

Systematic Review

Psychological Impact of False-Positive Results in Obstetric Screening: A Systematic Review

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Abstract

Background: Obstetric screening is a critical component of prenatal care, intended to identify potential health issues in both the mother and the fetus. However, the occurrence of false-positive (FP) results can introduce significant psychological distress for expectant parents. This systematic review aimed to compile existing research to form a comprehensive understanding of the psychological impact of FP results in obstetric screening, and to gain insight into the scope and magnitude of their effects on patients' mental health and well-being. **Methods:** A comprehensive literature search was conducted across multiple databases for studies examining the psychological impact of FP results in obstetric screening. Studies were selected based on predefined inclusion criteria, and the quality of each study was assessed. Data extraction focused on outcomes related to psychological distress, including anxiety, stress, depression, and changes in parental behavior or attitudes. Due to the methodological diversity of the studies, a narrative synthesis approach was employed. **Results:** The review included 7 studies that collectively suggested an immediate increase in psychological distress following FP results, primarily manifesting as heightened anxiety and stress among expectant mothers, and to a lesser extent, fathers. The distress was generally transient, with a tendency to return to baseline levels after confirmatory testing. However, some studies indicated potential long-term effects on parent-infant interactions and parental attitudes. The variability in psychological responses was influenced by demographic, clinical, dispositional, and social-environmental factors, with one study reporting minimal impact on psychological outcomes in a specific screening context. **Conclusion:** FP results in obstetric screening were linked with an immediate but transient increase in psychological distress. The variation in individual responses highlights the need for personalized communication strategies, prompt confirmatory testing, and psychological support services to mitigate both the short and potential long-term effects of these findings. Further research is necessary to explore the enduring impact of FPs and to develop interventions tailored to the needs of diverse patient populations. **The PROSPERO Registration:** CRD42024518412, https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42024518412.

Keywords: obstetric screening; false-positive results; psychological impact; anxiety; stress; prenatal care; maternal health; parental behavior

1. Introduction

Prenatal screening is a recent component of modern obstetric care that provides crucial information regarding the genetic and developmental condition of the fetus [1]. These screenings apply diagnostic approaches that range from biochemical blood tests and maternal serum markers (SMs) to advanced imaging modalities, such as nuchal translucency scans and fetal anomaly ultrasounds. The main aim is to detect at-risk fetuses with congenital conditions, such as chromosomal anomalies like Down syndrome, neural tube defects, and other genetic and structural disorders. Antenatal screening enables healthcare providers and parents to decide whether to choose further diagnostic tests, medical interventions, or pregnancy management strategies [2,3].

1.1 Challenges in Prenatal Screening

Technological improvements have enhanced the precision and depth of prenatal screenings. However, these screenings present several limitations. False-positive (FP)

results, where screening tests indicate a risk of anomalies that are later ruled out by confirmatory diagnostic testing, remain a significant challenge [4]. These may result from variability in maternal biomarkers, gestational age miscalculations, or limitations in screening tools' sensitivity and specificity. Although diagnostic procedures like amniocentesis or chorionic villus sampling (CVS) can provide a definitive diagnosis, they are invasive and carry risks, including miscarriage, which can further increase the anxiety of expectant parents [5,6].

1.2 Psychological Effects of FP Diagnosis

Series of increasingly invasive diagnostics procedures often follow FP results, significantly impacting the emotional well-being of parents. It goes all the way from joyful expectations to deep concerns. Some short-term and long-term psychological implications, such as anxiety, depression, and stress in mothers, can affect their relationship with the fetus and impact family dynamics, as highlighted by several research studies [4–6].



1.3 Variability in Prenatal Diagnostic Protocols

Prenatal diagnostic processes vary across health sectors, leading to differences in outcomes after such investigations. Ultrasonographic assessment, considered essential for detecting structural anomalies, is typically performed at a gestational age of 18–22 weeks. However, studies indicate that approximately 50% of morphological abnormalities can be visualized in the first-trimester, with lower FP rates [2,3]. This means that in severe cases, early diagnosis can help determine whether the pregnancy should be continued or appropriately terminated [4–6].

1.4 Gaps in Knowledge of Existing Research

Despite technological advancements, there remains a significant gap in understanding the psychological and emotional impact of FP results from prenatal screening. Early screening increases detection rates and provides ample time for decision-making. However, existing research has focused mainly on operational performance metrics, such as detection rates and predictive values [7–12]. Few studies analyze how screening impacts maternal mental health, family relationships, or healthcare decision-making. The long-term emotional impacts on parents and families are not adequately addressed. Therefore, this systematic review aims to address the gaps in the existing literature by synthesizing studies on the psychological impacts of FP prenatal screening results. Emotional outcomes, including anxiety, depression, and stress, will be discussed, and their impact on parental-fetal attachment and family decision-making will be considered.

2. Materials and Methods

2.1 Eligibility Criteria

In this systematic review, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) reporting guidelines [13] were followed to ensure a structured and transparent approach to the review process. The Population, Exposure, Comparison, and Outcome (PECO) protocol utilized for this review is as follows:

- Population (P): The review focused on pregnant women who underwent obstetric screening tests and received FP results.
- Exposure (E): The exposure of interest was receiving a FP result from an obstetric screening test, which includes, but is not limited to, screenings for Down syndrome, neural tube defects, and other genetic or structural anomalies.
- Comparator (C): The comparator group comprised pregnant women who underwent obstetric screening tests and received negative or true-positive results, although having a comparator was not mandatory.
- Outcome (O): The primary outcomes assessed included psychological factors such as anxiety, depression, stress levels, and emotional well-being (measured by validated scales such as State-Trait Anxiety Inventory (STAI),

Positive and Negative Affect Schedule (PANAS), and Hospital Anxiety and Depression Scale). Additionally, parental attitudes and maternal representations (e.g., altered perceptions of pregnancy and baby) were considered.

Table 1 presents the selection criteria devised for this review.

2.2 Database Search Strategy

A comprehensive database search protocol was developed to identify relevant studies pertaining to the objectives of this review across seven electronic databases. These databases included PubMed, EMBASE, PsycINFO, Cochrane Library, Web of Science, Scopus, and CINAHL. The search strategy was designed using a combination of Medical Subject Headings (MeSH) terms, keywords, and Boolean operators to ensure a thorough and precise retrieval of relevant literature. The search strategy was developed to include terms related to obstetric screening, FP results, and psychological outcomes. Boolean operators “AND” and “OR” were used to combine search terms. The “AND” operator narrowed the search by including studies that contained all the search terms. In contrast, the “OR” operator broadened the search by including studies that contained any of the search terms. The search terms were adjusted for each database to fit with the respective indexing system and search functionalities. The search strings utilized across the different databases are elucidated through Table 2.

2.3 Data Collection Process

The data extraction protocol for this review was initiated using a standardized data extraction form, which was developed and pre-tested on a subset of included studies to ensure consistency and completeness. This form was then used to extract data from all the eligible studies. Two independent reviewers performed the data extraction, and any discrepancies between the reviewers were resolved through discussion or consultation with a third reviewer, ensuring a high level of accuracy and reliability in the data extracted.

Data items selected for extraction were as follows:

- (1) General Information: This included the name of the author(s), year of publication, and country where the study was conducted.
- (2) Study Characteristics: Design of the study, setting, sample size, duration of follow-up, and method of recruitment were recorded.
- (3) Participant Demographics: Age, gestational age at screening, and other relevant demographic information, including socioeconomic status or parity, were noted.
- (4) Details of Obstetric Screening: The screening test type, the specific FP condition screened, and the timing of the screening relative to gestational age were documented.
- (5) Outcome Measures: The primary psychological outcomes measured (e.g., anxiety, depression, stress levels), the instruments or scales used for measurement, and the time points of outcome assessment were extracted.

Table 1. Inclusion and exclusion criteria devised for the review.

Criteria	Inclusion	Exclusion
Study design	Peer-reviewed observational studies, randomized controlled trials, cohort studies, case-control studies, and cross-sectional studies.	Editorials, commentaries, letters, conference abstracts, case reports, and reviews.
Participants	Pregnant women of any age who received FP results from obstetric screening tests.	Non-pregnant population, pregnant women without screening tests, and women with true positive or true negative results only.
Intervention/Exposure	Receiving a FP result from any standardized obstetric screening test.	Studies examining outcomes of diagnostic tests or interventions that follow screening.
Comparators	Pregnant women who received true-negative or not abnormal obstetric screening test results.	Studies without a clear comparator group.
Outcomes	Psychological outcomes including, but not limited to, anxiety, depression, stress, and health-related quality of life.	Studies focusing solely on physiological or non-psychological outcomes.

FP, false-positive.

Table 2. Search strings utilized across the different databases.

Database	Search string
PubMed	("Prenatal Diagnosis"[MeSH] OR "Pregnancy Trimester, Second"[MeSH] OR "Maternal Serum Screening Tests"[MeSH]) AND ("False Positive Reactions"[MeSH] OR "Diagnostic Errors"[MeSH]) AND ("Anxiety"[MeSH] OR "Depression"[MeSH] OR "Stress, Psychological"[MeSH] OR "Quality of Life"[MeSH])
EMBASE	("prenatal screening"/exp OR "antenatal screening"/exp OR "maternal serum screening"/exp) AND ("false positive result"/exp OR "diagnostic error"/exp) AND ("anxiety"/exp OR "depression"/exp OR "stress"/exp OR "health related quality of life"/exp)
PsycINFO	("Mass Screening"[Mesh] AND "Pregnancy") AND ("False Positive Reactions"[Mesh]) AND ("Mental Health"[Mesh] OR "Anxiety" OR "Depression" OR "Stress" OR "Psychological Distress")
Cochrane Library	(MeSH descriptor: [Prenatal Diagnosis] explode all trees AND MeSH descriptor: [Pregnancy Trimester, Second] explode all trees) AND (MeSH descriptor: [False Positive Reactions] explode all trees) AND (MeSH descriptor: [Anxiety] explode all trees OR MeSH descriptor: [Depression] explode all trees OR MeSH descriptor: [Stress, Psychological] explode all trees OR MeSH descriptor: [Quality of Life] explode all trees)
Web of Science	(TS = (prenatal diagnosis) OR TS = (maternal serum screening)) AND (TS = (false positive)) AND (TS = (anxiety) OR TS = (depression) OR TS = (psychological stress) OR TS = (quality of life))
Scopus	(TITLE-ABS-KEY (prenatal AND screening) OR TITLE-ABS-KEY (maternal AND serum AND screening)) AND (TITLE-ABS-KEY (false AND positive)) AND (TITLE-ABS-KEY (anxiety) OR TITLE-ABS-KEY (depression) OR TITLE-ABS-KEY (stress) OR TITLE-ABS-KEY (quality AND of AND life))
CINAHL	(MH "Prenatal Screening+") AND (MH "False Positive Reactions+") AND (MH "Anxiety+" OR MH "Depression+" OR MH "Stress, Psychological+" OR MH "Quality of Life+")

MeSH, Medical Subject Headings; ABS, abstract; KEY, keywords; MH, Medical Subject Headings; TS, topic subject.

(6) Results: Key findings, including statistical significance, effect sizes, and confidence intervals, were compiled.

(7) Quality Assessment: Information relevant to the methodological quality of each study and the risk of bias was gathered, based on the predetermined quality assessment tools.

(8) Conclusions: The authors' interpretations of the results, their implications for clinical practice, and recommendations for future research were summarized.

2.4 Risk of Bias Assessment

The risk of bias in the included non-randomized studies of interventions (NRSI) for this review was assessed using the Risk of Bias in Non-randomized Studies of Interventions (ROBINS-I) tool [14], whereas the Appraisal Tool for Cross-Sectional Studies (AXIS) tool was employed for the selected cross-sectional studies [15].

2.5 Certainty Bias Assessment

In conjunction with the bias assessment using the ROBINS-I and AXIS tools, the systematic review also incorporated the Grading of Recommendations, Assessment, Development, and Evaluations (GRADE) approach [16] to assess the overall certainty of the evidence regarding the psychological impact of FP results in obstetric screening. Following the individual risk of bias appraisals for each study, the GRADE framework was applied to evaluate the body of evidence across the outcomes reported in these studies.

3. Results

3.1 PRISMA Protocol Implementation

Starting with the first 522 entries obtained from the assessed databases, Fig. 1 illustrates the study selection process. 454 records remained, of which 68 duplicate records were removed before the screening process. Due to access issues, 52 data were excluding, leaving 402 records for further examination. Additionally, 46 records were unavailable for the comprehensive review. The remaining 356 records underwent a comprehensive eligibility assessment. At this stage, 47 entries were removed as they were not related to the research topic, and 79 records failed to meet the established PECO criteria. In this review phase, 51 narrative reviews, 51 animal studies, and 62 scoping reviews were also excluded due to their disagreement with the inclusion criteria. Using these criteria, it was determined that 7 studies [17–23] should be included in the systematic review.

3.2 Assessed Bias across Included Studies

The ROBINS-I tool (Fig. 2) revealed that Bardi *et al.* [17] and Viaux-Savelon *et al.* [21] each had an overall moderate risk of bias. This moderate rating was primarily driven by concerns in domain 3 (D3), which relates to

deviations from intended interventions, and in domain 5 (D5), related to the measurement of outcomes in the study by Viaux-Savelon *et al.* [21]. The remaining domains for these studies were assessed as low risk, indicating a generally robust methodological approach. Burton *et al.* [18] demonstrated a low overall risk of bias, although moderate concerns were noted in domains 6 (D6) and 7 (D7), which address the selection of the reported result and bias in participant selection, respectively. Marteau *et al.* [19], however, maintained a low risk across all domains, except for domain 1 (D1), associated with confounding factors, where it was rated as moderate.

Using the AXIS tool (Fig. 3), Tu *et al.* [20] and Wood *et al.* [23] were found to have a low overall risk of bias, exhibiting robust methods across most domains. Tu *et al.* [20], however, exhibited a moderate concern in the domain of reporting bias. Wood *et al.* [23] showed a moderate risk in the selection domain, which involves the representativeness and recruitment of the study sample. Wiggins *et al.* [22] presented a moderate overall risk of bias, with moderate concerns in several domains. Specifically, there were moderate concerns in the performance domain (evaluating the blinding of participants and personnel to the study hypothesis), the detection domain (assesses the blinding of outcome assessment), and the 'other' domain (covering biases not addressed in other domains).

3.3 Participant Demographics and Study Methodologies

Table 3 shows the included studies [17–23] that assessed the psychological impact of FP results in obstetric screening. Bardi *et al.* [17] conducted a prospective cohort study involving 1512 women who consented to participate, with retention rates decreasing across four time points. The methodology included a 13-week anomaly scan followed by four online questionnaires (Q1–Q4) designed to measure anxiety and affect using the STAI, PANAS, as well as ad hoc questionnaires. The longitudinal design and use of validated psychological measures allowed for an assessment of the trajectory of psychological distress over time.

Burton *et al.* [18] studied 205 women and their partners in an experimental group, and 192 control subjects with 148 male partners. They employed sequential assessments with tools such as the A-State scale and Maternal Attitude to Pregnancy Instrument. The study controlled for race, social class, and pregnancy planning status, providing valuable insights into the psychological impact of FP screening results while accounting for potential confounding factors. Marteau *et al.* [19] compared the psychological effects over time among 372 women, including 346 with negative and 26 with initially positive maternal serum alpha-fetoprotein (MS-AFP) screening results. The comparison was conducted over four time points, allowing for an analysis of the psychological impact from the receipt of the initial screening result to the resolution of the FP result.

Table 3. Observed impact of false-positive results in obstetric screening on maternal psychology across the included studies.

Study ID	Participants	Methodology	Key findings	Impact on parents	Impact on mother-infant interaction	Overall inference drawn
Bardi <i>et al.</i> [17]	1512 women consented; 1118 (74%) at Q1; 941 (64%) at Q2; 807 (55%) at Q3; 535 (37%) at Q4	Prospective-cohort study, 13-week anomaly scan, 4 online-questionnaires (Q1–Q4), STAI, PANAS, ad hoc questionnaires	Anxiety levels decreased and well-being increased after normal scan; anxiety increased then decreased around the 20-week scan in FPs	High initial anxiety in FPs, which later decreased; clinically relevant anxiety reported in 27.9% at Q1, decreasing over time	Not explicitly measured	Early anomaly scans can impact maternal anxiety and well-being, with FPs causing temporary increased anxiety
Burton <i>et al.</i> [18]	205 women and their partners for experimental; 192 control subjects and 148 male partners	Sequential assessments, a-state scale, maternal attitude to pregnancy instrument, control for race, social class, planned/unplanned pregnancy	Significant rise in anxiety after notification of elevated maternal serum a-fetoprotein; sharp decrease in anxiety after normal results; maintained high anxiety for successive elevations	Heightened anxiety observed in both female and male subjects during testing, which alleviated after normal results	Not explicitly measured	Anxiety levels in both mothers and fathers are affected by screening results but return to normal after confirmation of optimal outcomes
Marteau <i>et al.</i> [19]	372 women (346 negative, 26 initial positive MS-AFP results)	Comparisons over four time points using MS-AFP screening results	High anxiety and negative attitudes toward pregnancy and baby after abnormal results; reduced anxiety post-amniocentesis	Increased parental anxiety and worry after abnormal results, which decreased post-amniocentesis	Not directly measured, but more negative attitudes could imply altered interaction	FP MS-AFP results cause significant short-term anxiety and negative attitudes, which can be mitigated by follow-up procedures
Tu <i>et al.</i> [20]	49 infants with FP results and 42 with normal results	Structured interviews using Likert scales, parenting stress index	Higher stress in FP group, more hospitalizations, and higher rates of physician visits	Mothers reported higher stress and concerns about child's future health; fathers' stress levels were similar between groups	Not specifically measured	FP results significantly increase parental stress and concerns, especially among mothers, but not measured impact on father's stress
Viaux-Savelon <i>et al.</i> [21]	19 pregnant women with positive SM screening and reassuring follow-up, and 19 matched controls	Prospective case-control design, assessments for anxiety, depression, maternal representations; videotaped mother-infant interactions	Higher anxiety and depression in SM group; differences in maternal representations; perturbations in mother-infant interaction	Increased maternal anxiety, depression, and altered maternal representations	Dysregulated interactions, lower maternal sensitivity, higher maternal intrusiveness, and higher infant avoidance	FP SM results negatively affect maternal emotional status, representations, and mother-infant interaction quality
Wiggins <i>et al.</i> [22]	375 women with a FP ovarian cancer screening result	Assessments at baseline and 4-months post-FP result in OC screening program	Greater social constraint and less education linked to greater distress; various predictors for short-term and long-term psychological outcomes	Greater distress linked to demographic and psychological factors; less education and greater social constraint were consistent	Not explicitly measured	Demographic, clinical, dispositional, and social-environmental factors influence psychological outcomes after FP results
Wood <i>et al.</i> [23]	26 women from HNPCC families attending gynaecological screening	Hospital Anxiety and Depression Scale, Short Form36v2, gynaecological screening and follow-up at 3 and 6 months	No significant impact on anxiety or depression from FP results; health perceptions unchanged	No reported increase in anxiety or depression in parents following FPs	Not explicitly measured	Screening for gynaecological cancer, including FPs, does not significantly impact anxiety, depression, or health perceptions

MS-AFP, maternal serum alpha-fetoprotein; FP, false-positive; SM, serum marker; HNPCC, hereditary nonpolyposis colorectal cancer; STAI, State-Trait Anxiety Inventory; PANAS, Positive and Negative Affect Schedule; OC, ovarian cancer.

Tu *et al.* [20] focused on a smaller sample size, examining 49 infants with FP results and 42 with normal results. The study involved structured interviews, incorporating a Likert scale and the Parenting Stress Index, to measure the psychological burden on parents who received FP results for their infants. Viaux-Savelon *et al.* [21] conducted a prospective case-control study with 19 pregnant women who had received positive SM screening results but later received reassuring follow-up, and 19 matched controls. They assessed anxiety, depression, and maternal representations, as well as included videotaped mother-infant interactions to observe the potential impact on the mother-infant relationship.

Wiggins *et al.* [22] included 375 women with a FP ovarian cancer screening result. The study performed assessments at baseline and at 4 months post-FP result within an ovarian cancer screening program, allowing for an examination of the short-term psychological effects of FP results. Wood *et al.* [23] studied 26 women from hereditary nonpolyposis colorectal cancer (HNPCC) families attending gynaecological screening, using the Hospital Anxiety and Depression Scale and the Short Form-36v2. Assessments were made during the gynaecological screening and followed up at 3 and 6 months, providing a focused examination of the psychological impact in a high-risk population.

3.4 Observed Principal Findings

Bardi *et al.* [17] implemented a prospective cohort study that administered four online questionnaires at specific intervals after a 13-week anomaly scan. Their findings revealed a pattern where anxiety levels decreased and well-being increased following a normal scan result. In cases of FP results, anxiety levels exhibited an initial increase but then decreased around the 20-week scan, indicating a temporal psychological disturbance associated with FP findings. Burton *et al.* [18] conducted sequential assessments using the A-State scale and the Maternal Attitude to Pregnancy Instrument, while also controlling for demographic variables. Their results indicated a significant rise in anxiety after the notification of elevated maternal serum alpha-fetoprotein, which sharply decreased after the receipt of normal follow-up results. However, in cases of successive elevated results, anxiety levels remained high, underscoring the sustained psychological impact of recurring uncertain screening outcomes.

Marteau *et al.* [19] compared the psychological impact across four-time points consequent to MS-AFP screening results. The study reported high anxiety and negative attitudes toward pregnancy and the baby following abnormal results with a subsequent reduction in anxiety after confirmatory procedures, such as amniocentesis that yielded normal results. This suggests that follow-up procedures can significantly alleviate initial psychological distress caused by abnormal screening results. Tu *et al.* [20] employed

structured interviews using Likert scales and the Parenting Stress Index to evaluate the psychological impact on parents of infants with FP results. The study found that parents in the FP group experienced higher stress levels, more frequent hospitalizations, and increased physician visits, indicating a substantial psychological and practical burden associated with FP outcomes in infant screening.

Viaux-Savelon *et al.* [21] utilized a prospective case-control design and conducted assessments for anxiety, depression, and maternal representations, including analysis of videotaped mother-infant interactions. Their findings revealed that women with positive SM screening results who later received reassuring follow-up exhibited higher levels of anxiety and depression, alterations in maternal representations, and perturbations in mother-infant interactions. These results imply that FP screening results can have far reaching effects on both mental health and parent-child dynamics.

Wiggins *et al.* [22] focused on the psychological outcomes at baseline and 4 months post-FP result in an ovarian cancer (OC) screening program. They identified greater social constraint and less education as factors linked to greater distress, and highlighted various predictors for both short-term and long-term psychological outcomes. Such findings underscore the complex interplay of social and educational factors in the psychological response to FP screening results. Wood *et al.* [23] applied the Hospital Anxiety and Depression Scale (HADS) and Short Form36v2 in a cohort of women from HNPCC families attending gynaecological screening, with follow-ups at 3 and 6 months. They reported no significant impact on anxiety or depression from FP results and found that health perceptions remained unchanged. This suggests a resilience or perhaps an informed preparedness in this high-risk population that might mitigate the psychological impact of FP screening outcomes.

3.5 Parental Impact Observed

Bardi *et al.* [17] observed that there was a high initial level of anxiety among parents who received FP results, which decreased over time. They quantified this anxiety, noting that 27.9% of participants experienced clinically relevant anxiety at the first questionnaire (Q1), with a decremented prevalence at subsequent assessments. Although the study did not explicitly measure the impact on mother-infant interaction, the trajectory of parental anxiety suggests potential implications for early parental engagement. Burton *et al.* [18] found heightened anxiety in both mothers and fathers during the testing period, which alleviated after the receipt of normal results. This study did not specifically address mother-infant interaction; however, the elevated anxiety in both parents during the screening process could suggest a period of increased stress that might influence family dynamics. Marteau *et al.* [19] reported increased parental anxiety and worry after receiving abnormal screening results, which decreased following amniocente-

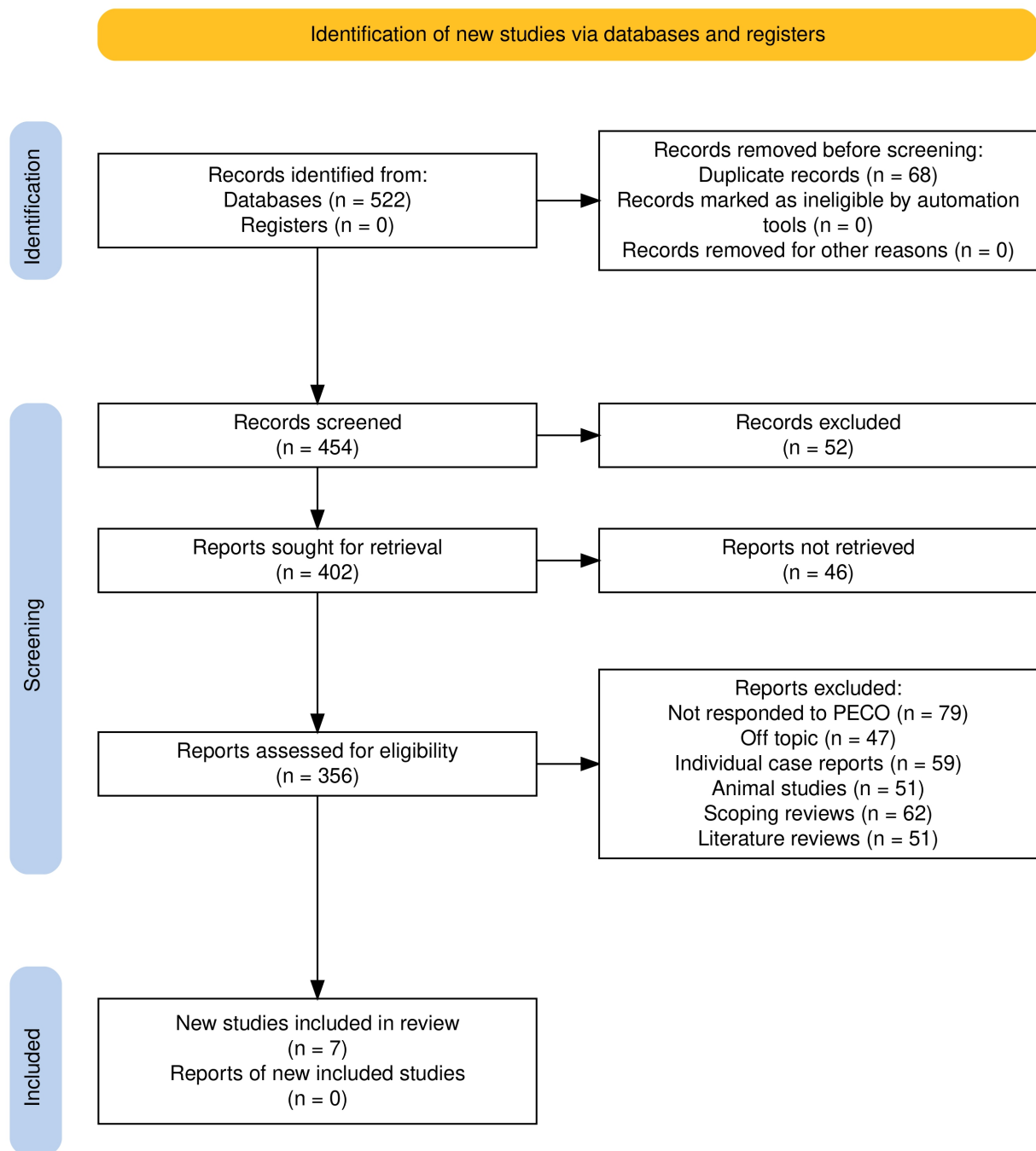


Fig. 1. Different stages of the article selection process for this review. PECO, the Population, Exposure, Comparison, and Outcome.

sis that confirmed normal development. While this study did not measure mother-infant interaction directly, the reported negative attitudes towards pregnancy and the baby, post-abnormal results could potentially affect maternal behaviours and the mother-infant bond.

Tu *et al.* [20] documented that mother of infants with FP results reported higher stress and concerns regarding their child's future health. In contrast, fathers' stress levels were similar between the FP and normal result groups. The study did not specifically measure the impact on mother-infant interaction, but the increased maternal stress levels

could have implications for the quality of caregiving and attachment. Viaux-Savelon *et al.* [21] identified increased maternal anxiety, depression, and altered maternal representations in the context of FP screening results. Furthermore, this study provided evidence of dysregulated mother-infant interactions, characterized by lower maternal sensitivity, higher maternal intrusiveness, and higher infant avoidance. These findings are indicative of a significant impact on the mother-infant relationship, likely mediated by the mother's psychological state.

		Risk of bias domains							
		D1	D2	D3	D4	D5	D6	D7	Overall
Study	Bardi et al [17]								
	Burton et al [18]								
	Marteau et al [19]								
	Viaux-Savelon et al [21]								

Domains:

D1: Bias due to confounding.

D2: Bias due to selection of participants.

D3: Bias in classification of interventions.

D4: Bias due to deviations from intended interventions.

D5: Bias due to missing data.

D6: Bias in measurement of outcomes.

D7: Bias in selection of the reported result.

Judgement

Moderate

Low

Fig. 2. Assessed bias across the included studies using the ROBINS-I tool. ROBINS-I, Risk of Bias in Non-randomized Studies of Interventions.

		Risk of bias						
		D1	D2	D3	D4	D5	D6	Overall
Study	Tu W-J et al [20]	<div>+</div>	<div>+</div>	<div>+</div>	<div>+</div>	<div>-</div>	<div>+</div>	<div>+</div>
	Wiggins et al [22]	<div>+</div>	<div>-</div>	<div>-</div>	<div>+</div>	<div>+</div>	<div>-</div>	<div>-</div>
	Wood et al [23]	<div>-</div>	<div>+</div>	<div>+</div>	<div>+</div>	<div>+</div>	<div>+</div>	<div>+</div>

D1: Selection
D2: Performance
D3: Detection
D4: Attrition
D5: Reporting
D6: Other

Judgement

-

 Unclear

+

 Low

Fig. 3. Assessed bias across the included studies using the AXIS tool. AXIS, Appraisal Tool for Cross-Sectional Studies.

Wiggins *et al.* [22] found that greater distress in parents was linked to demographic and psychological factors, with lower education levels and greater social constraint being associated with increased distress. The study did not examine the impact on mother-infant interaction, but the findings suggest that socio-demographic factors play a crucial role in the parental psychological response to FP results. Wood *et al.* [23] reported no increase in anxiety or depression among parents following FP results. The absence of significant psychological impact in this study suggests that, under certain circumstances or within specific populations,

parents may exhibit resilience or employ effective coping strategies that help buffer the stress associated with FP findings. This study did not address mother-infant interaction, but the lack of heightened anxiety or depression suggests a relatively stable parent-infant dynamic post-screening.

3.6 Practical Implication in the Decision-Making Process

This study underlines the need to identify and address the psychological effects of FP results in prenatal screening within the clinical decision-making and counseling process. Elevated parental anxiety, as reported in studies such as

Table 4. GRADE assessment observations across the included studies.

Study design	Number of studies	Observed common finding	Risk of bias	Inconsistency	Indirectness	Imprecision	Others	Certainty
Case-control	4	Temporary increase in anxiety due to FPs; normalization after confirmation	Low to moderate	Low	Low	Low	None	Moderate
Cross-sectional	3	Parental stress and concerns increased by FPs; demographic factors influencing outcomes	Low	Low	Low	Low	None	Moderate

GRADE, Grading of Recommendations, Assessment, Development, and Evaluations; FP, false-positive.

Bardi *et al.* [17], Burton *et al.* [18], and Marteau *et al.* [19], demonstrate the need for healthcare professionals to anticipate and manage emotional reactions, especially during the testing phase and following the notification of abnormal results. High levels of maternal stress and altered maternal representations, as highlighted by Viaux-Savelon *et al.* [21] and Tu *et al.* [20], suggest that FP findings may indirectly affect early caregiving, potentially influencing later child development. These aspects highlight of timely follow-up processes, such as confirmatory tests like amniocentesis, to reduce stress levels in parents and clarify the situation.

3.7 Mitigation Strategies for Psychological Impacts

- **Enhanced Counseling:** Thorough pre- and post-screening counseling to educate parents on the possibility of FPs, limitations of screening tests, and availability of confirmatory diagnostics.
- **Rapid Follow-Up Diagnostics:** Efficient access to confirmatory procedures, such as amniocentesis or detailed ultrasounds, to minimize the time parents spend in a state of uncertainty and anxiety.
- **Psychological Support:** Inclusion of mental health services, for example referring to psychologists or support groups, to help parents better cope with stress and anxiety over the outcome of the screening.
- **Tailored Communication:** Develop communication protocols based on clarity, empathy, and reassurance to reduce stress and distress, especially for vulnerable socio-demographic groups that had been identified by Wiggins *et al.* [22].
- **Parental Education Programs:** It provides educational resources that promote better understanding of the prenatal screening process and outcomes that reduce misinformation and increase resilience among parents, as suggested by the relatively stable results reported by Wood *et al.* [23].
- **Early Interventions for Risk Groups:** Additional support offered to populations at higher risk for psychological distress, such as those with lower education levels or greater social constraint, as emphasized by Wiggins *et al.* [22].

3.8 GRADE Assessment Observed

As evident through the findings shown in Table 4, for the case-control studies (Bardi *et al.* [17], Burton *et al.* [18], Marteau *et al.* [19], and Viaux-Savelon *et al.* [21]), the observed common finding was that early anomaly scans can impact maternal anxiety and well-being, with FPs causing a temporary increase in anxiety. This anxiety was found to normalize following confirmation of optimal outcomes. The risk of bias for these studies was low to moderate, with moderate concerns identified in specific domains as assessed by the ROBINS-I tool. Inconsistency among these studies was low, as they generally agreed on the temporary nature of the anxiety. Indirectness and imprecision were also low, indicating that the studies directly assessed the outcome of interest and provided sufficient data to support their findings. No other concerns were identified, leading to a moderate certainty in the evidence.

For the cross-sectional studies (Tu *et al.* [20], Wiggins *et al.* [22], and Wood *et al.* [23]), it was observed that FP results significantly increase parental stress and concerns, particularly among mothers, with demographic and other factors influencing psychological outcomes. The risk of bias was low, as reported by the AXIS tool, suggesting that the studies employed methodologically appropriate approaches in the context of cross-sectional research. Inconsistency and indirectness were low, indicating that findings were consistent across studies and applicable to the research question. Imprecision was also low, meaning that the study results were precise enough to draw conclusions. Given these considerations, the certainty of the evidence from the cross-sectional studies was also rated as moderate.

4. Discussion

4.1 Comparative Synthesis of Psychological Impacts

The included studies [17–23] collectively demonstrate that FP results in prenatal and newborn screening can significantly affect parental psychological well-being, although the severity and persistence of these effects vary. Bardi *et al.* [17] and Burton *et al.* [18] observed transient increases in parental anxiety following FP results, with anxiety levels returning to baseline after confirmatory testing. While Bardi *et al.* [17] focused exclusively on maternal

anxiety during early anomaly scans, Burton *et al.* [18] included both maternal and paternal perspectives, underscoring the shared emotional burden between partners. Similarly, Marteau *et al.* [19] reported heightened anxiety following abnormal results, coupled with negative attitudes toward both the pregnancy and the baby. This finding provides a nuanced understanding of how FP results might shape perceptions of the pregnancy, even if follow-up testing ultimately alleviates anxiety.

Tu *et al.* [20] highlighted the disproportionate stress burden on mothers compared to fathers, emphasizing the need for targeted support for maternal emotional health. While these findings align with the short-term psychological responses described in earlier studies, Viaux-Savelon *et al.* [21] extended the narrative by demonstrating how FP results can disrupt mother-infant interactions, including increased maternal intrusiveness and higher infant avoidance. This broader impact highlights the potential for long-term consequences that go beyond transient parental anxiety.

4.2 Sociodemographic Determinants of Psychological Distress

Wiggins *et al.* [22] explored how demographic, dispositional, and social-environmental factors influence psychological responses to FP results, underscoring that distress levels are not uniform across populations. Parents with lower education levels or those experiencing greater social constraints were more likely to report higher distress levels. These findings emphasize the importance of tailoring interventions to demographic vulnerabilities, as psychological outcomes are influenced not only by screening results but also by external social and personal factors.

In contrast, Wood *et al.* [23] found no significant psychological impact in a specific population undergoing gynecological screening for cancer, suggesting that certain screening contexts or populations may be less susceptible to the emotional effects of FP results. This outlier underscores the variability in psychological responses based on the screening modality, population characteristics, and counseling practices.

4.3 Implications for Parental Perceptions and Child Well-Being

FP results in prenatal and newborn screening have implications beyond immediate parental anxiety. Historical data, as referenced in newborn screening programs, indicate that parents often misinterpret FP findings, perceiving their children as medically fragile despite confirmatory tests ruling out anomalies [24–29]. This persistent perception aligns with the concept of “vulnerable child syndrome”, characterized by unwarranted parental concerns over their child’s health and susceptibility to future illnesses [29–31]. Such perceptions can lead to overprotective parenting, altered caregiving dynamics, and challenges in the parent-child relationship, as highlighted by studies like Viaux-Savelon *et al.* [21].

4.4 Practical Significance and Mitigation Strategies

These findings highlight the practical significance of addressing the psychological impact of FP results in prenatal and newborn screening. First, counseling and communication strategies must be improved to mitigate the emotional burden on parents. Clear and empathetic explanations of screening limitations and the potential for FP results can help manage expectations. Rapid access to confirmatory diagnostic tests can also help alleviate parental anxiety by reducing the duration of uncertainty. Additionally, providing tailored support for vulnerable groups, such as parents with lower educational levels or those experiencing social constraints, can help bridge the gaps identified in studies like Wiggins *et al.* [22].

Integrating psychological support services into prenatal and newborn care is critical, particularly for mothers, who consistently report higher stress levels than fathers [4]. This support can range from referrals to counselling services to the creation of peer-support networks for parents experiencing similar concerns. By addressing these impacts proactively, healthcare providers can foster more positive parental experiences and improve the long-term well-being of both parents and children.

4.5 Comparison to Other Studies in Literature

The review of findings from Liehr [32] and Pylypjuk and Monarrez-Espino [33] provided additional perspectives on the psychological and clinical impacts of FP screening results, as well as the efficacy of such screenings. Liehr [32] focused on non-invasive prenatal testing (NIPT) and found a significant discrepancy between FP and false-negative rates, with a 27:1 ratio. They raised concerns about the efficiency of NIPT compared to first-trimester screening and highlighted the lack of reporting on children born with chromosomal aberrations that were not detected by NIPT. This contrasts with the findings from our review, which primarily discussed the psychological impact of FPs, whereas Liehr [32] emphasized the statistical and clinical aspects of NIPT’s efficacy and limitations.

Pylypjuk and Monarrez-Espino [33] conducted a meta-analysis to explore the utility of FP second-trimester maternal serum screening (MSS) for Down syndrome as a marker of placentally mediated complications. They found increased odds of preeclampsia and stillbirth in pregnancies with FP MSS, but no significant association with preterm birth or growth restriction. In contrast to our review’s focus on psychological distress, Pylypjuk and Monarrez-Espino’s work [33] has clinical implications, suggesting that a FP MSS may have predictive value for certain complications.

Green *et al.* [34] explores a broader scope of psychosocial impacts of screening programs on parents, including knowledge, anxiety, and long-term effects. Their findings aligned with our review, particularly in the immediate increase in anxiety following a positive screening result, as well as the potential for residual anxiety even after reas-

asuring follow-up results. However, they also discussed the adequacy of knowledge transfer to parents, the effects of screening information on anxiety, and the uptake of neonatal screening, which were not covered in our review.

The review conducted by White and Algeri [35] provided a comprehensive statistical analysis of the lifetime risk of receiving at least one FP result from screening tests, based on adherence to standardized guidelines. Their study estimated that the probability is strikingly high, particularly among certain subpopulations recommended for more frequent screening. This finding underscores the significance of FPs as a common occurrence within the healthcare system, highlighting the need for patient education regarding this risk.

In contrast, Labonté *et al.* [36] focused on a narrower aspect of screening, specifically the psychological and social consequences of NIPT for chromosomal anomalies. Their scoping review, which included studies using validated psychological tests and qualitative assessments, provides valuable insights into the emotional and decision-making challenges faced by women undergoing NIPT.

Comparing the findings from our review with those of White and Algeri [35] and Labonté *et al.* [36], several similarities and differences emerge. A similarity is the acknowledgment of FPs as a source of psychological distress, as highlighted in the studies by Bardi *et al.* [17], Burton *et al.* [18] and Marteau *et al.* [19] in our review, as well as by the anxiety and distress reported by Labonté *et al.* [36]. Furthermore, the transient nature of this distress after follow-up procedures found in our review parallels the psychological outcomes examined by Labonté *et al.* [36], where the use of specific psychological tests likely measured short-term impacts.

A notable difference lies in the scope and methodology. While White and Algeri [35] provided a quantitative risk assessment of FPs over a lifetime, our review, along with Labonté *et al.* [36], discussed the psychological impact of FP results from a qualitative perspective. Moreover, the studies in our review spanned a range of obstetric screenings and included both maternal and paternal experiences, whereas Labonté *et al.* [36] concentrated exclusively on the consequences of NIPT, reflecting a more focused examination of prenatal screening. The outlier study by Wood *et al.* [23] stands as an outlier in our review, contrasting with the general consensus of increased psychological distress reported in the other studies and those included in Labonté *et al.* [36]. This suggests that the impact of FPs may vary significantly based on screening type and population, a perspective not directly addressed in White and Algeri [35], which did not differentiate between the psychological and medical consequences of FPs.

4.6 Limitations

The collective limitations of the studies included in this review must be understood within the context of sev-

eral key methodological and interpretive constraints. The heterogeneity of study designs, which range from quantitative assessments to qualitative analyses, introduces a significant challenge in synthesizing and comparing outcomes. This variation affects the ability to draw consistent conclusions about the psychological impact of FP obstetric screening results. Moreover, the diversity in population demographics and geographical locations limits the generalizability of the findings to broader audiences. Additionally, the temporal scope of these studies is a limitation, as most of them assessed the psychological impact within a short-term framework, potentially overlooking long-term consequences. This short-term focus fails to provide insight into whether psychological distress persists over time or impacts future healthcare decisions or family dynamics. The studies' reliance on self-reported measures of psychological outcomes is also a limitation due to the subjective nature of these reports, which may be influenced by recall bias or social desirability bias. Objective measures of psychological impact are rarely used, which could provide a more accurate assessment of the true psychological burden of FP results.

4.7 Recommendations

- Firstly, it is recommended that healthcare providers acknowledge the potential for immediate psychological distress following FP results and offer timely, clear and empathetic communication to help alleviate anxiety. This includes providing patients with information about the likelihood of FPs and what subsequent steps will be taken to clarify their results.

- Given the transient nature of anxiety, which tends to normalize after confirmatory testing, it is advisable to minimize the time between the initial screening and the follow-up procedures. Prompt provision of confirmatory tests can help reduce the duration of psychological distress.

- Given the findings that the impact of FP results may extend to negative attitudes and potentially affect parent-infant interactions, healthcare systems should consider implementing supportive counseling services. Such services could help parents cope with the stress associated with FP findings and prevent longer-term psychological sequelae.

- This review also indicates the importance of including both mothers and fathers in the support process, as both may experience stress in the face of uncertain screening results. Therefore, a recommendation would be to provide counseling and support resources to both parents, recognizing the shared nature of the screening process and its outcomes.

- Moreover, as some studies suggest that reactions to FP results are influenced by demographic, dispositional, and social-environmental factors, personalized care approaches should be adopted [34–36]. Healthcare providers might benefit from utilizing screening tools that identify individuals at higher risk of psychological distress, enabling targeted interventions to support those most in need.

5. Conclusion

This review highlights that a high rate of FPs from obstetric screening brings psychological distress associated with enhanced anxiety and tension. Typically, these symptoms are usually time-limited and cease following confirmatory diagnosis. Conversely, some studies suggest that FP may lead to adverse outcomes for parental attitudes and maternal or parental representations to the infant. However, the long-term psychological repercussions of such events remains unverified, leaving uncertainty about whether these consequences are persistent or eradicated over time. Variability in psychological responses, influenced by personal, demographic and socio-environmental factors, underscores the need for individualized interventions. Some populations were resilient, while other populations experienced greater distress, highlighting that the context matters. Long-term studies should then be done to determine if the psychological effects persist and alter parent-child dynamics. More importantly, variability in response can be used to build targeted support strategies that provide effective care for all obstetric screening patient groups.

Availability of Data and Materials

All data generated or analyzed during this study are included in this published article and its supplementary material files. Further details or clarifications are available from the corresponding author upon reasonable request.

Author Contributions

TA confirms sole responsibility for the following: study conception and design, data collection, analysis and interpretation of results, and manuscript preparation. TA read and approved the final manuscript. TA has participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

Not applicable.

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Conflict of Interest

The author declares no conflict of interest.

Supplementary Material

Supplementary material associated with this article can be found, in the online version, at <https://doi.org/10.31083/CEOG26696>.

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