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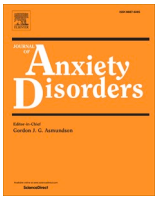

When is the best time to screen for perinatal anxiety? A longitudinal cohort study

Susan Ayers [a,*], Andrea Sinesi [b], Rose Coates [a], Helen Cheyne [b], Margaret Maxwell [b], Catherine Best [b], Stacey McNicol [b], Louise R. Williams [a], Nazihah Uddin [a], Judy Shakespeare [c], Fiona Alderdice [d], the MAP Study Team

[a] Centre for Maternal and Child Health Research, School of Health and Psychological Sciences, City, University of London, Northampton Square, London, UK
[b] Nursing, Midwifery and Allied Health Professions Research Unit, Pathfoot Building, University of Stirling, Stirling, UK
[c] Retired GP, Oxford, UK
[d] National Perinatal Epidemiology Unit, Nuffield Department of Population Health, University of Oxford, UK

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ABSTRACT

Background: For screening for anxiety during pregnancy and after birth to be efficient and effective it is important to know the optimal time to screen in order to identify women who might benefit from treatment.
Aims: To determine the optimal time to screen for perinatal anxiety to identify women with anxiety disorders and those who want treatment. A secondary aim was to examine the stability and course of perinatal anxiety over time.
Methods: Prospective longitudinal cohort study of 2243 women who completed five screening questionnaires of anxiety and mental health symptoms in early pregnancy (11 weeks), mid-pregnancy (23 weeks), late pregnancy (32 weeks) and postnatally (8 weeks). Anxiety and mental health questionnaires were the GAD7, GAD2, SAAS, CORE-10 and Whooley questions. To establish presence of anxiety disorders diagnostic interviews were conducted with a subsample of 403 participants.
Results: Early pregnancy was the optimal time to screen for anxiety to identify women with anxiety disorders and women wanting treatment at any time during pregnancy or postnatally. These findings were consistent across all five questionnaires of anxiety and mental health. Receiving treatment for perinatal mental health problems was most strongly associated with late pregnancy and/or postnatal assessments. Anxiety symptoms were highest in early pregnancy and decreased over time.
Conclusion: Findings show that screening in early pregnancy is optimal for identifying women who have, or develop, anxiety disorders and who want treatment. This has clear implications for practice and policy for anxiety screening during the perinatal period.

1. Background

Anxiety during pregnancy and after birth affects between 15% and 20% of women, (Dennis et al., 2017; Fawcett et al., 2019) with higher prevalence in low and middle income countries (Nielsen-Scott et al., 2022). Anxiety can constitute moderate symptoms (e.g. worry, fear, tension) or anxiety disorders, such as generalised anxiety disorder, panic disorder, phobias, social anxiety, obsessive compulsive disorder, and post-traumatic stress disorder. The impact of perinatal anxiety includes increased risk of preterm birth, postnatal depression and poorer emotional development of the infant (Ding et al., 2014; Glover, 2016). There is also evidence that symptoms of anxiety which do not meet diagnostic thresholds can be distressing and debilitating (Boots Family Trust Alliance, 2013). Research on the course of anxiety over the perinatal period suggests it may be higher in pregnancy (Dennis et al., 2017; Fawcett et al., 2019) but the evidence is not consistent, with significant variation between samples and outcomes examined e.g. anxiety symptoms or different anxiety disorders (Goodman et al., 2016; Viswasam et al., 2019).

Screening for anxiety during pregnancy has the potential to identify those who might benefit from support and treatment to reduce anxiety and minimise any wider or longer term impact. However, in most

* Corresponding author.
E-mail address: Susan.Ayers@city.ac.uk (S. Ayers).

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countries universal screening for perinatal mental health is not in place and guidelines vary or are even conflicting (Thombs et al., 2017; Hill, 2010). The UK National Screening Committee do not recommend universal screening for perinatal mental health disorders because of the lack of evidence on the accuracy of available screening tests and lack of clarity over the most effective way to treat different perinatal mental health disorders (UK National Screening Committee, 2019). Despite this, clinical guidelines issued by the UK National Institute for Health and Care Excellence (National Institute for Clinical Excellence, 2014) recommend health professionals ask two questions to screen for anxiety during routine maternity care appointments (the Generalised Anxiety Disorder scale, GAD-2 (Spitzer et al., 2006)) and a further two questions to screen for depression (the Whooley questions (Whooley et al., 1997)).

In order to screen effectively it is important to have good screening tools which can help identify those with possible perinatal anxiety disorders, acting as a flag for further assessment or diagnostic investigation. Robust and practical methods of screening for possible anxiety are essential if services are to identify and treat women early and appropriately.

As women develop different types of perinatal mental health problems it may be more efficient and clinically feasible to use general screening questionnaires to identify women with any type of psychological problem, rather than disorder-specific questionnaires (Ayers et al., 2015). However, it is not clear from the available evidence which approach or questionnaire assessment would be most effective. Thus there is no consensus on the best screening questionnaire to identify women with possible anxiety disorders and/or problematic symptoms of anxiety in pregnancy and after birth.

How screening is carried out is critical to its effectiveness. Screening is not a neutral process and may act as an intervention in its own right. Evidence suggests screening is acceptable to most women. Coates et al. (2024), Yapp et al. (2019), and the mode used (e.g. electronic or pen and paper administration) does not affect this Kingston et al. (2017). The optimal time at which to screen for perinatal mental health problems to maximise effectiveness is critical but not known. Ideally, we need to identify a time when screening is most predictive of current or subsequent anxiety disorders, as well as women with anxiety symptoms who do not meet criteria for a disorder but want professional help.

In summary, there is little consensus over whether screening for perinatal anxiety and other mental health disorders should be done and how to do it (Chaudron & Wisner, 2014). This is largely due to lack of evidence (UK National Screening Committee, 2019; National Institute for Clinical Excellence, 2014). Identifying the most effective and acceptable methods of screening and assessment is therefore vital to inform policy, health and social care services. Identifying the optimal time to screen in order to maximise effectiveness in terms of identifying those with anxiety disorders, or those do not have a disorder but want treatment, is critical. Recent prioritisation of perinatal mental health, investment and rapid development of perinatal mental health services in countries such as the UK and USA mean research in this area is urgently needed, as recognised by various national strategies and policy (NHS England Mental Health Taskforce, 2016; Scottish Government, 2017), clinical guidelines (National Institute for Clinical Excellence, 2014; Scottish Intercollegiate Guidelines Network SIGN, 2012) and research funders (National Institute of Health Research Health Services Delivery and Research Programme, 2017).

This study is part of a programme of research (the MAP study; www.mapstudy.org) which addressed this by providing evidence on methods of screening and assessing perinatal anxiety (Methods of Assessing Perinatal Anxiety MAP, 2023a). The analysis reported here aimed to determine the optimal time to screen for perinatal anxiety to identify women with anxiety disorders as well as those with symptoms who want treatment. Optimal timing was defined as the time at which screening was most accurate at identifying women with a diagnosed anxiety disorder, and most predictive of women self-reporting that they would like treatment. A secondary aim was to examine the stability and change in perinatal anxiety over time.

2. Methods

2.1. Study design

A prospective longitudinal cohort study of 2243 women (the MAP cohort) who completed questionnaires of mental health in early pregnancy (mean 11.4 weeks, SD 2.0), mid-pregnancy (mean 23.0 weeks, SD 1.3), late pregnancy (mean 31.9 weeks, SD 1.2), and postnatally (mean 7.9 weeks, SD 2.4). These timepoints were chosen to ensure representation from each trimester of pregnancy and postnatally, and to approximately map onto times when women would be in contact with services for routine clinical care. To establish cases of anxiety disorders diagnostic interviews were conducted on a subsample of 403 participants across the four time-points (see Fig. 1). The full protocol is available online (Methods of Assessing Perinatal Anxiety MAP, 2023a) and the study was pre-registered (Methods of Assessing Perinatal Anxiety MAP, 2023b).

2.2. Sample

Women were eligible for the MAP cohort if they were: aged 16 years or over; less than 15 weeks pregnant at the time of recruitment; able to provide written informed consent; and had sufficient English to understand and complete questionnaires. Diagnostic interviews were conducted on a consecutive sample of participants selected as questionnaires were returned. Sampling is shown in Fig. 1. There was some attrition in the MAP cohort over time, with 61% completing the postpartum questionnaires (see Fig. 1), but this did not affect the subsample for diagnostic interviews. **S**ample size calculations for diagnostic interviews were based on an estimated prevalence of 15% of women experiencing clinically significant anxiety in the perinatal period (Dennis, et al., 2017)**.** For sensitivity and specificity of 0.80 and a maximally clinically acceptable width of the 95% confidence interval of 0.10 a total sample size of 407 was required to achieve 80% power. A quarter of these participants were interviewed at each timepoint in order to reduce participant burden, avoid attrition, and avoid selection biases that can arise if high levels of commitment and time are demanded of participants. Data from diagnostic interviews were only used to determine the diagnostic accuracy of self-report screening tools at different timepoints. Course and stability of anxiety over time, wanting treatment, and receiving treatment were examined using questionnaire data from the larger MAP cohort across all timepoints.

2.3. Measures

Anxiety/mental health questionnaires were chosen on the basis of clinical utility (e.g. brevity, current use in clinical practice) and evidence suggesting they might be effective. Most questionnaires are recommended in clinical guidance on perinatal outcome measures (National Institute for Clinical Excellence, 2014; Scottish Government, 2017; Royal College of Psychiatrists, 2018) and care pathways for perinatal mental health (National Collaborating Centre for Mental Health, 2018). Five versions of four questionnaires were included - three that assess perinatal anxiety and two that assess broader distress:

- The GAD-7 (Spitzer et al., 2006) (Spitzer et al., 2006) consists of seven self-report items used to identify probable cases of GAD, according to criteria in the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) (American Psychiatric Association, 2013). Items are scored on a 0-3 Likert scale with a range of 0-21 and higher scores reflecting greater anxiety severity (Spitzer et al., 2006).
- The GAD-2 is a two-item version of the GAD-7 and is the clinically recommended assessment for perinatal anxiety in the UK (National

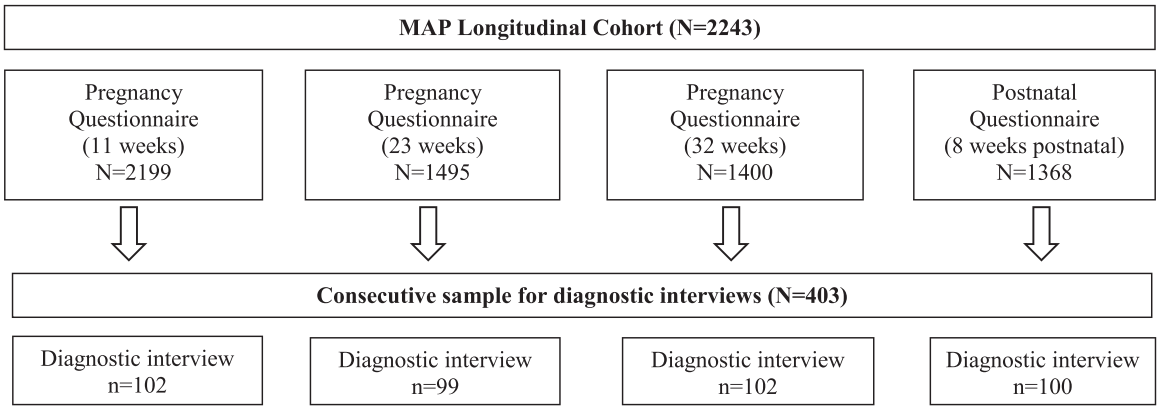

Fig. 1. Sampling for MAP cohort and diagnostic interviews.

Institute for Clinical Excellence, 2014). Evidence for using the GAD-2 with perinatal women is mixed with some finding poor diagnostic performance (Austin et al., 2022; Nath et al., 2018) and others finding good diagnostic performance (Zhong et al., 2015). GAD-2 total scores range from 0-6 (Spitzer et al., 2006).

- The Stirling Antenatal Anxiety Scale (SAAS) (Sinesi et al., 2022) is a 10-item, clinically derived questionnaire developed specifically for perinatal anxiety. The SAAS includes general anxiety and pregnancy-specific anxiety items. The pregnancy-specific items are about the birth and baby so the scale can be used postnatally. Items are scored on a 0-4 Likert scale with a range of 0-40 (Sinesi et al., 2022). The scale has good diagnostic accuracy and there is some evidence it performs better than the GAD-2 or GAD-7 at identifying women with perinatal anxiety (Ayers et al., 2024; Sinesi et al., 2022).
- The Clinical Outcomes in Routine Evaluation (CORE-10) (Barkham et al., 2013) is a 10-item questionnaire of psychological distress derived from the larger CORE-OM questionnaire. The 10 items are scored on a 0-4 Likert scale with a range of 0-40 (Barkham et al., 2013). The scale has good diagnostic accuracy for identifying perinatal anxiety and depressive disorders (Barkham et al., 2013) and includes an item assessing suicidal intent. The CORE-10 has good psychometric properties with pregnant women and performs better than measures of anxiety (GAD-2) and depression (Whooley questions) at identifying women worried about their psychological health (Ayers et al. 2024; Coates et al., 2020).
- The Whooley questions (Whooley et al., 1997) are two yes/no questions widely used in maternity services to assess depression (National Institute for Clinical Excellence, 2014). Answering 'yes' to one or both of the questions indicates possible depression (Whooley et al., 1997). There is evidence suggesting the scale has high sensitivity, but variable specificity, in identifying perinatal depression (Howard et al., 2018), as well as limited evidence it might identify perinatal anxiety as well (Nath et al., 2018).

History of mental health problems was assessed in early pregnancy (Have you ever experienced psychological or mental health problems? yes/no/don't know).

Anxiety disorders were assessed using a gold standard interview for psychiatric disorders: the Mini International Neuropsychiatric Interview version 7.0.2 (MINI) (Sheehan et al., 1998). Modules of the MINI administered were Panic Disorder, Agoraphobia, Social Anxiety Disorder, Obsessive-Compulsive Disorder, Posttraumatic Stress Disorder, Generalised Anxiety Disorder, Specific Phobia and Major Depressive Episode. Disorders were recorded if they were present at the time of the interview. Inter-rater reliability was checked for 5% of interviews selected at random and was 96%.

Treatment was measured by self-report at every timepoint. Participants were asked whether they were currently experiencing psychological or mental health problems with responses of yes, no, or don't know. Those who answered 'yes' were then asked whether they had received professional help or treatment for these problems with responses of yes, no, or not applicable. Type of treatment was reported with response options of: medication; psychotherapy or other talking therapy; other; or not applicable.

Desire for treatment was measured with the question 'If you are currently experiencing psychological problems, is this something you would like professional help or treatment for?' with responses of yes, no, or not applicable. This provides a measure of whether or not participants wanted treatment for mental health problems, regardless of whether they had a diagnosis or were currently being treated. This is important because women may receive treatment (e.g. medication) but still want further treatment (e.g. psychotherapy). Binary variables were created with the value of '1' if participants stated 'yes' at any timepoint and '0' otherwise.

Sociodemographic information was measured by self-report with questions based on the UK Census (Office for National Statistics, 2011; National Records of Scotland, 2011).

2.4. Procedure

Participants were recruited by research or clinical midwives/nurses at 12 NHS Trusts in England and five NHS Health Boards in Scotland. Recruitment was conducted in person or remotely, usually around the time of a woman's pregnancy booking appointment or early pregnancy scan. If women were interested in taking part they gave permission for their contact details to be shared with the research team. The research team then contacted these women directly by email or letter to provide further information, answer questions, and obtain informed consent. Questionnaires were sent to participants at three timepoints in pregnancy and once postnatally. Before contacting participants NHS sites were contacted to check whether any serious adverse events (e.g. pregnancy loss, stillbirth) had occurred. Questionnaires were sent and completed online or by post, depending on participants' preferences. The order in which mental health questionnaires were presented was counterbalanced to minimise risk of bias in response patterns. Safeguarding procedures were in place for any participant who scored over the cut-off score on mental health questionnaires and if they expressed suicidal intent on the CORE-10.

Diagnostic interviews were conducted with a consecutive sample of 99 to 102 women at each timepoint (Fig. 1). Participants for diagnostic interviews were approached after their questionnaire was returned. Participants who consented to the diagnostic interview were interviewed using the MINI (Sheehan et al., 1998). Interviews were administered by two psychologists with doctoral training and a midwife trained in administering the MINI prior to conducting interviews. All interviewers were blind to the results of the assessment questionnaires.

Interviews were audio-recorded to check for inter-rater reliability. Participants were interviewed by telephone and interviews were completed within 28 days of participants returning their questionnaires.

2.5. Analysis

The analysis plan was published on the Open Science Framework (Open Science Framework, 2022) and analyses conducted in Stata version 17. The optimal timing of screening was determined by comparing the Area Under the Receiver Operating Characteristic (AUROC) curves for each of the questionnaires at antenatal and postnatal timepoints and evaluating which timepoint provided the highest diagnostic accuracy. The Receiver Operating Characteristic curve is the plot of sensitivity versus 1- specificity across all possible threshold values of a measure. An AUROC value of 0.90 or above was considered excellent, with an AUROC between 0.80 and 0.90 indicating good discriminative accuracy (Pallant, 2013). Comparison between the results of the questionnaires and diagnostic interviews in the same participants provided an indication of each questionnaire's diagnostic accuracy.

Stability and change in antenatal anxiety symptom scores over time were examined using questionnaire data from the total MAP cohort by fitting individual growth curve models with a random intercept for individuals and a random slope for change over time. The variance and covariance structure were examined to evaluate stability over time for each questionnaire.

To examine the relative effect of the timing of observations for the different questionnaires, a binary logistic regression model was fitted, which directly compared the effect of anxiety scores at each timepoint on the probability of participants ever reporting wanting treatment. We examined the magnitude of the coefficients at each timepoint on the probability of wanting treatment for a mental health condition. This analysis enabled us to examine the relative effect of the timing of observations for the different questionnaires and so determine which observation timepoint had most utility in predicting later outcomes. The same method was used to assess the effect of timing on probability of accessing treatment. Only participants who responded at all four time points were included in these analyses.

3. Results

Sample characteristics are shown in Table 1. The majority of the sample were white British, educated to degree level or above and married or cohabiting. Around a fifth of women in the interview sample reported an anxiety disorder (19.9%) and over a third reported previous mental health problems (34.5% of cohort and 39.9% of the interview sample).

3.1. Optimal time to screen for perinatal anxiety

Fig. 2 shows the AUROC for each questionnaire at different timepoints. The AUROC value can be interpreted as the probability that a randomly chosen woman with perinatal anxiety (by the MINI interview) is ranked as more likely to have perinatal anxiety by the questionnaire than a randomly chosen woman without perinatal anxiety. It can be seen that the early pregnancy timepoint had the greatest diagnostic accuracy on all questionnaires. Tests of differences in accuracy showed that early pregnancy screening was significantly more accurate than postnatal screening for the Whooley (χ^2 =8.13, p = 0.043). However, there were no significant differences in accuracy between timepoints for the other questionnaires (GAD 2 χ^2 = 1.10, p = 0.776; GAD7 χ^2 = 1.63, p = 0.652; SAAS χ^2 = 2.12, p = 0.549; CORE 10 χ^2 =1.85, p = 0.604).

The second most accurate timepoint varied for different questionnaires. For the CORE-10 and SAAS the next most accurate timepoint was mid-pregnancy, and accuracy decreased with each subsequent timepoint, with the CORE-10's accuracy being indistinguishable between late pregnancy and postnatally (both 0.78). Similarly for the SAAS, diagnostic accuracy decreased with each timepoint. For the GAD-2 and Whooley the next most accurate timepoint after early pregnancy was late pregnancy, followed by mid-pregnancy and postnatally. For the GAD-7 the next most accurate timepoint was postnatally, followed by mid- and late pregnancy.

Overall, questionnaires in early pregnancy had highest point estimates for diagnostic anxiety compared to later timepoints during pregnancy and postnatally. The difference between time points was not statistically significant.

Table 1
Sample characteristics.

		Total sampleN = 2243 N (%)[a]	Interview sample N = 403 N (%)[b]
Relationship status	In a relationship but not cohabitating	164 (8.2)	14 (3.7)
	Cohabitating	682 (34.2)	128 (34.1)
	Married/Civil partnership	1072 (53.7)	223 (59.5)
	Separated/Divorced/ Single	79 (3.9)	10 (2.7)
Education	None	49 (2.4)	3 (0.8)
	Secondary education	193 (9.6)	19 (5.0)
	Post-secondary education	284 (14.1)	49 (13.0)
	Vocational qualification	246 (12.2)	35 (9.3)
	Degree or equivalent	819 (40.7)	165 (43.8)
	Postgraduate degree or equivalent	364 (18.1)	87 (23.1)
	Doctorate	56 (2.8)	19 (5.0)
Ethnicity	White British	1337 (66.5)	274 (72.5)
	Black (African/Caribbean/ Other)	89 (4.4)	13 (3.4)
	Asian (Bangladeshi/ Indian/Chinese /Pakistani/other)	259 (12.9)	31 (8.2)
	Mixed/multiple ethnicity	91 (4.5)	13 (3.5)
	Other ethnic background (White)	214 (10.6)	44 (11.6)
	Other ethnic background (Arab/other)	21 (1.0)	3 (0.8)
Previous pregnancy		1363 (62.1)	236 (60.1)
Previous mental health disorder		742 (34.5)	149 (39.9)
Anxiety disorders (MINI)			80 (19.9)

[a] Missing values mean *n* ranges from 2022 to 2196.
[b] Missing values mean *n* ranges from 373 to 403.

3.2. Stability of perinatal anxiety symptoms over time

A regression model examining the pattern of anxiety symptoms over time is shown in Table 2. Anxiety symptoms were highest in early pregnancy and decreased over time. The random slope was small but significant, suggesting that, within individuals, anxiety symptoms were variable over time. However, examination of the variance covariance matrix also suggests that anxiety symptom scores decreased within individuals over time.

The pattern of decreasing symptoms over time was observed on anxiety questionnaires (the GAD-2, GAD-7, SAAS), and other mental health questionnaires (CORE-10 and Whooley questions). Examination of the correlation between the random intercepts and random slopes of these models indicated negative correlations, which suggests participants with higher initial symptoms were likely to have more negative slopes i.e. higher initial scores were associated with a more rapid decrease. These estimates are shown in supplementary materials (Tables S1-S5).

This model was adjusted for potential confounding factors of degree-level education, ethnicity, age, marital status, previous mental health problems and number of children (see supplementary materials, Table S6). Prior mental health problems were associated with

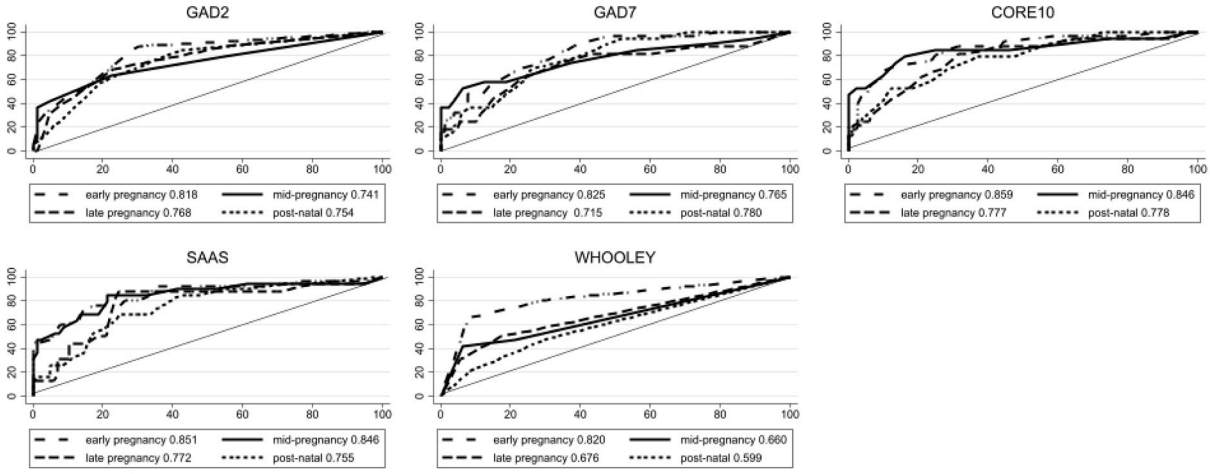

Fig. 2. Area under the receiver operator curve (AUROC) for questionnaires at each timepoint compared to diagnosis of any anxiety disorder.

Table 2
Association between scores on screening questionnaires and time of assessment (adjusted model).

	GAD-2	GAD-7	CORE-10	SAAS	Whooley
Timepoint	ref early pregnancy				
Mid-pregnancy	-.289 * **	-.685 * **	-.784 * **	-1.447 * **	-.174 * **
Late-pregnancy	-.317 * **	-.776 * **	-.553 * *	-2.074 * **	-.215 * **
Postnatal	-.436 * **	-.944 * **	-1.962 * **	-2.833 * **	-.234 * **
Intercept	2.244 *	8.942 * *	13.930 * *	12.984 *	0.863
N	3242	3242	3237	3243	3261
Log likelihood	-5429.6	-8853.7	-9683.9	-10215.2	-3494.5
BIC[a]	11012.8	17861.1	19521.3	20584.0	7142.8

Model adjusted for: degree-level education, ethnicity, age, relationship status, previous mental health problems and number of children.
[a] Bayesian Information Criterion * p < 0.05 * *p < 0.01 * **p < 0.001

significantly increased anxiety and mental health symptoms on all questionnaires.

3.3. Identifying women who wanted treatment

A mixed-effects logistic regression model examining at which timepoint screening was most predictive of women wanting treatment is shown in Table 3. Results show that for all questionnaires, screening in early pregnancy had the highest magnitude i.e. the greatest utility in predicting whether participants ever stated they wanted treatment. This is in line with findings from the ROC curve analysis that suggested screening in early pregnancy was most accurate at identifying women with anxiety disorders. Table 4.

More detailed analysis was conducted to examine which timepoint was most predictive of women wanting treatment in early, mid-, late pregnancy or postnatally. This showed that for all the questionnaires, a participant's score at the previous timepoint was significantly predictive of wanting treatment at the subsequent timepoint (see Supplementary materials, Table S7). For the GAD-2, a 1-unit increase in a participant's score at the previous timepoint, increased the odds of stating they wanted treatment by 22%. For the GAD-7, a 1-unit increase in their score at the previous timepoint, increased the odds of stating they want treatment by 10%. For the CORE-10 it was 8% and for the SAAS it was 7%. There was no significant effect of the Whooley scores on reported want for treatment at subsequent timepoints.

3.4. Identifying women who received treatment

Further analysis examined the relationship between scores on questionnaires and whether a woman reported receiving treatment at any time during pregnancy or after birth for a mental health problem. Although scores on questionnaires in early pregnancy were significantly associated with receiving treatment, the strongest relationships were for the late pregnancy and/or postnatal timepoints. The largest effect sizes were seen for the Whooley questions (OR 1.72) and GAD-2 (OR 1.50) respectively, which might be because they are shorter questionnaires and fewer items often lead to higher odds ratios. It might also reflect that they are the recommended questionnaires used in maternity care in the UK (National Institute for Clinical Excellence, 2014) so may lead to referrals.

4. Discussion

This research suggests screening in early pregnancy is accurate at identifying women who have anxiety disorders (at any time during pregnancy and postnatally) as well as those who want treatment (at any

Table 3
Association between scores on screening questionnaires at different timepoints and participants wanting treatment.

	GAD-2		GAD-7		CORE-10		SAAS		Whooley	
	OR	z	OR	z	OR	z	OR	z	OR	z
Early pregnancy	1.35 * **	4.76	1.13 * **	5.24	1.16 * *	7.13	1.11 * **	5.66	2.02 * **	5.68
Mid-pregnancy	1.11	1.41	1.03	1.1	1.00	0.15	0.99	-0.71	1.38 *	2.33
Late pregnancy	1.33 * **	3.34	1.07 *	2.27	1.05	1.8	1.07 *	3.01	1.58 * *	3.28
Postnatal	1.27 * **	3.79	1.07 * *	3.16	1.07 * **	3.68	1.04 * *	2.72	1.50 * *	3.25
N	1016		1007		1000		1010		1020	
Log likelihood	-350.39538		-346.25403		-311.97684		-332.62361		-344.8805	
BIC[a]	735.4089		727.08171		658.49245		699.83575		724.3988	

[a] Bayesian Information Criterion * p < 0.05 * *p < 0.01 * **p < 0.001

Table 4
Association between scores on screening questionnaires at different timepoints and participants receiving treatment.

	GAD-2		GAD-7		CORE-10		SAAS		Whooley	
	OR	z	OR	z	OR	z	OR	z	OR	z
Early pregnancy	1.14	1.92	1.06 *	2.41	1.07 * *	3.10	1.06 * *	2.87	1.67 * *	3.90
Mid-pregnancy	1.10	1.21	1.00	0.05	1.02	0.98	0.99	-0.62	1.25	1.51
Late pregnancy	1.41 * **	3.90	1.14 * **	4.12	1.07 *	2.45	1.08 *	3.28	1.94 * **	4.59
Postnatal	1.40 * **	5.10	1.09 * **	3.78	1.07 * **	3.49	1.08 * **	4.77	1.56 * **	3.45
N	1016		1007		1000		1010		1020	
Log likelihood	-326.214		-324.62066		-315.54793		- − 307.71467		-319.23158	
BIC[a]	687.04748		683.81498		665.63464		650.01787		673.10095	

[a] Bayesian Information Criterion * $p < 0.05$ * *$p < 0.01$ * **$p < 0.001$

time during pregnancy and postnatally). These findings were robust in that they were consistent across all five questionnaire measures of anxiety and mental health used; and were consistent for identifying both women with anxiety disorders and women wanting treatment.

These results have clear implications for clinical practice, policy and research. The consistency of findings across all five questionnaires is encouraging and suggests screening in early pregnancy may be optimal, regardless of the questionnaire used. This makes it simpler to implement early screening in policy and practice, as it reduces the need to standardise the screening tool used beforehand. Healthcare services that already screen for perinatal anxiety could continue to use screening tools they currently use and ensure screening is conducted in early pregnancy. In this study, early pregnancy questionnaires were completed around 11 weeks gestation, which coincides with maternity care appointments in many countries, such as pregnancy booking or scan appointments. For example, in the UK pregnancy booking appointments usually occur before 10 weeks gestation and include mental health screening so these results support continued mental health screening at this time.

However, it is important to note this optimal timepoint is based on statistical diagnostic accuracy and predictive power for women self-reporting that they wanted treatment. It is not based on clinical considerations such as how early pregnancy screening fits into clinical care pathways, or the effectiveness of screening in terms of improving outcomes for women and their infants. In clinical practice, screening is only an initial step which requires further action. Screening in itself does not provide a diagnosis so should always be explored further and followed by a full clinical assessment (National Institute for Clinical Excellence, 2014) and treatment where needed. There are questions over whether screening for perinatal mental health is effective in itself at improving outcomes for women (Thombs et al., 2017; Hill, 2010; UK National Screening Committee, 2019). Indeed, it is only likely to be effective if it leads to successful treatment for those who want and benefit from it. Research is therefore needed to determine whether screening for anxiety in early pregnancy, as part of a care pathway, is effective at improving anxiety disorders and related outcomes in the short and long-term (UK National Screening Committee, 2019).

A secondary aim was to examine the course of perinatal anxiety over time. Results showed that anxiety symptoms were highest in early pregnancy and reduced over time. These findings add to the literature suggesting anxiety may be higher in pregnancy (Dennis et al., 2017; Fawcett et al., 2019), although the research is inconsistent (Goodman et al., 2016; Viswasam et al., 2019). This may partly be due to individual variation in the course of anxiety symptoms (also observed in this sample). Early pregnancy may be a particularly anxious time when women adjust to the physical and psychological challenges of pregnancy and may have pregnancy-related concerns such as worries about miscarriage. In many countries women are not in regular contact with maternity services before the third month of pregnancy (e.g. 8 or more weeks gestation). Many cultures discourage disclosure of pregnancy in the first trimester so women may also have less support from family and friends, resulting in the absence of both formal and informal support. Thus routine screening of mental health in early pregnancy could help women access support and early intervention if needed.

In this study, receiving treatment was most strongly associated with anxiety screening in late pregnancy or postnatally. This could be due to multiple factors. It may be that anxiety in early pregnancy is normalised so referrals are not made until later when it is clear anxiety symptoms are chronic. A delay in referrals means women may be more likely access treatment in late pregnancy or postnatally (Ford et al., 2017). This highlights the importance of not normalising results of screening but exploring them further and referring earlier where needed. Alternatively, the association between anxiety screening in late pregnancy/-postnatally and treatment might reflect delays in women accessing treatment after they have been referred. Referrals were not measured in this study so it is difficult to know whether this is the case.

4.1. *Strengths and limitations*

This study is the first to examine the optimal time to screen for perinatal anxiety in a large UK cohort. The consistency of results across all screening questionnaires and outcomes of receiving treatment and wanting treatment adds to the strength of the findings. The sample was representative of the general population in terms of ethnicity, age and relationship status, but more highly educated than the general population. It is also possible that women with anxiety were more likely to participate. Rates of anxiety disorders were similar in this sample to other research (Dennis, May et al., 2017; Fawcett et al., 2019), although previous mental health problems were slightly higher in the interview sample than the cohort. Further research is therefore needed to examine whether results are similar in other samples and groups not represented in this study.

Data were collected during the COVID-19 pandemic so anxiety symptoms and disorders may have been influenced by this. However, this is unlikely to influence the association between self-reported anxiety symptoms and diagnosed anxiety, or between self-reported anxiety symptoms and wanting treatment. Changes to service provision during the pandemic may have influenced whether women obtained treatment and subsequent delays to treatment so it is important to replicate these findings in future.

Finally, other possible screening tools were not evaluated here, such as the EPDS (Cox et al., 1987). Diagnostic interviews also follow diagnostic criteria which in some instances have a required timeframe. This is particularly pertinent for GAD where symptoms have to be experienced for 6-months prior to a diagnosis. Participants with new-onset GAD in the perinatal period may therefore not have met this time criteria and not been identified, despite having significant anxiety. This limitation is relevant to results of analyses of diagnostic accuracy but not other analyses which were based on symptoms of anxiety reported on screening questionnaires across all timepoints. Similarly, as diagnostic interviews were only conducted with each participant at one timepoint, changes in anxiety over time were examined using symptoms reported across all timepoints on questionnaires, and not on diagnosed disorders. Further research is therefore needed to examine the course and stability

of anxiety disorders over time.

4.2. Conclusion

This study suggests early pregnancy is the optimal time to screen for perinatal anxiety. Findings show anxiety symptoms are greatest in early pregnancy and screening at this time is most predictive of women who have, or develop, anxiety disorders and who want treatment. This is the case regardless of the screening questionnaire used. Screening in early pregnancy is therefore important to implement in healthcare, despite different screening questionnaires being used in different contexts. This has clear implications for anxiety screening during the perinatal period and can inform healthcare policy and practice. Further research is needed to determine replicability and generalisability to groups not represented here, to examine the course of anxiety disorders over time, and to test the efficacy of screening as part of a care pathway for perinatal anxiety in improving outcomes for women and families.

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CRediT authorship contribution statement

Maxwell Margaret: Conceptualization, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Writing – review & editing. **Cheyne Helen:** Conceptualization, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Writing – review & editing. **McNicol Stacey:** Data curation, Formal analysis, Writing – original draft. **Best Catherine:** Conceptualization, Data curation, Formal analysis, Funding acquisition, Methodology, Supervision, Writing – original draft, Writing – review & editing. **Ayers Susan:** Conceptualization, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Writing – original draft, Writing – review & editing. **Alderdice Fiona:** Conceptualization, Funding acquisition, Investigation, Methodology, Writing – review & editing. **Coates Rose:** Conceptualization, Data curation, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Writing – review & editing. **Sinesi Andrea:** Conceptualization, Data curation, Funding acquisition, Investigation, Methodology, Project administration, Writing – review & editing. **Williams Louise R.:** Data curation, Methodology, Project administration, Supervision, Writing – review & editing. **Shakespeare Judy:** Conceptualization, Funding acquisition, Investigation, Methodology, Writing – review & editing. **Uddin Nazihah:** Data curation, Project administration, Writing – review & editing.

Declaration of Competing Interest

Andrea Sinesi, Helen Cheyne and Margaret Maxwell developed and published one of the measures evaluated in the MAP programme, the Stirling Antenatal Anxiety Scale. All other authors have no declaration of interests.

Data Availability

Data will be made available on request.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.janxdis.2024.102841.

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