</sup> Despite these improvements, one-in-five women (21%) are still not screened at both time points in line with clinical guidance.<sup>9</sup>

There has also been a 40% reduction in the rate of teenage pregnancy in Australia between 2006 and 2017, from 17.6 to 9.2 live births per 1,000 females aged 15-19.<sup>10</sup> However, there is wide variation across different populations with a rate of 53 live births per 1,000 among adolescents who identify as Aboriginal or Torres Strait Islander.<sup>11</sup> The rate is also higher among those who live in remote areas, are socially disadvantaged with unstable housing and who receive social welfare.<sup>11</sup> Struggles with mental health issues among these young mothers are not uncommon but there are recognised barriers to adequate care including a lack of resources, adequately trained professionals, and the social stigma associated with mental disorders, although the greatest impediment is inaccurate assessment.<sup>12</sup> Often, individuals are either not diagnosed or misdiagnosed.

Studies that examine screening for depression in adolescent mothers have used various instruments including the Center for Epidemiological Studies Depression Scale (CES-D) and the Beck Depression Inventory (BDI).<sup>13,14</sup> The psychometric properties of both scales demonstrate their suitability for use among adolescent mothers, but neither focuses on

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the measurement of symptoms that are specific to PPD. In contrast, the Edinburgh Postnatal Depression Scale (EPDS) was created especially for screening PPD symptoms.<sup>15</sup> The EPDS was originally developed in the United Kingdom (UK), has been translated into more than 50 languages and is now used extensively throughout the world.<sup>16</sup>

Although initially developed for identifying possible symptoms of depression in the postnatal period, the EPDS has been adequately tested among adult samples to also identify symptoms in the antenatal period.<sup>17</sup> The scale contains 10-items that capture data on depressive symptoms experienced over the preceding seven days, excluding somatic symptoms which can be confused with physiological changes in pregnant or postpartum women. The most typically used threshold score to identify mothers with major depressive disorder is  $\geq 12$ . Shorter versions of the tool have also been created including the EPDS 2-item, 3-item and 7-item.<sup>5</sup>

Few psychometric data on the full or shortened versions of the EPDS among pregnant or adolescent mothers have been reported. To date, there is no validated version or any other measure of PPD in any language for adolescents,<sup>3</sup> although there is some evidence to suggest that cut-off scores lower than  $\geq 12$  may be advisable among this population.<sup>5</sup>

Australian clinical practice guidelines recommend use of the EPDS to screen for depression during the perinatal period and advise formal psychiatric assessment for scores of 13 or more, with repeated screening within a 2 to 4-week period for scores of between 10 and 12.<sup>8</sup> The guidelines advise that appropriately translated versions of the EPDS should be used when necessary with culturally relevant cut-off scores, but advice is not tailored to adolescents who are mentioned only as examples of complex presentations for which inter-professional collaboration is recommended.<sup>8</sup> Accurate

screening for PPD among adolescents remains an important clinical challenge. This paper therefore presents a systematic review that considered the suitability of the EPDS for use among this group. Specific objectives were to:

- appraise the validity of the EPDS as a screening tool for pregnant and postpartum adolescents;
- identify the optimal EPDS threshold scores that indicate possible PPD in adolescents.

## METHODS

The Cochrane Handbook for Systematic Reviews of Diagnostic Test Accuracy was used to design and execute the review.<sup>18</sup> It is reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement extensions for Diagnostic Test Accuracy studies (PRISMA-DTA).<sup>19</sup> An *a priori* protocol was prepared for the review and is available on request from the corresponding author. Completed DTA checklists are available online (Appendix A).

## SEARCH STRATEGY

A preliminary search of the Cochrane library was undertaken to ensure no other related systematic reviews had been conducted. A population, intervention and outcome (PIO) analysis was then performed to identify index terms using the medical subject headings (MeSH) thesaurus and associated free-text terms,<sup>20</sup> which were expanded and combined in the search strategy using Boolean operators (Table 1). This strategy was applied to the Cumulative Index to Nursing and Allied Health Literature (CINAHL), Medline, EMBASE, Maternity and Infant Care Database (MIDIRS) and PsycInfo in August 2020. Forward citation tracking of retrieved articles was also conducted by hand searching reference lists.

**TABLE 1 PIO ANALYSIS SEARCH TERMS**

	Population		Intervention	Outcome
Index terms/MeSH	Pregnancy in adolescence/ Adolescent pregnancy		Psychometrics	Postpartum depression
Free-text terms	Adolescent mother* OR Pubescen* mother* OR Child bearing* OR Child-bearing OR childbearing* OR teen* mother* OR young* mother*	AND	Rating scale* OR Rating tool* OR Rating instrument* OR Measurement scal* OR Measurement tool* OR Measurement instrument* OR Assessment scal* OR Assessment tool* OR Assessment instrument* OR Screening scal* OR Screening tool* OR Screening instrument* OR Depression adj3/n3 scale* OR Depress* adj3/n3 detect* OR Psychometric* adj2/n2 scal* OR Mood* adj3/n3 scale* OR Mental adj3/ n3 scale* OR Postnatal scale* OR Postpartum scale* OR Edinburgh adj2/n2 scale* OR EPDS	AND PPD OR Postpartum adj3/n3 depress* OR Postnatal* adj3/n3 depress* OR Perinatal* adj3/n3 depress* OR Puerperal adj3/n3 depress* OR Postnatal depression OR PND

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### INCLUSION CRITERIA AND STUDY SELECTION

Studies were included if they reported quantitative research that sampled adolescent mothers aged between 13 and 19 years who were pregnant or in the postpartum period, which screened for depressive symptoms or PPD using any version of the EPDS, and which considered the validity of the tool. Only studies reported in the English language between 1987, when the EPDS was first published, and 2020 were included. Qualitative designs, expert opinion or consensus statements were excluded.

Both authors (FB and AG) independently assessed titles, abstracts and full-text articles against eligibility criteria. The resulting indecision and disagreement regarding the eligibility criteria of individual titles, abstracts, and full-text articles were discussed and excluded by agreement amongst the two authors. Selection decisions were agreed through discussion and full-text copies of the included articles were uploaded into Covidence for analysis ([www.covidence.org](http://www.covidence.org)).

### DATA EXTRACTION AND ANALYSIS

A data extraction template captured methodological details from each study including country of origin, study aim and index test, design and reference standard, sample and setting, and key findings. Index test extractions included the EPDS version(s) being tested and other validated tests used for comparative purposes. Reference standard extractions included the assessment instrument, diagnostic classification system and the diagnoses used for analysis purposes. Sample extractions included the sampling method, demographic and stage of pregnancy data (antenatal or time postnatal). Key findings extractions were of the principal diagnostic accuracy measures including sensitivity, specificity, positive and negative predictive values, receiver operator curve statistics and optimum cut-off scores.

Four different diagnostic reference standards were used across the studies resulting in different classifications of depression e.g. minor and major depression combined, and major depressive episode alone. There were also important differences in study samples, being exclusively pregnant or postpartum adolescents. These differences between reference standards and participants precluded a meta-analysis.<sup>21</sup>

The studies were initially grouped according to assessment of the EPDS against a diagnostic reference standard or against another depression screening tool. Within and between group comparisons of study contexts, methods and diagnostic accuracy results were then undertaken to provide a narrative synthesis of the results.

### QUALITY APPRAISAL

Quality appraisal of the studies was undertaken using the Quality Assessment of Diagnostic Accuracy Studies checklist (QUADAS 2019).<sup>22</sup> The Cochrane handbook recommends using 11 of the 14 original QUADAS quality items for DTA reviews and adding additional items for particular topics or contexts.<sup>18</sup> The QUADAS is principally designed to appraise studies in which the accuracy of a test such as the EPDS is measured against a diagnostic reference standard, rather than when two or more screening tests are compared with each other. Because some of the studies in this review undertook comparisons of different screening tests, adjustments were made to the wording of some QUADAS items to include the reference standard or comparison test e.g., was the reference standard/ comparison test independent of the index test?

The checklist included space for a description and judgement against each quality item. The description provided a succinct statement of the stated facts from a study upon which each judgement was based. Judgements were rated as 'yes', 'can't tell', 'no' or 'N/A'. QUADAS ratings were completed separately by each author (FB and AG) with any disagreements resolved through discussion. Results are provided as a narrative summary.

## RESULTS

### SEARCH OUTCOMES

The literature search returned 3,588 studies. After the removal of duplicates, and title and abstract screening, 53 studies were retrieved for full text review from which five met eligibility criteria and were included in the review (Figure 1).

### STUDY CHARACTERISTICS

Table 2 presents the characteristics of included studies. They collectively sampled 1,241 participants with mean ages from 15 to 17 years across the studies, and individual sample sizes from 59 to 807. Three studies were conducted in the USA one in Mexico and one in Brazil.<sup>5,23-26</sup> Study designs included one randomised controlled trial (RCT) and four cross sectional surveys.<sup>5,5,23-25</sup> Two studies assessed the EPDS among pregnant adolescents and three assessed its use among adolescent mothers during the postpartum period.<sup>5,23-26</sup>

Participants were sampled from public services in their respective countries, typically prenatal hospital-based clinics and postnatal community services. Two studies from the USA included participants from the teen parenting program of a public school system.<sup>23,24</sup> Four of the studies assessed the EPDS against a diagnostic reference standard,<sup>5,24-26</sup> although different reference standards were used in each study. Three of these four studies also assessed EPDS performance against other screening tests.<sup>5,24,26</sup> The fifth study used the CES-D as a concurrent validity check for the EPDS without a diagnostic reference standard.<sup>23</sup>

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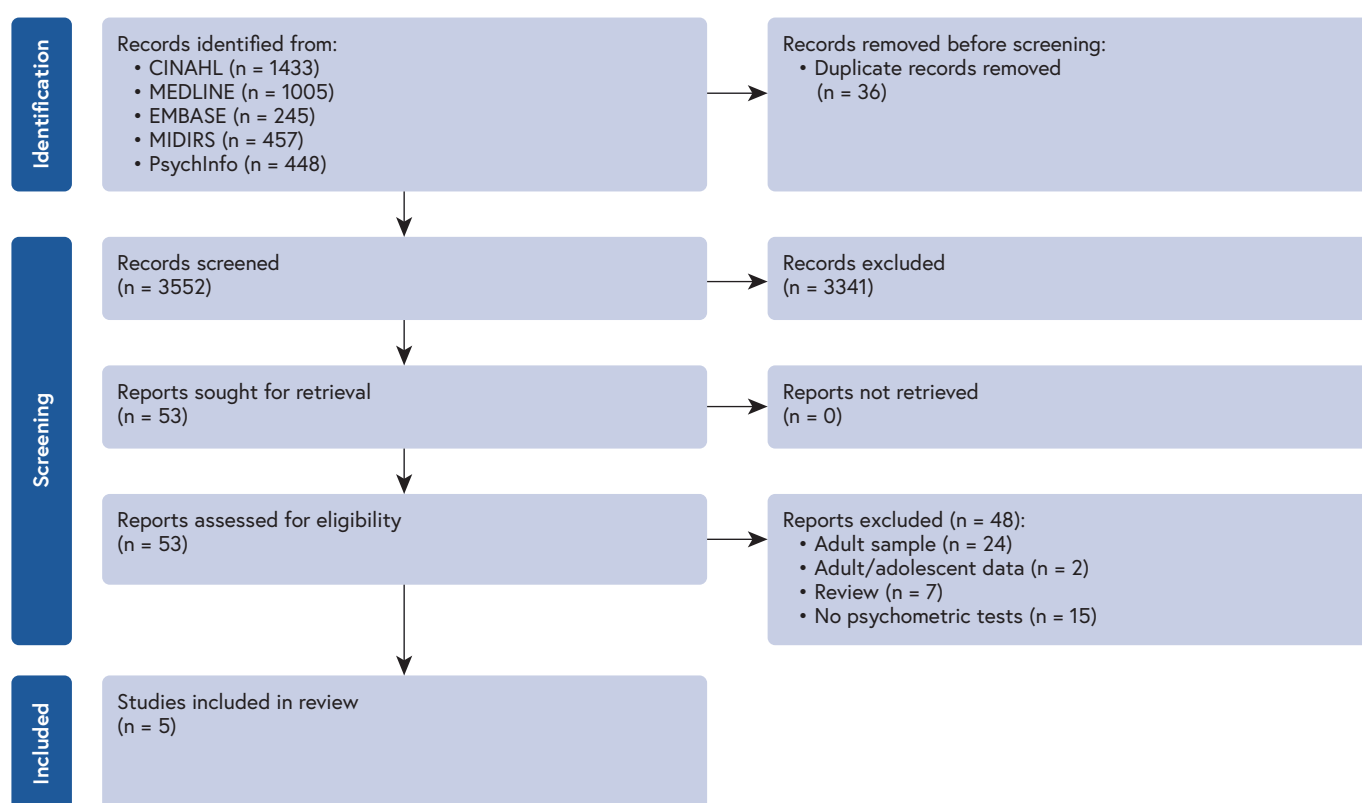
FIGURE 1 PRISMA FLOWCHART<sup>27</sup>

TABLE 2 STUDY CHARACTERISTICS

Authors and country	Aim and index test	Design and reference standard	Sample and setting	Key findings
Alvarado-Esquivel et al, (2014) <sup>25</sup> Mexico	To validate a Spanish translated Mexican version of the EPDS in pregnant adolescents	Cross-sectional survey using DSM-IV psychiatrist assessment as a reference standard Major and minor depression diagnoses included in analyses.	Random selection of 120 pregnant adolescents from a prenatal hospital clinic in Durango City, Mexico (mean age 15.9 years ± 1.0)	<ul style="list-style-type: none"> <li>• Sensitivity 70.4% and specificity 84.9%</li> <li>• Positive predictive value 47.6% and negative value 91.0%</li> <li>• AUC 0.81 (95% CI: 0.56-1.07)</li> <li>• Optimal cut-off score 8/9</li> </ul>
Logsdon et al (2009) <sup>23</sup> United States of America	To assess the psychometric properties of the EPDS among adolescent mothers	Cross-sectional survey using the CES-D as a concurrent validity check without a diagnostic reference standard	Convenience sample of 149 adolescent mothers from two community hospitals and one public school for pregnant and parenting teens in southern United States (postpartum 4-6 weeks, mean age 16 years ± 1.19)	Principal components analysis <ul style="list-style-type: none"> <li>• Factor 1 anxiety (Alpha 0.82, loading range 0.61-0.80)</li> <li>• Factor 2 depression (Alpha 0.82, loading range 0.51-0.82)</li> </ul> Item analysis <ul style="list-style-type: none"> <li>• Total items &gt;0.44 (moderate)</li> <li>• Inter-items 0.23-0.72 (moderate to strong)</li> </ul> Concurrent validity <ul style="list-style-type: none"> <li>• Correlation with CES-D r=0.77 (mid-level)</li> </ul> Internal consistency <ul style="list-style-type: none"> <li>• Cronbach's alpha 0.88</li> </ul>



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TABLE 2 STUDY CHARACTERISTICS

Authors and country	Aim and index test	Design and reference standard	Sample and setting	Key findings
Logsdon and Myers (2010) <sup>24</sup> United States of America	To establish whether the EPDS or CES-D 20- and 30-item is more efficient at predicting major depressive disorder in adolescent mothers, and to assess their psychometric properties	Cross-sectional survey using the KSADS-PL as a reference standard, which incorporates DSM-IV diagnoses Diagnosis of major depressive disorder included in analyses	Convenience sample of 59 adolescent mothers from a public school for pregnant and parenting teens in southern United States (postpartum 4-6 weeks, mean age 16.38 years $\pm$ 1.34)	<p>Diagnosis</p> <ul style="list-style-type: none"> <li>Reference standard 16.9%</li> <li>EPDS (traditional cut-off 12) 12.5%</li> <li>CES-D20 (traditional cut-off 16) 32.2%</li> <li>CES-D30 (using cut-off 24) 30.5%</li> <li>EPDS, CES-D 20 and 30 all significantly correlated with one another (<math>p &lt; 0.001</math>), but reference standard not correlated with any</li> </ul> <p>Sensitivity, specificity and AUC</p> <ul style="list-style-type: none"> <li>EPDS cut-off of 5 produced similar results to cut-off of 12 in adult population (sensitivity 0.8, specificity 0.6)</li> <li>AUC 0.68 (95% CI 0.51-0.84, <math>p = 0.041</math>)</li> <li>CES-D20 similar to adult population cut-off of 16 (sensitivity 0.7, specificity 0.5)</li> <li>AUC 0.62 (95% CI 0.47-0.80, <math>p = 0.201</math>)</li> <li>CES-D30 optimal cut-off of 16 (sensitivity 1.0, specificity 0.27)</li> <li>AUC 0.60 (95% CI 0.45-0.77, <math>p = 0.343</math>)</li> </ul>
Martins et al (2015) <sup>26</sup> Brazil	To identify the best cut-off scores of the EPDS and BDI in pregnant adolescents	Cross-sectional survey using MINI psychologist assessment as a reference standard, which is consistent with DSM-IV criteria Diagnosis of major depressive episode included in analyses	Consecutive sample of 807 pregnant adolescents from 47 primary care units and three obstetric clinics in Pelotas, Southern Brazil (mean age 17.3 years $\pm$ 1.4)	<p>EPDS</p> <ul style="list-style-type: none"> <li>Sensitivity 81.1% and specificity 82.7%</li> <li>Positive predictive value 43.6% and negative value 93.3%</li> <li>AUC 0.90 (95% CI 0.87 - 0.92)</li> <li>Optimal cut-off score <math>\geq 10</math></li> </ul> <p>BDI</p> <ul style="list-style-type: none"> <li>Sensitivity 86.7% and specificity 73.8%</li> <li>Positive predictive value 37.0% and negative value 92.8%</li> <li>AUC 0.87 (95% CI 0.84 - 0.89)</li> <li>Optimal cut-off score <math>\geq 11</math></li> </ul>
Venkatesh et al, (2014) <sup>5</sup>  United States of America	To evaluate the accuracy of the EPDS and three subscales for identifying postpartum depression among primiparous adolescent mothers	Randomised controlled trial that used the KID-SCID as a reference standard, which incorporates DSM-IV diagnoses Diagnosis of major depressive disorder included in analyses	<p>Randomisation of 106 adolescent mothers to an interpersonal theory intervention to prevent depression or a control group that received a guidebook as a didactic intervention: both five sessions (assessed at 6-weeks, 3 and 6-months postpartum, mean age 16 years, range 13-18).</p> <p>Because the intervention was designed to prevent depression, adolescents with psychiatric disorders including depression were excluded.</p>	<p>Overall scores across three time points</p> <ul style="list-style-type: none"> <li>EPDS full 10-item AUC 0.94 (95% CI 0.91 - 0.99)</li> <li>EPDS 7-item AUC 0.96 (95% CI 0.92 - 0.99)</li> <li>EPDS 3-item AUC 0.81 (95% CI 0.73 - 0.88)</li> <li>EPDS 2-item AUC 0.90 (95% CI 0.93 - 0.97)</li> </ul> <p>Standard cut-off score <math>\geq 10</math></p> <ul style="list-style-type: none"> <li>Full EPDS, 7- and 2-item performed satisfactorily AUC <math>&gt; 0.85</math></li> <li>3-item performed less well AUC = 0.72</li> </ul> <p>Optimal cut-off score <math>\geq 9</math></p> <ul style="list-style-type: none"> <li>Full EPDS improved AUC 0.90</li> </ul> <p>Optimal cut-off score <math>\geq 7</math></p> <ul style="list-style-type: none"> <li>EPDS 7-item improved AUC 0.89</li> </ul> <p>Sensitivity and specificity</p> <ul style="list-style-type: none"> <li>EPDS full at standard cut-off: overall sensitivity 80%, specificity 92% and at optimal cut-off sensitivity 90%, specificity 90%</li> <li>EPDS 7-item at standard cut-off: overall sensitivity 77%, specificity 96% and at optimal cut-off sensitivity 90%, specificity 87%</li> <li>EPDS 2-item sensitivity 87%, specificity 83%</li> <li>EPDS 3-item sensitivity 74%, specificity 70%</li> </ul>

Key: AUC = area under the curve, BDI = Beck depression inventory, CES-D = Center for Epidemiological Studies-Depression scale, DSM-IV = Diagnostic and Statistical Manual version 4, EPDS = Edinburgh Postnatal Depression Scale, KID-SCID = Structured Clinical Interview for DSM-IV Childhood Disorders, KSADS-PL = Schedule for Affective Disorders and Schizophrenia for School Age Children-Present and Lifetime Version, MINI = Mini International Neuropsychiatric Interview

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### QUALITY OF STUDIES

Table 3 presents quality appraisal results. The overall quality of the body of evidence was considered good although, it was not possible to rate one item in four studies and another item in three studies due to insufficient information: whether EPDS results were interpreted without knowledge of reference standard results and the representativeness of samples.<sup>5,23,26</sup> Whether EPDS results were interpreted blind of the reference standard, rests on whether participants knew their diagnosis before completing the EPDS. Detail on the sequencing of tests and the disclosure of results to participants was not provided in sufficient detail to judge. The samples may be representative of those who will receive the EPDS in practice, given the studies' inclusion of pregnant and postpartum adolescents attending public ante and postnatal services, but in three studies the sampling method is not clear.<sup>5,23,24</sup> One of these studies also had an unexplained incomplete data set,<sup>5</sup> indicating withdrawals from the study, which may further undermine representativeness.

There was also insufficient information to judge whether assessors were blind to index test results in two studies,<sup>5,23</sup> and one study, although meeting six criteria, provided insufficient information to rate the remaining five criteria.<sup>23</sup> However, with the exception of unexplained withdrawals, these are all problems identified with the reporting of studies and it is unclear whether the omission of information hides deeper methodological problems. No study was excluded based on its quality appraisal but results are accounted for in the synthesis of evidence and the conclusions drawn. Completed appraisals are available online (Appendix B).

### REVIEW FINDINGS

Reported findings include sensitivity, specificity, positive and negative predictive values, and area under the receiver operator curve statistics. Sensitivity is the true positive rate and specificity the true negative rate of clinically diagnosed depression in the participants. Positive predictive values represent the probability that individuals who screened positively with the EPDS truly had depression, or truly didn't for negative predictive values. All these values change depending on the EPDS cut-off score that was used to determine the likely presence of depression. Choosing a cut-off score that increases sensitivity will result in decreased specificity. Area under the receiver operator curve statistics are the result of computing true positive versus false positive scores across a range of cut-off values, which allows optimal cut-off scores to be identified for clinical use.<sup>28</sup> Findings are presented for studies that assessed EPDS performance against a diagnostic reference standard, followed by studies that assessed performance against another depression screening tool.

### ASSESSMENT AGAINST A DIAGNOSTIC REFERENCE STANDARD

Venkatesh et al.<sup>5</sup> assessed the full 10-item, 7-item, 3-item and 2-item EPDS scales among adolescent mothers using the Structured Clinical Interview for DSM-IV Childhood Diagnoses (KID-SCID) as their reference standard. The diagnosis of major depressive disorder was used for diagnostic accuracy tests. Against a standard cut-off score of  $\geq 10$ , the full 10-item, 7-item and 2-item scales performed satisfactorily (area under the curve [AUC]  $\geq 0.85$ ). The 3-item scale performed less well (AUC=0.72). When adjusting the cut-off score to  $\geq 9$ , performance of the full EPDS improved

**TABLE 3 QUALITY APPRAISALS**

QUADAS appraisal items <sup>22</sup>	Alvarado-Esquivel et al (2014) <sup>25</sup>	Logsdon et al (2009) <sup>23</sup>	Logsdon and Myers (2010) <sup>24</sup>	Martins et al (2015) <sup>26</sup>	Venkatesh et al (2014) <sup>5</sup>
1. Representative spectrum	Y	?	Y	?	?
2. Acceptable reference standard/comparison	Y	Y	Y	Y	Y
3. Acceptable delay between tests	Y	?	Y	Y	Y
4. Partial verification avoided	Y	?	Y	Y	Y
5. Differential verification avoided	Y	Y	Y	Y	Y
6. Incorporation avoided	Y	Y	Y	Y	Y
7. Index test results blinded	Y	?	Y	Y	?
8. Reference standard/comparison test results blinded	?	?	Y	?	?
9. Relevant clinical information	Y	Y	Y	Y	Y
10. Uninterpretable results reported	Y	Y	Y	Y	Y
11. Withdrawals explained	Y	Y	Y	Y	N

Key: Y=yes, ?=can't tell, N=no, N/A=not applicable

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(AUC=0.90), as did performance of the 7-item scale with a cut-off score of  $\geq 7$  (AUC=0.89). Sensitivity of the full EPDS at  $\geq 10$  cut-off was 80% and specificity 92%, but sensitivity improved with a  $\geq 9$  cut-off (90%). All other sensitivity values and most specificity values reduced for the 7-, 3- and 2-item scales.

Logsdon and Myers assessed the full 10-item EPDS scale among adolescent mothers using the Kiddie Schedule for Affective Disorders and Schizophrenia,<sup>24</sup> Present and Lifetime version (KSADS-PL) as their reference standard, which incorporates DSM-IV diagnoses. The diagnosis of major depressive disorder (MDD) was used for diagnostic accuracy tests. Using a traditional cut-off score of  $\geq 12$ , the EPDS identified MDD in 12.5% of the sample compared to 16.9% identified by the KSADS-PL (non-significant correlation). However, when the EPDS cut-off was reduced to  $\geq 5$ , it produced similar sensitivity (0.8) and specificity (0.6) results among their adolescent sample as those found among adult samples using a  $\geq 12$  cut-off (AUC=0.68, 95% CI 0.51-0.84,  $p=0.041$ ).

Alvarado-Esquivel et al.<sup>25</sup> assessed the full 10-item EPDS scale among pregnant adolescents using the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) as their reference standard. The combined diagnoses of minor and major depression were used for diagnostic accuracy tests. Sensitivity was 70.4% and specificity was 84.9%. Positive and negative predictive values were 47.6% and 91.0% respectively. Optimal sensitivity and specificity were found at a cut-off score of between 8 and 9 (AUC 0.81, 95% CI 0.56-1.07).

Martins et al.<sup>26</sup> assessed the EPDS full 10-item scale among pregnant adolescents using the Mini-International Neuropsychiatric Interview (MINI) as their reference standard, which is consistent with DSM-IV criteria. The diagnosis of major depressive episode was used for diagnostic accuracy tests. Sensitivity was 81.8% and specificity was 82.7%. Positive and negative predictive values were 43.6% and 93.3% respectively. Optimal sensitivity and specificity were found at a cut-off score of  $\geq 10$  (AUC 0.90, 95% CI 0.87-0.92).

### ASSESSMENT AGAINST ANOTHER DEPRESSION SCREENING TOOLS

Logsdon et al.<sup>23</sup> assessed the full 10-item EPDS scale among adolescent mothers against the Center for Epidemiological Studies Depression Scale (CES-D). The concurrent validity correlation with the CES-D was  $r=0.77$  (mid-level), and test characteristic curves for both scales suggested that the items in each scale were well aligned to one another. Principal component analysis of the EPDS identified two factors: anxiety (Alpha 0.82, loading range 0.61-0.80), and depression (Alpha 0.82, loading range 0.51-0.82). The internal consistency of the EPDS was 0.88 (Cronbach's alpha), which did not improve with the removal of any item.

Logsdon and Myers,<sup>24</sup> and Martins et al.<sup>26</sup> also assessed the CES-D and the Beck Depression Inventory (BDI)

respectively against their reference standards (KSADS-PL and MINI). Results can therefore be compared with the EPDS performance. The CES-D 20- and 30-item scales both identified a greater proportion of cases diagnosed by the reference standard than the EPDS (32.2% and 30.5% versus 12.5%) but, as with the EPDS, these were non-significantly correlated with the KSADS-PL. CES-D 20- and 30-item AUC scores were no better than for the EPDS and did not reach statistical significance. The BDI had a slightly improved sensitivity value than the EPDS (86.7% versus 81.1%) but positive predictive values for the EPDS were higher than the BDI values at all cut-off points. The BDI and EPDS AUC scores were similar (0.90 versus 0.87).

## DISCUSSION

The objectives of this review were to appraise the validity of the EPDS as a screening tool for depression among pregnant and postpartum adolescents, and to identify optimal EPDS threshold scores indicative of possible depression. Age-specific screening for adolescent depression during the perinatal period remains an important priority, particularly given its adverse, and possibly lifelong effects on mother and child.<sup>3</sup> Against this backdrop, the paucity of available literature is a striking feature of this review. This may reflect the general tendency for women to have children later in life, and a corresponding decline in pregnancies at a younger age, thereby shifting the lens of inquiry away from adolescents.<sup>29</sup> There was also a noted tendency for the age of mothers in the articles screened for this review to be a purely descriptive characteristic, rather than a variable to stratify samples across which results could be compared. This was particularly so before the year 2000 and persisted to some degree beyond that time point. For example, Santos et al.<sup>30</sup> reported an EPDS validation study in which 22.2% ( $n=84$ ) of their sample were under the age of 20 years although no attempt was made to consider optimal EPDS cut-off points across age groups.

The four studies in this review that calculated optimal cut-off scores all reported a lower value than that traditionally used among adult samples ( $\geq 12$ ).<sup>5,24-26</sup> Optimal values ranged from 2 to 7 points lower, and the extremes of this range differentiated between pre and postnatal adolescents. Optimal postpartum scores were 7 points lower and prenatal scores were 2 points lower.<sup>24,26</sup> This may be an artifact of ethnic and geographical differences between study samples,<sup>31</sup> and may also be due to a type I error for the postpartum score. The study by Logsdon and Myers from which that result emerged had a sample size between 44 and 92% smaller than the other studies ( $n=59$ ).<sup>24</sup> However, the pre-postnatal cut-off difference is consistent with the origins of the EPDS, which was designed to screen for the increased vulnerability of women to psychiatric disorder in the months following childbirth.<sup>15</sup> It is also known that incident depression, new cases in people with no history of depression, is higher in the postnatal period.<sup>32</sup> The findings of this review may point to a greater incidence and intensity



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of depressive feelings in postpartum adolescents compared to prenatal adolescents. Regardless of this uncertainty, the consistent trend toward lower scores across these studies suggests that the standard cut-off for the EPDS may not accurately identify adolescents who are at high risk of depression during the perinatal period.

Three other points of interest are noteworthy from these four studies that compared the EPDS with a diagnostic reference standard. Sensitivity and specificity were high except in the Logsdon and Myers study where neither the EPDS, CES-D or BDI correlated with the KSDAS-PL reference standard, although they significantly correlated with each other.<sup>24</sup> Again, uncertainty surrounds this finding because of the small sample size and the possibility this time, of a type II error. Larger samples may generate improved sensitivity and specificity values against the KSDAS-PL. Venkatesh et al.<sup>5</sup> reported valid results not only for the full 10-item EPDS but also for the shorter 7- and 2-item versions. In services with limited time and resources this is an important finding and may advantage the EPDS over other scales. The studies by Logsdon and Myers,<sup>24</sup> and Martins et al.<sup>26</sup> point to other EPDS advantages. Receiver operator curve results and AUC statistics indicated that the overall performance of the EPDS 10-item was equivalent to that of the CES-D 20- and 30-item instruments,<sup>24</sup> and performed better than the BDI.<sup>26</sup>

The literature emphasises the importance of screening for both anxiety and depression in postpartum women,<sup>33,34</sup> and more specifically, that adolescent mothers' feelings of depression include an anxiety component.<sup>35,36</sup> Principal component analysis of the EPDS performed by Logsdon et al.<sup>24</sup> identified two components labelled anxiety and depressive symptoms, which lend further weight to the value of the EPDS as a screening instrument among adolescents. The two factor structure is also supported by the work of Ross et al.<sup>34</sup> who sampled adult mothers.

Australian guidelines for perinatal depression screening are some of the most detailed in the world,<sup>8</sup> and whilst they acknowledge the importance of culturally relevant cut-off scores when using the EPDS, little is said about the tool's implications for adolescents. The findings of this review do not provide definitive evidence to offer greater specificity, but they do raise important points for policy makers and practitioners. Guideline recommendations to undertake formal psychiatric assessment for scores of 13 or more,<sup>8</sup> with repeated screening within a two to four week period for scores of between 10 and 12, are not in line with the findings of this review. They suggest that concerns for possible depression among perinatal adolescents should be triggered at lower EPDS values. Leaving to one side the Logsdon and Myers study that may contain sampling bias,<sup>24</sup> the weight of evidence points to a need for formal psychiatric assessment at scores of  $\geq 9$  among adolescents. With a young woman's consent, such assessments can realise treatment benefits and in the most extreme cases, may save lives.

## LIMITATIONS

The availability of only five studies is a limitation of this review. Given the increased prevalence of depression in adolescents during the perinatal period, its potential consequences for mother and child, and a recognition that threshold scores for screening instruments among this group may need to be lowered, it is surprising that so few studies have addressed this important challenge. Conclusions drawn and recommendations made should therefore be viewed as preliminary. However, this is an important review output that provides a marker for the strength of the evidence base. The relative importance of the preliminary findings is also underlined by a 'good' quality appraisal for the overall body of evidence.

The transcultural applicability of the results is uncertain, although the EPDS has been translated and validated for use among adults in 50 languages around the world.<sup>16</sup> Confidence in the review's findings is supported by the consistent trend toward lower cut-off EPDS scores among adolescents from studies conducted in North and South America. However, it is not possible to accurately deduce whether or how much those scores should be lowered for different geographical settings and languages.

## CONCLUSION

The consistent, systematic use of an accurate method to screen for depression among adolescents during the perinatal period is a pre-requisite for improved diagnosis, the selection of effective interventions, and the amelioration of the burden and risks associated with the condition. The EPDS is a valid, brief, easy to administer tool that can support those endeavours. Despite its development more than 30 years ago, research into its psychometric properties for use among adolescents is still in its infancy. This review makes an important contribution to that body of evidence by revealing its limits, but also highlighting trends that suggest different scoring systems may be necessary, both in the pre and postnatal period, from those recommended for adults. Researchers should build on this knowledge to further study and publish data on the psychometric properties of the tool for pregnant and postpartum adolescents. The absence of more definitive conclusions does not negate the importance of monitoring for depressive symptoms in perinatal adolescents at every healthcare encounter.<sup>37</sup>

## IMPLICATIONS FOR RESEARCH, POLICY AND PRACTICE

Although Australian guidelines for perinatal depression screening are some of the most detailed in the world, limited guidance is offered for EPDS use among adolescents. The findings of this review raise important points for that guidance, for practitioners and for research. The evidence

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suggests that concerns for possible depression in adolescents should be triggered at an advisory EPDS cut-off score of  $\geq 9$ , and that this score may need to be lower for postpartum compared to pregnant adolescents. The existing evidence base is insufficiently mature to allow meta-analyses. More primary research with improved reporting standards is needed to confirm or refute the findings of this review.

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