UK National Screening Committee

Screening for Iron Deficiency Anaemia (IDA) in Pregnancy

An evidence map to outline the volume and type of evidence related to screening for IDA in pregnancy for the UK National Screening Committee

Version: 1.2

Author: Costello Medical

Date: October 2025

The UK National Screening Committee secretariat is hosted by the Department of Health and Social Care

Contents

About the UK National Screening Committee (UK NSC)

The UK National Screening Committee (UK NSC) advises ministers and the NHS in the 4 UK countries about all aspects of population and targeted screening and supports implementation of screening programmes.

Conditions are reviewed against evidence review criteria according to the UK NSC's evidence review process.

Read a complete list of UK NSC recommendations.

UK National Screening Committee, Southside, 39 Victoria Street, London, SW1H 0EU

www.gov.uk/uknsc

Blog: https://nationalscreening.blog.gov.uk/

For queries relating to this document, please contact: uknsc@dhsc.gov.uk.

Published September 2025

Summary

This document discusses the findings of the evidence map on screening for iron deficiency anaemia (IDA) in pregnancy.

Evidence maps are a way of scanning published literature to look at the volume and type of evidence in relation to a specific topic. They inform whether the evidence is sufficient to commission a more sustained analysis on the topic under consideration.

Based on the findings of this evidence map, no further evidence synthesis work on screening for IDA in pregnancy should be commissioned at the present time.

The UK NSC will return to screening for IDA in pregnancy in 3 years' time.

Introduction and approach

Background and objectives

The UK NSC external reviews (also known as evidence summaries or evidence reviews) are developed in keeping with the UK NSC evidence review process to ensure that each topic is addressed in the most appropriate and proportionate manner. Further information on the evidence review process can be accessed online.

Screening for IDA in pregnancy is a topic currently due for an update external review.

Description of the condition

Iron deficiency (ID) occurs when the body's total iron levels are too low. If left untreated IDA can develop, a condition characterised by a lower number of healthy red blood cells or haemoglobin. Symptoms of IDA may include tiredness, shortness of breath, heart palpitations and headaches. Anaemia during pregnancy is associated with various maternal and infant health complications (1). IDA is the most prevalent form of pregnancy-related anaemia, accounting for almost 75% of cases (2). A multicentre study conducted from 2018 to 2019 across 86 maternity units in the UK and Ireland reported an overall prevalence of IDA during pregnancy of 30.4% (3).

Iron supplementation is recommended for pregnant individuals who are anaemic. However, mild-to-moderate IDA is often asymptomatic. Moreover, when symptoms do occur, they are typically non-specific and may go unrecognised unless the anaemia is severe (4). Further, the benefits and harms of treating pregnant women with mild to moderate IDA are not well established (5).

Previous review on screening for IDA in Pregnancy

The UK NSC currently recommends against screening for IDA in Pregnancy (previous evidence map available here). The Committee based this recommendation on the evidence provided by the 2021 review carried out by Costello Medical.

The previous review did not identify evidence to suggest that screening for IDA in pregnancy should be recommended in the UK:

- No evidence was identified which reported on the potential harms of IDA in women who had not explicitly received iron treatment;
- Weak evidence from studies where it was unclear if women received iron treatment and/or supplementation suggested that there may be a clinical need to identify women with mild or moderate IDA, although the severity of this problem was unclear;
- Only two publications were deemed relevant to screening for IDA in pregnancy. Both were literature reviews which did not include publications that report on the benefits and/or harms of screening versus no screening for IDA, thereby it could not be concluded whether screening for IDA in pregnancy would have any benefit;
- Available evidence on the benefits and harms of treatment was deemed poor quality.

Aims of the evidence map

Evidence maps are rapid evidence products which aim to gauge the volume and type of evidence relating to a specific topic.

This evidence map has been developed to assess whether a more sustained review on screening for IDA in pregnancy should be commissioned and to evaluate the volume and type of evidence on key issues related to screening for IDA in pregnancy.

The aim was to address the following questions:

1. What is the volume and type of evidence on the maternal and infant outcomes associated with untreated ID, with or without mild or moderate anaemia in pregnancy?
2. What is the volume and type of evidence on the benefits and harms of treating pregnant women for IDA to pregnant women and their infants?
3. What is the volume and type of evidence on the benefits and harms of screening for IDA during pregnancy?

Overall, the objective of this evidence map was to assess the volume and type of evidence relevant to screening for IDA in pregnancy, with a concentration on the outcomes associated with asymptomatic or untreated ID or IDA, the benefits and harms of iron therapy during pregnancy, and whether screening for IDA in pregnancy has an effect on maternal or neonatal outcomes.

The findings of this evidence map will provide the basis for discussion on whether there is sufficient evidence to justify commissioning a more sustained review of the evidence on IDA in pregnancy.

The aim of this document is to present the information necessary to inform UK NSC decision-making processes.

Search methods and results

The search was conducted on 6th August 2025 in the following databases:

- MEDLINE®, including MEDLINE® In-Process, MEDLINE® Daily and MEDLINE® ePub Ahead of Print
- Embase®
- Cochrane Central Register of Controlled Trials (CENTRAL)
- Cochrane Database of Systematic Reviews (CDSR)

All databases were searched simultaneously via the Ovid EBMR platform. Automatic de-duplication was conducted during the database searches in the Ovid EBMR platform. The search period was restricted to 2020 to August 2025. The detailed search strategy, including inclusion criteria, is available in Appendix 1.

One reviewer examined all titles and abstracts against the prespecified eligibility criteria (available in Appendix 1). All references were reviewed at abstract level, and in some cases full texts were reviewed to clarify uncertain pieces of information. A formal quality appraisal of the evidence was not required, given the remit of the evidence map.

Abstract reporting tables are available in Appendix 2.

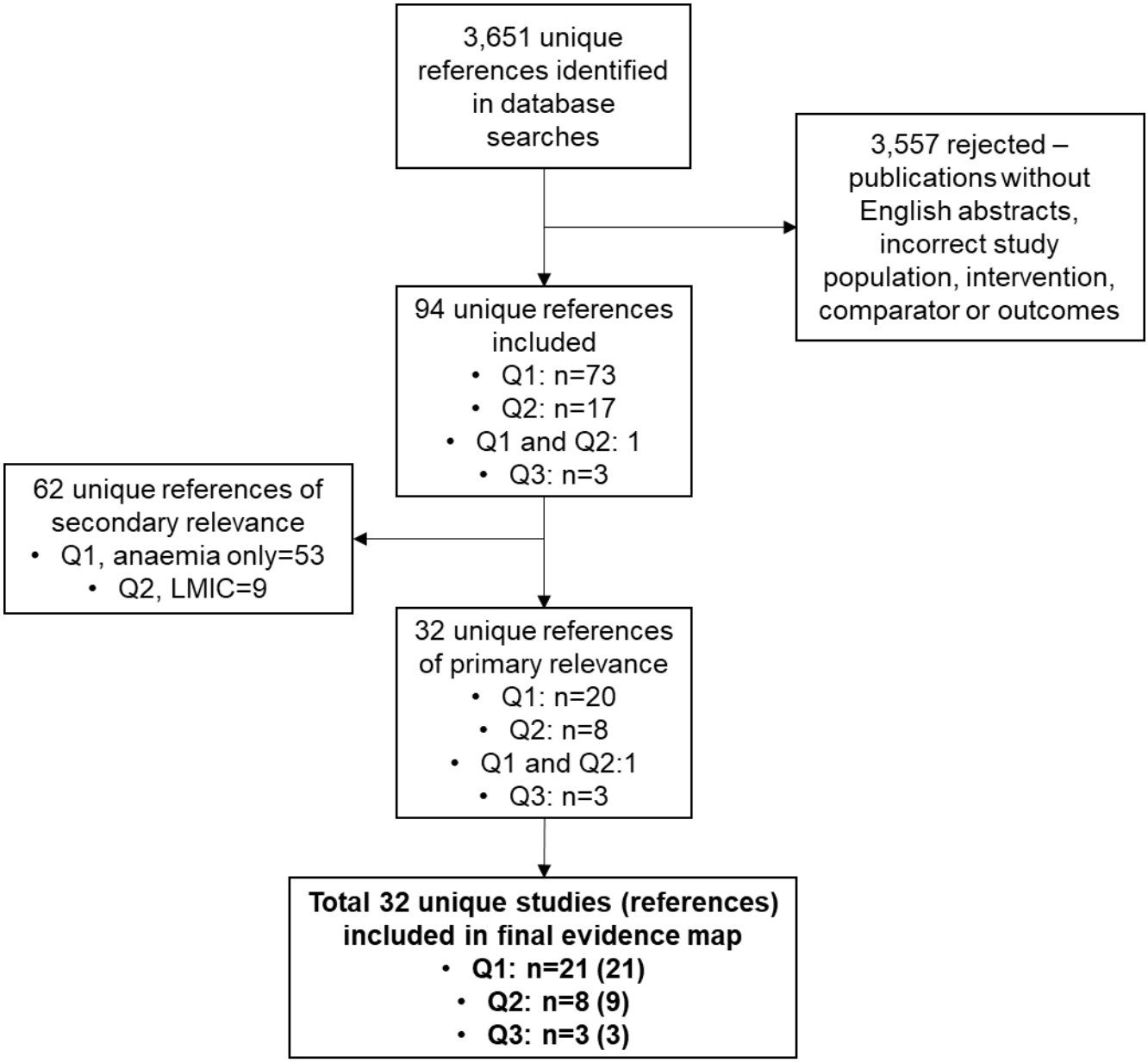
The search returned 5,166 results. After automatic and manual de-duplication, 3,651 unique references were reviewed for relevance to the question/questions. In total, 94 references were included in the evidence map. Of these, 32 were considered of the highest relevance. Studies considered to be of lower relevance included:

- Question 1: anaemia of unspecified type (unclear if due to ID)
- Question 2: Lower-middle income countries (LMICs)

These studies of lower relevance were not summarised in the evidence map but are listed in Appendix 3.

A flow diagram summarising the number of studies included and excluded is presented in Figure 1.

Figure 1. Summary of included and excluded publications



Footnote: the total number of unique studies reported for Q1 and Q2 includes the reference identified as relevant to both streams.
Abbreviations: LMIC: lower-middle income country.

Summary of findings

Question 1: What is the volume and type of evidence on the maternal and infant outcomes associated with untreated ID, with or without mild or moderate anaemia in pregnancy?

Overall, there were 21 records reporting a population with ID or IDA in pregnancy identified as relevant to Question 1. Of these, 3 studies reported a population of pregnant mothers with ID or IDA who were explicitly not treated with any iron-containing therapy (6-8).

Ibsen 2025 was a longitudinal cohort study conducted in Denmark that investigated maternal and infant outcomes associated with ID in pregnancy (7). The study enrolled 182 pregnant women with ID (of whom 4.4% had IDA), and compared these to 262 pregnant women without ID. A sensitivity analysis was performed to exclude any participants who had previously received intravenous (IV) iron infusion, and/or had anaemia (n=19 participants). The sensitivity analysis found that untreated ID in pregnancy significantly increased the risk of low birth weight compared to the cohort without ID ($p<0.001$) (7).

Another cohort study, Detlefs 2022, investigated the benefits of iron therapy in IDA. The study also compared 3,402 pregnant women with anaemia who were not treated with iron supplementation to a cohort with no anaemia (8). Women with untreated anaemia were found to have a higher risk of adverse outcomes compared to those without anaemia, including preterm birth (adjusted odds ratio [aOR]: 1.45 (95% confidence interval [CI]: 1.26 to 1.67), blood transfusion (aOR: 3.70 [95% CI: 2.76 to 4.98]) and post-partum haemorrhage (PPH; aOR: 1.56 [95% CI: 1.18 to 2.05]) (8). Additionally, pregnant women with untreated IDA were found to have an increased prevalence of delivery by caesarean section, composite maternal morbidity (defined as pre-eclampsia, gestational hypertension, sepsis, chorioamnionitis, endometritis, hysterectomy, intensive care unit [ICU] admission, blood transfusion, pulmonary oedema, maternal death, postpartum readmission), in addition to the standalone outcomes of blood transfusion, intrapartum haemorrhage and PPH (all $p<0.0001$) compared to women without anaemia (8).

Banavathu 2025 was a prospective case-control study in India comparing adverse outcomes between pregnant populations with and without IDA, with anaemia defined as haemoglobin (Hb) <10g/dL (6). Patients with any prior iron supplementation were excluded from the study. The study found that mothers with untreated IDA had higher rates of preterm birth (8% vs 2% for IDA vs non-IDA respectively), PPH (7% vs 1%), and morbidity (17.5% vs 2%) compared to pregnancies without anaemia (6). Additionally, adverse neonatal outcomes such as low birth weight, birth asphyxia and neonatal morbidity were found to be more prevalent in the maternal IDA population.

Overall, these three studies consistently reported that untreated ID, with or without anaemia in pregnancy, was associated with adverse maternal and neonatal outcomes compared to a cohort without ID or IDA.

A further 18 records reported the benefits and harms of ID or IDA in pregnancy, but it was unclear whether the patients enrolled in these studies received any therapy for the condition. Twelve of these studies recruited a population with IDA, and 6 recruited a population with ID (9-14). Two studies were conducted in Europe (10, 15), 2 in the USA (9, 16), and the remaining records were from Lower-middle income countries (LMIC). The most frequently reported study

design was retrospective (5 records) (16-20), followed by prospective cohort (4 records) (9, 11, 13, 21), cross-sectional (3 records) (14, 22, 23), case-control (3 records) (12, 24, 25), systematic literature review (SLR; 2 records) (10, 26) and registry analysis (one record) (15). Most studies concluded that ID or IDA gave rise to increased risk or prevalence of a wide range of adverse maternal or neonatal outcomes. However, 3 studies came to different conclusions: Arica 2025 found that the presence of IDA in pregnancy did not significantly give rise to harms (22), Percher 2024 found that maternal outcomes in pregnant women with ID and rheumatic disease were reduced compared to those without ID (15), and Rahman 2021 found a positive relationship between low iron levels and higher birth weight (13).

There were an additional 53 records (51 unique studies) that reported a patient population with unclassified anaemia (that is, it was unclear whether anaemia was due to ID) and were therefore deprioritised in this evidence map. The citations for all records of secondary relevance can be found in Appendix 3.

In summary, although most of the 21 records identified as relevant to Question 1 found increased harms for ID or IDA in pregnancy compared to pregnancies without these conditions, 18 of these did not specify whether patients were treated with iron therapy, and only 3 studies reported data for patients who were confirmed to be untreated. While the evidence from the 3 studies on untreated patients is strong, there is an insufficient volume of evidence in this area to justify commissioning an evidence summary at present. Therefore, it is unlikely to lead to a change in the UK NSC's current position.

Question 2: What is the volume and type of evidence on the benefits and harms of treating pregnant women for IDA to pregnant women and their infants?

In total, 17 studies (reported across 18 publications) met the eligibility criteria for Question 2. Of these, 8 studies were prioritised for being conducted in high-income countries. They are summarised in detail in this section and in Appendix 2. The remaining 9 studies were considered lower priority as they were conducted in LMICs. The citations for these records are provided in Appendix 3, and a brief summary of the evidence is provided in this section.

Of the 8 prioritised studies, one was a Systematic Literature Review (SLR), one was a prospective cohort study, 5 were retrospective cohort studies, and one was a case-control study. Three studies were conducted in Europe; however, no UK-based studies were identified.

Cantor 2024 conducted an SLR for the U.S. Preventive Services Task Force on screening and supplementation for ID and IDA in pregnancy (27). Across the included RCTs, iron supplementation did not demonstrate benefits on maternal outcomes such as hypertensive disorders (5 trials), caesarean delivery (8 trials), gestational diabetes (2 trials), haemorrhage (2 trials), or quality of life (1 trial), compared with no iron supplementation or placebo. Similarly, no significant improvements were observed in infant outcomes including preterm birth (5 trials), low birth weight (6 trials), or small for gestational age (4 trials). The SLR concluded that while routine iron supplementation in pregnancy reduces the rates of ID and IDA, the available evidence on maternal or neonatal health outcomes is limited or shows no improvement (27).

Three cohort studies examined general iron supplementation or oral iron supplementation. Luik and Rull 2021 conducted a prospective cohort study in Estonia and examined the association between iron supplementation and pregnancy complications (28). Women who received third-trimester iron replacement therapy had lower rates of preeclampsia (1.1% vs 6.2%; OR 0.2, 95% CI 0.01 to 0.6) and caesarean section (14.7% vs 22.4%; OR 0.6, 95% CI 0.4 to 0.9) compared to those without iron therapy (28). A retrospective cohort study from the USA (Sutter 2024) reported that oral iron therapy in anaemic pregnant inpatients did not improve maternal or neonatal outcomes, such as caesarean delivery, estimated blood loss, birth haemoglobin, birthweight, neonatal intensive care unit (NICU) admission, or neonatal death. Median hospital stay was longer in the oral iron group (11.4 vs 7.1 days, p=0.03) (29). The study concluded that lack of standardised iron regimens and short hospital stays may contribute to the inefficacy of oral iron for this inpatient pregnant population (29). Detlefs 2022, a population-based retrospective cohort study conducted in the USA, compared pregnant women whose anaemia responded to oral iron therapy (defined as normal haemoglobin at the time of admission for delivery) with untreated anaemia (8). Women whose anaemia responded to treatment had numerically lower rates of preterm birth (5.1% vs 12.1%), preeclampsia (5.9% vs 12.4%), and composite maternal morbidity (19.8% vs 30.0%) compared with untreated women. However, the study did not conduct any comparisons with patients who did not respond to iron treatment, and no formal statistical comparisons between relevant study groups were performed, limiting the strength of conclusions (8).

Three retrospective cohort studies examined the effect of IV iron specifically. Tan 2022 conducted a retrospective cohort study in the USA of women with antenatal anaemia and found a higher unadjusted incidence of postnatal depression among those who received IV iron compared with those who did not (18.5% vs 13.4%; p=0.008) (30). However, after adjusting for

confounders, this association was not statistically significant (aOR 1.21, 95% CI 0.89 to 1.63). Wesstrom 2020 conducted a retrospective cohort study in Sweden of pregnant women with ID or IDA and compared women who received high-dose IV iron isomaltoside (1000 to 1500mg) with those who did not receive IV iron (31). Maternal and foetal outcomes were similar between groups, including hypertension, preeclampsia, primary caesarean, average blood loss during delivery, and neonatal ward admission. Burn 2023, conducted in the USA, reported that antepartum IV iron in pregnant patients with IDA increased haematocrit but was associated with higher maternal morbidity compared to no IV iron (unadjusted OR 1.47, 95% CI 1.11 to 1.95) (32). The effect was weaker after adjusting for potential confounders (aOR 1.37, 95% CI 1.02 to 1.85) and was not significant among patients who completed a full treatment course (32).

A retrospective case-control study by Oskovi-Kaplan 2021, conducted in Turkey, compared third-trimester IV iron (ferric carboxymaltose) with uncorrected anaemia (defined as women who were anaemic at the time of admission for delivery) (33). Women who received IV iron had reduced maternal morbidity, with lower rates of primary caesarean section (4.2% vs 19.4%; $p<0.001$) and postpartum transfusion (8.3% vs 29.2%; $p=0.02$) compared with women with uncorrected anaemia. Neonatal outcomes, including APGAR scores (standardized assessment of a neonate's status immediately after birth), NICU admission, preterm delivery, and birth weight, were similar between groups (33).

Nine studies from LMICs were identified. Of these, 4 were SLRs (34-37), 2 were RCTs (38, 39), 2 were prospective cohort studies (40, 41), and one was a secondary analysis of a cross-sectional survey (42). Two of the SLRs included studies conducted in LMICs, one included studies conducted in Nepal, and one included studies conducted in South Africa. The RCTs were conducted in Tanzania (n=1) and India (n=1), and the remaining studies were conducted in India (n=2) and China (n=1). Although one SLR concluded that supplementation had little effect on the iron status of pregnant women with anaemia (34), the other 2 observed significant improvements in maternal anaemia, as well as adverse maternal and neonatal outcomes, such as neonatal mortality and low birthweight (35-37).

Overall, the evidence, as it is reported, appears to be mixed. Some studies report reductions in maternal or neonatal outcomes such as preeclampsia and caesarean delivery with oral or IV iron, while others show minimal or no improvement. Without thorough quality appraisal of the included studies, it is unclear whether the variable outcomes reported are due to poor study quality. It remains uncertain whether pregnant women with mild to moderate IDA benefit from treatment, and a change in the UK NSC’s current guidance is unlikely.

Question 3: What is the volume and type of evidence on the benefits and harms of screening for IDA during pregnancy?

In total, 3 references were included in the final evidence map for Question 3 (43-45). Two of the 3 included references were retrospective cohort studies conducted in Australia (44, 45), and the third was a prospective cohort study conducted in Denmark (43).

Hansen 2022 conducted the prospective cohort study in Denmark with overall aims being to assess associations between first trimester iron deficiency and obstetric and perinatal outcomes and post-treatment iron status after iron supplementation (43). Screening was conducted for anaemia and ID via Hb and plasma ferritin measurements taken from a venous blood sample following referral to standard antenatal care. Based on the screening results, women were recommended daily iron supplementation, with the amount of iron given dependent upon the Hb and ferritin levels recorded. The screened women were categorised into three groups (IDA cases, ID non-anaemic cases, and iron replete non-anaemic references). Obstetric and perinatal outcomes were reported. The only outcomes with statistically significant between-group differences were development of gestational diabetes, which was more likely in the IDA cases compared with the reference group, and stillbirth, for which a higher risk was identified for ID non-anaemic cases than those in the reference group. However, the authors noted that these findings should be taken with caution due to few events and wide confidence intervals. This is especially true for the stillbirth outcome, since no stillbirths occurred in the IDA group, and the overall incidence of stillbirth in the population was low (12/5,479 babies stillborn).

The Australian studies retrospectively audited the medical records of pregnant women to evaluate the impact and utility of screening for ID or anaemia in pregnant women.

Naidoo 2023 assessed medical records pre- and post-implementation of standardised screening and management for antenatal ID, comparing the rates of IDA in pregnant women at the time of delivery with rates of peripartum blood transfusion (44). Their findings suggested a clinically and statistically significant reduction in blood transfusions after the implementation of screening all pregnant women for ID. In terms of study limitations, the authors identified the retrospective design, a lack of complete ferritin screening data and limited baseline data, making it difficult to verify that the changes in outcomes were due to the intervention. However, the authors did note that while the reduced blood transfusion finding is uncommon, two other studies from larger cohorts in Canada and Australia have found similar reductions (46, 47). Both studies were published prior to the date limit included in the eligibility criteria for this evidence map.

The background to the study conducted by Purcell 2022 (45). was that there is an inconsistency in guidelines for screening and treating anaemia in pregnancy, with most recommending screening at the first antenatal visit and at 28 weeks (48-55) but some also recommending screening at 36 weeks regardless of the 28-week result (53-55). The authors aimed to determine if there was a cohort of women who, based on their routine 28-week blood test, would be able to safely avoid a routine 36-week blood test. A 10-year retrospective analysis was undertaken of 10,518 pregnancies where there was no specific indication for repeat blood tests. The authors concluded that using a 28-week Hb threshold of ≥110g/L, 7 out of 10 pregnant women could safely forego a routine 36-week full blood count. Less than 2.5% would be anaemic at 36 weeks.

In summary, limited evidence has been identified suggesting possible benefits of screening and treating IDA in pregnancy. As such, at present there is an insufficient volume of evidence in this

area to justify commissioning an evidence summary. The type of evidence identified is unlikely to lead to a change in the UK NSC’s current position.

Conclusions

The findings of this evidence map are unlikely to impact the current recommendation on screening for IDA in pregnancy as limited evidence was identified that would change this conclusion.

Recommendations

On the basis of this evidence map, the volume and type of evidence related to screening for IDA in pregnancy is currently insufficient to justify an update review at this stage and so should be re-considered in 3 years' time.

Appendix 1 — Search strategy for the evidence map

Databases and platforms searched

- MEDLINE®, including MEDLINE® In-Process, MEDLINE® Daily and MEDLINE® ePub Ahead of Print
- Embase®
- CENTRAL
- CDSR

Search dates

- MEDLINE®, including MEDLINE® In-Process, MEDLINE® Daily and MEDLINE® ePub Ahead of Print (August 05, 2025)
- Embase® (1974 to August 04, 2025)
- CENTRAL (June 2025)
- CDSR (2005 to July 30, 2025)

Search strategies

Lists of search terms used in MEDLINE®, Embase®, CENTRAL and CDSR (searched simultaneously via the Ovid EBMR platform), along with number of hits:

1. exp *Anemia, Iron-Deficiency/ or exp *iron deficiency anemia/ or exp *iron deficiency/ or "anemia, iron-deficiency".kw. – 35,549
2. (iron adj3 (deficien$ or deplet$ or shortage or insufficien$ or low) or (low adj3 (h?emoglobin or Hb))).ti,ab,kf,kw. –111,590
3. *Anemia/ or "anemia".kw. – 113,633
4. (an?emi$).ti,ab,kf,kw. – 511,796
5. or/1-4 – 571,880
6. exp *Pregnancy/ or *Prenatal Care/ or "pregnancy".kw. or "prenatal care".kw. or (pregnan$ or gestation$ or prenatal$ or antenatal$ or pre-natal$ or ante-natal$ or maternal$).ti,ab. – 2,518,984
7. *mass screening/ or "mass screening".kw. or screen$.ti,ab. or (detect$ or predict$ or identif$ or diagnos$ or test$).ti. - 8,248,486
8. exp *Pregnancy Outcome/ or "pregnancy outcome".kw. – 79,965
9. (pregnancy outcome$).ti,ab,kf,kw. – 105,884

10. exp *Cesarean section/ or "cesarean section".kw. – 81,633
11. ((rate$ or incidence or prevalence) adj3 (C?esarean section or C?esarean delivery or C section)).ti,ab,kf,kw. – 24,814
12. exp *Pregnancy Complications, Infectious/ or pregnancy complication/ or "pregnancy complications, infectious".kw. – 228,539
13. ((infect$ or transfusion) adj3 pregn$).ti,ab,kf,kw. – 45,937
14. exp *Pregnancy Complications, Hematologic/ or blood transfusion/ or "pregnancy complications, hematologic".kw. or "blood transfusion".kw. – 245,926
15. exp *Postpartum Hemorrhage/ or "postpartum hemorrhage".kw. – 172,274
16. ((postpartum or post partum or puerperal or postnatal or post natal) adj3 h?emorrhage).ti,ab,kf,kw. – 31,911
17. exp *Depression, Postpartum/ or exp *puerperal depression/ or exp *postnatal depression/ or "depression, postpartum".kw. – 17,742
18. ((postpartum or post partum or puerperal or postnatal or post natal) adj3 (mental health or depress$ or mental disorder)).ti,ab,kf,kw. – 34,084
19. exp *Breast Feeding/ or exp *lactation/ or "breast feeding".kw. or "lactation".kw. – 120,497
20. ((breastfeeding or breast feeding or lactat$) adj3 (problem$ or duration or length or time)).ti,ab,kf,kw. – 26,260
21. or/8-20 – 891,595
22. exp *"parameters concerning the fetus, newborn and pregnancy"/ – 131,719
23. ((neonatal or infant or f?etal or newborn) adj outcome$).ti,ab,kf,kw. – 79,616
24. exp *Infant, Low Birth Weight/ or exp low birth weight/ or "infant, low birth weight".kw. – 129,866
25. (low birth weight or low birthweight).ti,ab,kf,kw. – 109,683
26. exp *Infant, Small for Gestational Age/ or exp small for date infant/ or "infant, small for gestational age".kw. – 28,010
27. (small for gestational age or SGA or small for date).ti,ab,kf,kw. – 53,438
28. *Premature Birth/ or prematurity/ or *Obstetric Labor, Premature/ or *premature labor/ or "premature birth".kw. or "obstetric labor, premature".kw. – 196,771
29. ((premature or pre-term or preterm or early) adj3 (birth or labo?r)).ti,ab,kf,kw. – 144,875
30. exp *Perinatal Mortality/ or exp *Perinatal Death/ or "perinatal mortality".kw. or "perinatal death".kw. – 16,134
31. (intrauterine fetal demise or IUFD or stillbirth or still birth or stillborn or ((antenatal or postnatal or perinatal) adj3 (death or mortality))).ti,ab,kf,kw. – 86,266

32. *Intensive Care Units, Neonatal/ or *Intensive Care, Neonatal/ or *neonatal intensive care unit/ or *newborn intensive care/ or "intensive care units, neonatal".kw. or "intensive care, neonatal".kw. – 28,885
33. ((NICU or hospital or special care or intensive care) adj3 admission$).ti,ab,kf,kw. – 282,987
34. *Neurodevelopmental Disorders/ or *Developmental Disabilities/ or *developmental delay/ or *developmental disorder/ or "neurodevelopmental disorders".kw. or "developmental disabilities".kw. – 175,171
35. ((neurodevelopmental or intellect$) adj3 (delay or disorder$)).ti,ab,kf,kw. – 70,210
36. or/22-35 – 1,089,191
37. Randomized Controlled Trials as Topic/ or "randomized controlled trial (topic)"/ – 534,786
38. Randomized Controlled Trial/ – 1,735,049
39. Random Allocation/ or randomization/ – 235,432
40. Double-Blind Method/ or double blind procedure/ – 660,643
41. Single-Blind Method/ or single blind procedure/ – 144,413
42. Cross-Over Studies/ or crossover procedure/ – 211,854
43. Placebos.mp. or placebo/ [mp=ti, ot, ab, fx, sh, hw, kw, tx, ct, tn, dm, mf, dv, kf, dq, bt, nm, ox, px, rx, ui, sy, ux, mx] – 570,787
44. exp Clinical Trials as Topic/ or exp "clinical trial (topic)"/ – 1,003,479
45. Clinical Trial/ – 2,172,855
46. Clinical Trial, Phase I/ or phase 1 clinical trial/ or Clinical Trial, Phase II/ or phase 2 clinical trial/ or Clinical Trial, Phase III/ or phase 3 clinical trial/ or Clinical Trial, Phase IV/ or phase 4 clinical trial/ – 471,170
47. Controlled Clinical Trial/ or Adaptive Clinical Trial/ or multicenter study/ – 1,373,257
48. randomized controlled trial.pt. – 643,371
49. clinical trial.pt. – 1,070,955
50. (clinical trial, phase i or clinical trial, phase ii or clinical trial, phase iii or clinical trial, phase iv).pt. – 90,746
51. (controlled clinical trial or multicenter study).pt. – 468,749
52. (clinical adj trial$).ti,ab,kf. – 1,756,393
53. ((singl$ or doubl$ or treb$ or tripl$) adj (blind$3 or mask$3)).ti,ab,kf. – 942,222
54. placebo$.ti,ab,kf. – 1,134,955
55. (allocat$ adj2 random$).ti,ab,kf. – 182,606
56. Randomi?ed adj2 trial$.ti,ab,kf. – 1,763,603
57. rct.ti,ab,kf. – 165,844

58. or/37-57 – 7,193,603
59. Epidemiologic Studies/ – 332,849
60. Observational Study/ – 658,493
61. Cohort Studies/ or cohort analysis/ – 1,792,034
62. exp Case-Control Studies/ or exp case control study/ – 1,913,663
63. Cross-Sectional Studies/ or cross-sectional study/ – 1,314,220
64. Clinical Study/ – 177,263
65. Follow-Up Studies/ or follow up/ – 3,277,659
66. Longitudinal Studies/ or longitudinal study/ – 447,560
67. Retrospective Studies/ or retrospective study/ – 3,199,644
68. (Prospective Studies/ not Randomized Controlled Trials as Topic/) or (prospective study/ not "randomized controlled trial (topic)"/) – 1,838,586
69. (observational adj (study or studies)).ti,ab,kf. – 560,962
70. (cohort adj (study or studies)).ti,ab,kf. – 1,033,363
71. cohort analy$.ti,ab,kf. – 42,026
72. case control.ti,ab,kf. – 416,349
73. cross sectional.ti,ab,kf. – 1,503,051
74. (follow up adj (study or studies)).ti,ab,kf. – 157,422
75. longitudinal.ti,ab,kf. – 948,198
76. retrospective.ti,ab,kf. – 2,487,548
77. (chart adj3 review$).ti,ab,kf. – 201,307
78. exp Registries/ or exp disease registry/ – 345,586
79. (registry or registries).ti,ab,kf. – 605,458
80. (prospective adj (study or studies)).ti,ab,kf. – 643,690
81. (epidemiologic$ adj (study or studies)).ti,ab,kf. – 244,650
82. (evaluation adj (study or studies)).ti,ab,kf. – 22,108
83. (medical record$ or real world or population based or survey$ or questionnaire$ or medicare or medicaid or marketscan).ti,ab,kf. – 5,166,269
84. or/59-83 – 15,516,943
85. (single arm adj3 (trial$ or stud$)).ti,ab,kf. – 52,171
86. (open label adj (trial$ or stud$)).ti,ab,kf. – 68,292
87. (non blinded adj (trial$ or stud$)).ti,ab,kf. – 1,104

88. (pragmatic trial$ or pragmatic stud$).ti,ab,kf. or Pragmatic Clinical Trial/ or pragmatic trial/ – 16,911
89. or/85-88 – 134,859
90. Animals/ – 9,455,214
91. Humans/ – 52,475,380
92. 90 not 91 – 6,594,144
93. (conferenc$ or comment or editorial or case reports or historical article or preprint).pt. – 12,113,826
94. editorial/ or case report/ – 4,689,450
95. (case stud$ or case report$).ti. – 996,876
96. Or/92-95 – 21,509,650
97. 5 and 6 and (7 or 21 or 36) – 29,120
98. 5 and 6 and (7 or 21 or 36) and (58 or 84 or 89) –15,917
99. 98 not 96 – 12,851
100. 99 use ppez – 5,274
101. 99 use oemezd – 6,750
102. 97 use coch – 0
103. 97 use cctz – 1,374
104. 103 not 96 – 1,168
105. 100 or 101 or 102 or 104 – 13,192
106. Limit 105 to yr=2020-curent – 5,173
107. Remove duplicates from 106 – 3,651

Numbers of results for each database and question if applicable

The number of hits prior to combination/limits are as follows:

- MEDLINE®: 1,788
- Embase®: 2,923
- CENTRAL: 462
- CDSR: 0
- Total: 5,173
- **Total unique results after deduplication: 3,651**

Inclusions and exclusions

Question 1: What are the maternal and infant outcomes associated with untreated ID, with or without mild or moderate anaemia in pregnancy?

- **Population:** Pregnant individuals who have ID but are asymptomatic for IDA and their infants
- **Exposure:** Untreated ID, with or without IDA
- **Comparators:** Pregnancies without ID or IDA
- **Outcomes:**
    - Risks of adverse maternal outcomes, including but not limited to:
        - Caesarean section
        - Infection during pregnancy
        - Transfusion
        - Postpartum haemorrhage
        - Postpartum mental health problems
        - Breastfeeding problems and duration
    - Risks of adverse neonatal (<2 years) outcomes, including but not limited to:
        - Low birth weight
        - Small for gestational age birth
        - Preterm birth (<37 weeks' gestation)
        - Very preterm birth (<34 weeks' gestation)
        - Perinatal mortality
        - Admission to neonatal care unit
        - Neurodevelopmental delay
        - Congenital anomalies
        - Early infantile IDA
        - Transfusion requirement
- **Study design:** Systematic reviews and meta-analyses, randomised controlled trials (RCTs; non-interventional arms only), cohort studies, cross-sectional studies and case-control studies
- **Other considerations:** English language and published since 2020

Question 2: What is the volume and type of evidence on the benefits and harms of treating pregnant women for IDA to pregnant women and their infants?

- **Population:** Pregnant individuals with IDA
- **Intervention:**
  - Oral iron supplementation, iron-fortified diet or combination of both
  - IV iron
- **Comparators:** No treatment
- **Outcomes:**
  - Harms of no treatment
  - Risks of adverse maternal outcomes, including but not limited to:
    - Caesarean section
    - Infection during pregnancy
    - Transfusion
    - Postpartum haemorrhage
    - Postpartum mental health problems
    - Breastfeeding problems and duration
  - Risks of adverse neonatal (<2 years) outcomes, including but not limited to:
    - Low birth weight
    - Small for gestational age birth
    - Preterm birth (<37 weeks' gestation)
    - Very preterm birth (<34 weeks' gestation)
    - Perinatal mortality
    - Admission to neonatal care unit
    - Neurodevelopmental delay
    - Congenital anomalies
    - Early infantile IDA
    - Transfusion requirement
- **Study design:** Systematic reviews and meta-analyses, randomised controlled trials (RCTs; non-interventional arms only), cohort studies, cross-sectional studies and case-control studies
- **Other considerations:** English language and published since 2020

Question 3: What is the volume and type of evidence on the benefits and harms of screening for IDA during pregnancy?

- **Population:** Pregnant individuals who are asymptomatic for IDA and their infants
- **Intervention:** Any screening test to identify IDA (e.g., haemoglobin/serum ferritin/other)
- **Comparators:** Any or none
- **Outcomes:**
    - Harms of not screening and treating
    - Risks of adverse maternal outcomes, including but not limited to:
        - Caesarean section
        - Infection during pregnancy
        - Transfusion
        - Postpartum haemorrhage
        - Postpartum mental health problems
        - Breastfeeding problems and duration
    - Risks of adverse neonatal (<2 years) outcomes, including but not limited to:
        - Low birth weight
        - Small for gestational age birth
        - Preterm birth (<37 weeks' gestation)
        - Very preterm birth (<34 weeks' gestation)
        - Perinatal mortality
        - Admission to neonatal care unit
        - Neurodevelopmental delay
        - Congenital anomalies
        - Early infantile IDA
        - Transfusion requirement
- **Study design:** Systematic reviews and meta-analyses, RCTs and cohort studies, cross-sectional studies and case-control studies
- **Other considerations:** English language and published since 2020

Appendix 2 – Abstract reporting

Question 1

Citation 1

Banavathu HB, Kolluru K, Hasamnis VA. Maternal and Perinatal Outcome in Anaemic Pregnancies with Iron Deficiency and Non-Anaemic Pregnancies. European Journal of Cardiovascular Medicine. 2025;15(3):474-80.(6)

Study type

Prospective case-control

Objectives

To compare the maternal and foetal outcomes in anaemic pregnancies with iron deficiency and non-anaemic pregnancies.

Components of the study

- **Population:** 100 pregnant patients with IDA (further defined as mild, moderate and severe based on haemoglobin levels)
- **Exposure:** Untreated IDA: patients with prior iron supplementation were excluded
- **Comparators:** 100 pregnant patients without anaemia
- **Context:** Untreated patients, LMIC (India)

Outcomes reported

- **Maternal outcomes:**
    - Preterm birth: IDA (8%) vs non-anaemic patients (2%)
    - Post-partum haemorrhage: IDA (7%) vs non-anaemic group (1%)
    - Maternal morbidity: IDA (17.5%) vs non-anaemic group (2%)
- **Foetal outcomes:**
    - Stillbirth: IDA (3%) vs non-anaemic patients (0%)
    - Early neonatal death: IDA (4%) vs non-anaemic patients (0%)
    - Low birth weight: IDA (22%) vs non-anaemic patients (3%)
    - Birth asphyxia: IDA (7%) vs non-anaemic patients (2%)
    - Neonatal morbidity: IDA (17.5%) vs non-anaemic patients (6%)

[Confirmed in full-text]

Conclusions

This study found that IDA is associated with increased rates of preterm birth, PPH, and maternal morbidity compared to pregnancies without anaemia.

Citation 2

Ibsen CP, Scavenius C, Frederiksen KD, Wonsbek L, Ammitzboll ILA, Vojdeman FJ, et al. Impact of second trimester iron deficiency on maternal and infant outcomes: A Danish cohort study. European Journal of Obstetrics and Gynecology and Reproductive Biology. 2025;311(no pagination).(7)

Study type

Longitudinal cohort study

Objectives

To investigate the prevalence of ID among pregnant women during the second trimester of pregnancy and to evaluate the associations with adverse maternal and infant outcomes.

Components of the study

- **Population:** 182 pregnant women with iron deficiency (serum ferritin [SF] <15 µg/L) during third trimester, 4.4% of these had IDA
- **Exposure:** Sensitivity analysis performed excluding participants with IV iron infusion treated and/or anaemia (n=19)
- **Comparators:** 262 pregnant women without ID
- **Context:** Blood samples drawn from apparently healthy women at 24 to 28 weeks gestation, Denmark

[Confirmed in full-text]

Outcomes reported

- Sensitivity analysis excluding patients with participants with anaemia and IV iron therapy:
    - **Emergency caesarean section, n (%):** ID: 20 (12.9) vs non-ID 33: (13.7), p=0.88
    - **Preterm birth (<37+0), n (%):** ID: 5 (3.0) vs 7 (2.5), p=1
    - **Preterm birth weight, gram, mean (SD):** 3,698 (480) vs 3,520 (531), p<0.001

[Confirmed in full-text]

Conclusions

For otherwise healthy patients with ID not treated with iron therapy, ID was associated a higher preterm birth weight compared to pregnancies without maternal ID. The presence of ID in the third trimester of pregnancy was not found to have adverse pregnancy outcomes.

Citation 3

Detlefs SE, Jochum MD, Salmanian B, McKinney JR, Aagaard KM. The impact of response to iron therapy on maternal and neonatal outcomes among pregnant women with anemia. American Journal of Obstetrics and Gynecology MFM. 2022;4(2) (no pagination).(8)

Study type

Population-based cohort study (PeriBank database)

Objectives

To determine whether response to iron therapy among women with anaemia is associated with a change in odds of adverse maternal and neonatal outcomes.

Components of the study

- **Population:** All singleton pregnancies and sufficient prenatal care from August 2011 to November 2019 in the PeriBank database
- **Exposure:** 3,402 pregnant women with anaemia not treated with iron supplementation
- **Comparators:** 13,274 pregnant women without anaemia
- **Context:** Anaemia defined as receiving iron therapy or haemoglobin level below the cut-off based on gestational age (American College of Obstetricians and Gynaecologists), USA

[Confirmed in full-text]

Outcomes reported

- aOR of anaemic vs reference group:
    - **Caesarean delivery:** 1.38 (95% CI: 1.25 to 1.51)
    - **Pre-term birth**: 1.45 (95% CI: 1.26 to 1.67)
    - **Composite maternal morbidity**: 1.71 (95% CI: 1.52 to 1.92)
    - **Maternal blood transfusion**: 3.70 (95% CI: 2.76 to 4.98)
    - **Intrapartum haemorrhage:** 1.31 (95% CI: 0.98 to 1.73)
    - **PPH:** 1.56 (95% CI: 1.18 to 2.05)
- N (%) of maternal outcomes
    - **Caesarean delivery:** anaemic: 1,182 (34.8) vs non-anaemic: 3,858 (29.1), p<0.0001
    - **Preterm birth:** anaemic: 410 (12.1) vs non-anaemic: 1,106 (8.3), p<0.0001

- **Composite maternal morbidity** (pre-eclampsia, gestational hypertension, sepsis, chorioamnionitis, endometritis, hysterectomy, ICU care, blood transfusion, pulmonary oedema, maternal death, postpartum readmission**:** anaemic: 935 (30.0) vs non-anaemic: 2,709 (21.7), p<0.0001
- **Maternal blood transfusion**: anaemic: 118 (3.5) vs non-anaemic: 130 (1.0), p<0.0001
- **Maternal death**: anaemic: 0 (0) vs non-anaemic: 0 (0)
- **Intrapartum haemorrhage:** anaemic: 89 (2.6) vs non-anaemic: 262 (2.0), p<0.0001
- **PPH:** anaemic: 101 (3.0) vs 242 (1.8), p<0.0001

[Confirmed in full-text]

Conclusions

Pregnant women with anaemia who were not treated with iron supplementation were associated with higher risks of adverse maternal outcomes, except for maternal death which was not experienced by either treatment group.

Citation 4

Arica G, Davutoglu EA, Buldum D, Kucuksuleymanoglu D, Najmeddin S, Madazli R. Fetal Fornix-Hippocampus Complex and Hippocampus Height Measurements Between 18 and 24 Weeks of Gestation and the Effect of Maternal Iron Deficiency Anemia. J Clin Ultrasound. 2025;53(6):1288-95.(22)

Study type

Prospective cross-sectional study

Objectives

Components of the study

- **Population:** 222 singleton pregnancies between 18 + 0 and 23 + 6 weeks of gestation
- **Exposure:** 30 women with IDA
- **Comparators:** 193 patients in control group (no IDA)
- **Context:** IDA diagnosed in line with American College of Obstetrics and Gynecology (ACOG) criteria (haemoglobin <10.5g/dL), Turkey

[Confirmed in full-text]

Outcomes reported

- In IDA vs non-IDA pregnancies, there were no significant differences (p>0.05) between:
    - Right and left side foetal fornix–hippocampus complex (FHC) lengths
    - Right and left side foetal hippocampus heights
    - Nulliparity, gestational age at assessment, gestational age at delivery and birthweight, and 5-min APGAR scores
- Mean (SD) outcomes (IDA vs non-IDA) of relevant harms include:
    - **Birth weight, g**: 3,129 (606) vs 3,110 (851)
    - **Gestational age at delivery, weeks:** 37.82 (4.88) vs 37.8 (2.42)

[Confirmed in full-text]

Conclusions

IDA in pregnancy does not give rise to adverse neonatal outcomes compared to non-anaemic pregnancies or impact the development of the foetal hippocampus and fornix during the mid-trimester.

Citation 5

Aringazina R, Kurmanalina G, Bazargaliyev Y, Kononets V, Kurmanalin B, Bekkuzhin A. Impact of anemia in pregnant women on the neonatal conditions. Open Access Macedonian Journal of Medical Sciences. 2021;9:1185-8.(17)

Study type

Retrospective analysis

Objectives

To study the condition of neonates born to women with iron deficiency anaemia.

Components of the study

- **Population:** 230 patient medical files in the maternity and pregnancy pathology departments
- **Exposure:** 113 pregnancies with IDA
- **Comparators:** 117 pregnancies without IDA
- **Context:** Diagnosis of IDA established according to WHO criteria, Kazakhstan

[Confirmed in full-text]

Outcomes reported

- IDA vs non-IDA outcomes were as follows, mean (range):
    - **Height, cm:** 53.2 (51 to 55) vs 54.1 (52 to 55), p=0.2101
    - **Weight, kg:** 3.440 (3.170 to 3.680) vs 3.612 (3.330 to 3.836), p=0.0256
    - **Mass-growth index (Quetelet 1), g/cm:** 63.4 (56.1 to 66.8) vs 66.4 (58.4 to 70.1), p=0.236
    - **APGAR score:** 9.3 (9 to 10) vs 9.5 (9 to 10), p=0.6469
- IDA vs non-IDA neonatal pathology outcomes were as follows, n (%):
    - **Foetal impairment:** 5 (4.4) vs 3 (2.5), p=0.441
    - **Antenatal foetal death:** 4 (3.5) vs 1 (0.8), p=0.162
    - **Congenital heart defect:** 3 (2.6) vs 3 (2.5), p=0.965
    - **Cryptorchidism:** 1 (0.8) vs 0, p=0.307
    - **Single umbilical artery:** 1 (0.8) vs 1 (0.8), p=0.980
    - **Shoulder dystocia:** 0 (0) vs 1 (0.8), p=0.324
    - **Threatening foetal condition:** 2 (1.7) vs 0, p=0.148
    - **Delayed intrauterine development of foetus:** 1 (0.8) vs 0, p=0.307

Conclusions

This study found that risk of low birth weight was significantly higher in maternal IDA compared to non-IDA patients. Though the IDA group reported a higher proportion of adverse neonatal outcomes compared to the non-IDA cohort except for shoulder dystocia, none of these were deemed statistically significant.

Citation 6

Berenji F, Shamsian SA, Teimourisani Z, Bagherpoor MR, Zarean M, Jamali J, et al. Assessment of Blastocystis hominis as a Risk Factor for Iron Deficiency Anemia in Pregnant Women. Iranian Journal of Parasitology. 2025;20(1):75-82.(23)

Study type

Cross-sectional

Objectives

To assess the role of Blastocystis hominis infection as a potential risk factor for IDA in pregnant women.

Components of the study

- **Population:** 208 pregnant women enrolled at Imam Reza and Ghaem Hospitals in Mash-had, Iran during 2022 to 2023
- **Exposure:** 98 pregnant women with IDA (case group)
- **Comparators:** 110 pregnant women without IDA (control group)
- **Context:** anaemia defined as haemoglobin <11g/dL and ferritin <15mug/L, Iran

Outcomes reported

- B. hominis infection was significantly higher in the group with IDA (38.8%) compared to the control group (10.9%) ($p<0.001$)

Conclusions

B. hominis infection may increase risk of IDA during pregnancy, and this study showed that the infection was significantly more prevalent in pregnant women with IDA compared to a control group.

Citation 7

ElAlfy MS, Ali El-Farrash R, Mohammed Taha H, Abdel Rahman Ismail E, Ahmed Mokhtar N. Auditory brainstem response in full-term neonates born to mothers with iron deficiency anemia: relation to disease severity. Journal of Maternal-Fetal and Neonatal Medicine. 2020;33(11):1881-8.(21)

Study type

Prospective cohort

Objectives

To evaluate the effect of maternal IDA on auditory brainstem response (ABR) in full-term neonates.

Components of the study

- **Population:** 223 pregnant women
- **Exposure:** 50 pregnant women with IDA (case group)
- **Comparators:** 50 pregnant women without IDA (control group)
- **Context:** Egypt

Outcomes reported

- Of 100 neonates screened for ABR, 25 failed the test (all born to mothers with IDA)
- 88% of neonates who failed the test had latent iron deficiency (cord blood ferritin 11 to 75microg/L)

Conclusions

This study found that IDA during pregnancy may negatively affect the hearing of neonates.

Citation 8

Evanchuk JL, Kozyrskyj A, Vaghef-Mehrabani E, Lamers Y, Giesbrecht GF, Letourneau N, et al. Maternal Iron and Vitamin D Status during the Second Trimester Is Associated with Third Trimester Depression Symptoms among Pregnant Participants in the APrON Cohort. Journal of Nutrition. 2024;154(1):174-84.(9)

Study type

Prospective cohort study (Alberta Pregnancy Outcomes and Nutrition study)

Objectives

To examine associations between maternal iron and vitamin D status, individually and in combination, on depression symptoms in pregnant individuals.

Components of the study

- **Population:** 1,822 post-partum mothers and 1,920 in third trimester
- **Exposure:** Pregnant women with low concentrations of iron
- **Comparators:** Pregnant women with normal concentrations of iron
- **Context:** Iron levels measured by SF levels. Alberta Pregnancy Outcomes and Nutrition cohort study included pregnant participants and their children from Calgary and Edmonton, Canada

Outcomes reported

- Post-partum depression measured via Edinburgh Postnatal Depression Scale (EPDS) scale scores.
- Higher second trimester maternal concentrations of SF (beta: -0.8; 95% CI: -1.5 to -0.01) predicted lower maternal EPDS scores in the third trimester (fewer depression symptoms)
- Pregnant individuals with a low iron (SF <15 mug/L) and replete vitamin D (25(OH)D >=75nmol/L) (beta: 1.1; 95% CI: 0.03 to 2.1) or low iron (SF <15mug/L) and vitamin D (25(OH)D <75nmol/L) (beta: 2.2; 95% CI: 0.3 to 4.2) status during mid-pregnancy had higher third trimester EPDS scores compared with those that were replete in both micronutrients

Conclusions

A higher mid-pregnancy maternal iron and vitamin D status, independently or in combination, predicted fewer maternal depression symptoms in the third trimester.

Citation 9

Faruk S, Sanusi KO, Ibrahim KG, Abubakar B, Malami I, Bello MB, et al. Age and sex-based impacts of maternal iron deficiency on offspring's cognitive function and anemia: A systematic review. European Journal of Clinical Nutrition. 2024;78(6):477-85.(10)

Study type

SLR

Objectives

To investigate the correlation between maternal iron deficiency and cognitive impairment and anaemia in offspring, considering age and gender differentials.

Components of the study

- **Population:** Studies in human and animal subjects linking maternal iron status to cognitive function
- **Exposure:** Infants with maternal iron deficiency
- **Comparators:** Infants without maternal iron deficiency
- **Context:** PubMed, ScienceDirect and Google Scholar were searched with no publication date restriction until 2022. A total of 6 articles on human studies were included, 3 of which investigated neonatal outcomes from ID vs non-ID pregnancies without iron treatment (USA, Spain and Israel)

[Confirmed in full-text]

Outcomes reported

- **Amin 2013:** Infants born at ≥35 weeks to mothers with ID had abnormal auditory myelination compared to those with normal iron levels
- **Bergland 2017:** Offspring of mothers with ID had lower composite motor scores at 18 months
- **Wainstock 2019:** Neurological disorders are more common in children who have anaemic mothers compared to those without anaemia, and male infants of ID mothers are more likely to develop anaemia than female

[Confirmed in full-text]

Conclusions

Infants born to mothers with ID are more likely to experience abnormal cognitive outcomes compared to those born to mothers without ID.

Citation 10

Fite MB, Tura AK, Yadeta TA, Oljira L, Roba KT. Prevalence, predictors of low birth weight and its association with maternal iron status using serum ferritin concentration in rural Eastern Ethiopia: a prospective cohort study. BMC Nutrition. 2022;8(1) (no pagination).(11)

Study type

Prospective cohort study

Objectives

To assess the prevalence, predictors of low birth weight, and its association with maternal iron status using serum ferritin concentration in Haramaya district, eastern Ethiopia, 2021.

Components of the study

- **Population:** 412 pregnant women in Ethiopian community
- **Exposure:** Pregnant women with ID
- **Comparators:** Pregnant women without ID
- **Context:** ID defined as SF ≤15 mug/L and IDA as SF ≤15mug/L and haemoglobin level <11.0g/dl during the first or third trimester or <10.5g/dl during the second trimester, Ethiopia

Outcomes reported

- The neonates of women with ID during pregnancy had lower birth weight (aOR=5.04; 95% CI = 2.78 to 9.14) than the neonates of women who had normal iron levels

Conclusions

This study found that ID during pregnancy had a negative effect on birth weight.

Citation 11

Hameed S, Naser IA, Al Ghussein MA, Ellulu MS. Is iron deficiency a risk factor for postpartum depression? A case-control study in the Gaza Strip, Palestine. Public health nutrition. 2022;25(6):1631-8.(12)

Study type

Case-control

Objectives

To investigate the association between iron body status and postpartum depression (PPD) among mothers during the postpartum period.

Components of the study

- **Population:** 150 mothers diagnosed with PPD 1 month after delivery, and 150 mothers without PPD
- **Exposure:** Pregnant women with ID
- **Comparators:** Pregnant women without ID
- **Context:** Iron status measured by ferritin levels, Palestine

Outcomes reported

- Mothers who suffered from ID were 3x more likely to have PPD (aOR 3.25; p=0.015).

Conclusions

This study found that ID during pregnancy represents a risk factor for PPD.

Citation 12

Lao TT, Wong LL, Hui SYA, Sahota DS. Iron Deficiency Anaemia and Atonic Postpartum Haemorrhage Following Labour. Reproductive Sciences. 2022;29(4):1102-10.(18)

Study type

Retrospective cohort study

Objectives

To determine if IDA is associated with increased atonic PPH following labour.

Components of the study

- **Population:** Women with singleton pregnancy carried to 24 or more weeks gestation, who were delivered under care by the researchers from 1997 to 2019
- **Exposure**: 1,032 women with IDA in pregnancy
- **Comparators:** Women without IDA in pregnancy
- **Context:** IDA defined by haemoglobin <10g/dL and SF <15mug/L in the absence of haemoglobinopathies, Hong Kong

Outcomes reported

- Despite similar incidences of augmentation, labour induction, and instrumental and intrapartum caesarean delivery, women with IDA had a higher incidence of:
    - Total PPH: 4.5% vs 3.2%, p=0.024
    - Atonic PPH: 3.1% vs 2.0%, p=0.011
- Multivariate analysis: IDA is associated with PPH
    - Total PPH: adjusted relative risk (aRR): 1.455 (95% CI: 1.040 to 2.034)
    - Atonic PPH: aRR: 1.588 (95% CI: 1.067 to 2.364)

Conclusions

This study found a relationship between IDA in pregnancy and incidence of total and atonic PPH.

Citation 13

Long XJ, Chen CW, Sun N, Yang GY, Chen CH. Study on the correlation between maternal iron deficiency anemia and ROP in premature or low birth weight infants. [Chinese]. International Eye Science. 2022;22(5):853-7.(24)

Study type

Case-control

Objectives

To explore the correlation between maternal IDA and retinopathy of prematurity (ROP) in premature infants or low birth weight infants so that to provide possible scientific basis for the prevention and control of ROP.

Components of the study

- **Population:** 317 premature or low birth weight infants who were diagnosed with ROP and their mothers in the investigator's hospital between January 2019 to July 2021 due to ROP screening for the first time, about 30 days after birth
- **Exposure:** 235 mothers with IDA
- **Comparators:** 82 mothers without IDA
- **Context:** China

Outcomes reported

- Stage II ROP was more significant in mothers with IDA ($p<0.05$)
- Stage III and Stage IV ROP was observed in 9.4% and 4.7% of mothers with IDA respectively, but not observed in mothers with normal iron levels
- Neonates born to mothers with IDA had higher mean gestational age, shorter gestational week, mean lower birth weight (all $p<0.05$)

Conclusions

This study concluded that infants born to mothers with IDA were more likely to develop ROP, be premature, and have lower birth weight.

Citation 14

Mohamed KJ, Yaqoub NK. Maternal Iron Deficiency Anemia as A risk Factor for Preterm Labor in Salaheddin Governorate, Iraq, 2022. NeuroQuantology. 2022;20(11):1024-31.(25)

Study type

Case-control

Objectives

Aims of this study included:

- To decrease the prevalence of preterm labour and its complication
- To assess the impact of iron deficiency anaemia on the pregnancy as a cause of pre-term labour
- To find out the main factors that might be associated with increased risk of anaemia in pregnancy

Components of the study

- **Population:** 100 pregnant women enrolled from Salaheddin General Hospital Gynaecology and Obstetrics department during from 1 January 2022 to 30 June 2022
- **Exposure:** 50 pregnant women with preterm labour
- **Comparators:** 50 women who presented at term labour and matched with the case group regarding the age, body mass index, parity, and abortion
- **Context:** SF levels, Iraq

Outcomes reported

- 52% of the participants in the case group had anaemia

Conclusions

This study concluded that anaemia is considered a significant risk factor for preterm labour.

Citation 15

Nyarko SH, Greenberg LT, Saade GR, Phibbs CS, Buzas JS, Lorch SA, et al. Association between iron deficiency anemia and severe maternal morbidity: A retrospective cohort study. Annals of Epidemiology. 2024;100:10-5.(16)

Study type

Retrospective cohort study

Objectives

To examine the association between IDA and severe maternal morbidity (SMM) during delivery and up to 1-year postpartum.

Components of the study

- **Population:** 2,459,106 individuals across 3 states
- **Exposure:** 252,240 mothers with IDA
- **Comparators:** Pregnancies without IDA
- **Context:** USA

Outcomes reported

- Outcomes for IDA vs non-IDA are as follows:
    - **Blood transfusions:** 329 per 10,000 deliveries vs 33 per 10,000 deliveries
    - **Non-transfusion SMM:** 122 per 10,000 deliveries vs 46 per 10,000 deliveries
- Risks were higher in patients with IDA:
    - **Blood transfusion:** aRR: 8.2 (95% CI: 7.9 to 8.5)
    - **Non-transfusion SMM:** aRR: 1.9 (95% CI: 1.8 to 2.0)
- Attributable risk per 10,000 deliveries due to IDA during delivery:
    - **Blood transfusions:** 29.5 (95% CI: 28.9 to 30.0)
    - **Non-transfusion SMM:** 5.7 (95% CI: 5.3 to 6.2)
- Within 1-year postpartum, the risk of non-transfusion SMM (aRR:1.3; 95% CI: 1.2 to 1.3) was 30% higher among individuals with IDA

Conclusions

This study concluded that IDA is associated with increased SMM risk and requirement for blood transfusion during delivery.

Citation 16

Ozyurt R, Bulutlar E. Effect of Iron Deficiency Anemia on Fetal and Maternal Morbidity. Bagcilar Medical Bulletin. 2024;9(2):87-92.(19)

Study type

Retrospective chart review

Objectives

To investigate the effect of third-trimester iron deficiency anaemia on foetal and maternal morbidity.

Components of the study

- **Population:** 240 pregnant women with third trimester haemoglobin level <11g/dL
- **Exposure:** Pregnant women who had blood samples taken at least twice for the diagnosis of anaemia in the third trimester
- **Comparators:** Pregnant women whose gestational weeks were matched and without anaemia
- **Context:** Anaemia defined as haemoglobin level <11g/dL, abstract discusses iron supplementation in conclusion, Turkey

Outcomes reported

- Rates of caesarean delivery, preterm labour, placental abruption, premature membrane rupture, low birth weight, and admission to intensive care due to foetal distress were significantly higher in the anaemic group
- Vaginal birth rate: 29.2% (anaemic group) vs 50% (non-anaemic group)
- Caesarean section, anaemic vs non-anaemic group: 170 (70.8%) vs 120 (50%)

Conclusions

Anaemia during pregnancy increases caesarean delivery rates and decreases vaginal birth rates. The study also concluded that treating anaemic pregnant women with iron supplementation may reduce caesarean section rates and increase normal birth rates.

Citation 17

Pecher AC, Bach S, Pauluschke-Frohlich J, Abele H, Henes J, Henes M. Anemia and iron deficiency in pregnant women with rheumatic diseases. Joint Bone Spine. 2024;91(1) (no pagination).(15)

Study type

Registry analysis

Objectives

To investigate the frequency of anaemia and iron deficiency during pregnancy in patients with rheumatic diseases and whether anaemia is a risk factor for adverse maternal or child outcome.

Components of the study

- **Population:** 368 pregnancies
- **Exposure:** Low haemoglobin or ID
- **Comparators:** Normal haemoglobin or no ID
- **Context:** Diagnosis of IDA established according to WHO criteria, patients enrolled from German registry for pregnancies in patients with rheumatic diseases (TURIRE) from 2014 to 2022

Outcomes reported

- Low haemoglobin levels (OR 0.52) or ID (OR 0.86) had a negative impact on child outcome
- Lower haemoglobin levels were associated with a lower risk for maternal complications (OR 1.47)

Conclusions

In patients with rheumatic diseases, ID in pregnancy may increase risk of adverse neonatal outcomes but reduce maternal harms.

Citation 18

Rahman SM, Siraj MS, Islam MR, Rahman A, Ekstrom EC. Association between maternal plasma ferritin level and infants' size at birth: a prospective cohort study in rural Bangladesh. Global health action. 2021;14(1):1870421.(13)

Study type

Prospective cohort study

Objectives

To evaluate the association between maternal iron status during pregnancy and infant size at birth (birth weight and length).

Components of the study

- **Population:** 573 singleton pregnancies, enrolled into the MINIMat study from January to December 2002
- **Exposure:** Pregnant women with ID
- **Comparators:** Pregnant women without ID
- **Context:** ID defined as plasma ferritin <12µg/L, Bangladesh

[Confirmed in full-text]

Outcomes reported

- Multivariable-adjusted linear regression: birth weight was lower among the newborns of women in the highest tertile of plasma ferritin (>45µg/L) at 14 gestational weeks (median 64µg/L) compared to women in the lowest tertile (median = 17µg/L) (B = −70; 95% CI: −147 to 7.6; p=0.077).
- The newborns of women in the highest tertile of plasma ferritin (median = 29µg/L) had on average a 93-gm lower birth weight (95% CI: −172 to –14; p = 0.021) than the newborns of women in the lowest tertile of plasma ferritin level (median = 8µg/L).
- The proportions of low birth weight babies were significantly higher among women in the highest ferritin tertile at gestational week 30 (42%, 35%, and 23% in the highest, intermediate, and lowest tertiles, respectively; p=0.020).

[Confirmed in full-text]

Conclusions

This study found a negative association between maternal plasma ferritin at gestational week 30 and birth weight. It was found that babies born to mothers with ID may have babies of higher birth weight compared to infants born to mothers with high serum ferritin concentrations.

Citation 19

Safarzadeh S, Banihashemi F, Montazeri F, Roozbeh N, Darsareh F. Maternal and Neonatal Outcomes of Iron Deficiency Anemia: A Retrospective Cohort Study. Cureus. 2023;15(12):e51365.(20)

Study type

Retrospective cohort study

Objectives

To assess the maternal and neonatal outcomes of women with IDA.

[Confirmed in full-text]

Components of the study

- **Population:** All singleton pregnant women who gave birth at a tertiary hospital in Bandar Abbas, Hormozgan province, Iran from January 2020 to January 2022
- **Exposure:** 257 pregnant women with IDA
- **Comparators:** 8,631 pregnant women without IDA
- **Context:** Iron deficiency anaemia was defined as haemoglobin <10.5mg/dl at the time of admission without any other hemoglobinopathy, such as sickle cell anaemia or thalassemia, Iran

[Confirmed in full-text]

Outcomes reported

- Instrumental deliveries (via vacuum), IDA vs non-IDA: 4.3% vs 0.8%
- Maternal and neonatal outcomes were as follows, non-IDA vs IDA, n (%):
    - Preeclampsia: 8,565 (6.5) vs 12 (4.7), p=0.302
    - Gestational diabetes: 1,320 (15.3) vs 28 (10.9), p=0.609
    - Placenta abruption: 277 (3.2) vs 8 (3.1), p=0.999
    - Stillbirth: 62 (0.7) vs 3 (1.2), p=0.060
    - PPH: 727 (8.4) vs 32 (12.5), p<0.001
    - Maternal blood transfusion: 121 (1.4) vs 42 (16.3), p<0.001
    - Maternal intensive care unit admission: 92 (1.1) vs 7 (2.7), p=0.137
    - Low birth weight: 1,172 (13.6) vs 46 (17.9), p<0.001
    - Intrauterine growth delay: 275 (3.2) vs 14 (5.4), p<0.01
    - Preterm birth: 1,202 (13.9) vs 44 (17.1), p<0.001
    - Newborn asphyxia: 85 (1.0) vs 5 (1.9), p=0.389

    - Neonatal intensive care unit admission: 1,730 (20.1) vs 62 (24.1), p<0.01
- IDA led to higher risks of:
    - Blood transfusion: aOR: 6.54 (95% CI: 4.72 to 8.15)
    - PPH: aOR: 1.54 (95% CI: 0.71 to 2.11)
    - Preterm birth: aOR: 0.98 (95% CI: 0.45 to 1.13)
    - Low birth weight: aOR: 1.04 (95% CI: 0.78 to 2.01)
    - Intrauterine growth delay: aOR: 1.30 (95% CI: 0.99 to 2.10)
    - Neonatal intensive care admission: OR: 1.06 (95% CI: 0.52 to 2.72)

[Confirmed in full-text]

Conclusions

This study concluded that IDA did not give rise to an increase in maternal intensive unit risk admission, despite the higher incidence of PPH and maternal blood transfusion. Neonates born to mothers with IDA had higher risk of preterm birth, low birth weight, intrauterine, growth delay, and neonatal intensive care admission compared to those born to mothers without IDA.

Citation 20

Zhang Y, Huang X, Chen Z, Yang Q, Li X, Zhang R, et al. Iron deficiency, a risk factor for thyroid autoimmunity during second trimester of pregnancy in China. Endocrine Practice. 2020;26(6):595-603.(14)

Study type

Cross-sectional study

Objectives

To explore the relationship between ID and thyroid dysfunction, as well as thyroid autoantibodies, during the second trimester of pregnancy.

Components of the study

- **Population:** 1,592 pregnant women
- **Exposure:** Pregnant women with ID
- **Comparators:** Pregnant women without ID
- **Context:** ID defined as SF <20mug/L, China

Outcomes reported

- The study analysed levels of thyroid stimulating hormone (TSH) and free thyroxin (FT4) to measure hypothyroidism in non-ID and ID pregnant women.
- Compared with the non-ID group, the ID group had:
    - Higher TSH levels (1.85mIU/L [0.01 to 7.84mIU/L] vs 1.69mIU/L [0.01 to 10.2mIU/L], p<0.05)
    - Lower FT4 levels (13.94pmol/L [8.91 to 29.82pmol/L] vs 14.63pmol/L [8.22 to 47.24pmol/L], p<0.001])
- Logistic regression analysis indicated that ID is a risk factor for increased thyroglobulin antibody (TG-Ab) (OR: 1.974, 95% CI 1.065 to 3.657; p<0.05), but not for increased thyroid peroxidase antibody (TPO-Ab) or subclinical hypothyroidism

Conclusions

This study found that ID in pregnancy is associated with increased risk of maternal thyroid dysfunction during the third trimester of pregnancy.

Citation 21

Zhao B, Sun M, Wu T, Li J, Shi H, Wei Y. The association between maternal anemia and neonatal anemia: a systematic review and meta-analysis. BMC Pregnancy Childbirth. 2024;24(1):677.(26)

Study type

SLR and meta-analysis

Objectives

To study the relationship between maternal anaemia during pregnancy and neonatal haemoglobin levels.

Components of the study

- **Population:** 18 observational studies reporting the association between maternal anaemia during pregnancy and neonatal anaemia
- **Exposure:** 3 studies investigating IDA
- **Comparators:**
- **Context:** Databases include PubMed, Web of science, Scopus, MEDLINE, Embase, ProQuest, Dissertations & Theses Global, The Cochrane Library, China Biology Medicine Database, Chinese CNKI Database, and Chinese Wanfang Database, searched from inception to August 31, 2022 ID defined as maternal SF or plasma ferritin levels <15 ug/Land <12ug/L in neonates.

[Confirmed in full-text]

Outcomes reported

- IDA vs control (mean difference, 95% CI):
    - Terefe 2015: -1.10 (-1.31 to -0.89)
    - Basu 2015: -0.50 (-0.95 -0.05)
    - Basu 2015: -3.90 (-4.26 to -3.54)
    - Basu 2016: -4.10 (-4.99 to -3.21)
    - Basu 2017: -2.45 (-3.12 to -1.78)
    - Random effects model: -2.39 (-3.81 to -0.97)

[Confirmed in full-text]

Conclusions

IDA mothers have a stronger correlation with neonatal haemoglobin comparing to those including all anaemia types. The study indicated the significance of screening for not only blood routine examination (haemoglobin concentration), but also iron index.

Question 2

Citation 1

Luik K, Rull K. Anaemia and iron supplement usage in pregnancy: association with pregnancy complications [Estonian]. Eesti Arst. 2021;100(2):79-89.(28)

Study type

Prospective cohort study

Objectives

To assess the prevalence of anaemia and anaemia-related complications during the pregnancy and to address the association between iron supplementation and pregnancy complications.

Components of the study

- **Population:** pregnant women at their first antenatal visit to the Women's Clinic, Tartu University Hospital, in 2013 to 2015
- **Intervention:** iron replacement therapy in the third trimester
- **Comparators:** no iron replacement therapy in the third trimester

Outcomes reported

- Maternal outcomes for intervention vs comparator:
    - **Preeclampsia**, %: 1.1 vs 6.2; OR 0.2 (95% CI 0.01–0.6)
    - **Caesarean section**, %: 14.7 vs 22.4; OR 0.6 (95% CI 0.4–0.9)

Conclusions

Anaemia in pregnancy increases the risk for pregnancy loss, preterm birth, preeclampsia, birth of a newborn small for gestational age, and PPH. Iron supplements reduce the risk for preeclampsia and the rate of caesarean section among pregnant women with anaemia, but not among pregnant women without anaemia.

Citation 2

Oskovi-Kaplan ZA, Kilickiran H, Buyuk GN, Ozyer S, Keskin HL, Engin-Ustun Y. Comparison of the maternal and neonatal outcomes of pregnant women whose anemia was not corrected before delivery and pregnant women who were treated with intravenous iron in the third trimester. Arch Gynecol Obstet. 2021;303(3):715-9.(33)

Study type

Retrospective case-control study

Objectives

To compare the maternal and foetal outcomes in labour and delivery in women whose anaemia was treated with IV iron and women who delivered with uncorrected anaemia.

Components of the study

- **Population:** term (>37 weeks), singleton, low-risk pregnant women with anaemia who were admitted to a tertiary obstetric care centre for delivery
- **Intervention:** IV ferric carboxymaltose treatment in the third trimester
- **Comparators:** women who were anaemic at the time of admission for delivery (anaemia was not corrected before delivery)
- **Context:** anaemia was defined as Hb <10g/dL

Outcomes reported

- Maternal outcomes for the intervention group vs comparator group:
    - **Primary caesarean section**, %: 4.2 vs 19.4; p<0.001
    - **Postpartum blood transfusion**, %: 8.3 vs 29.2; p=0.02
    - Mean **APGAR scores**, **admission to neonatal intensive care unit**, and the rates of **preterm delivery**, **small for gestational age**, and **low-birth weight infant** were similar between groups

Conclusions

Correction of anaemia with IV ferric carboxymaltose in the third trimester does not significantly change neonatal outcomes but it is effective in reducing maternal morbidity.

Citation 3

Tan HS, Guinn NR, Fuller ME, Habib AS. The association between intravenous iron for antenatal anaemia and postnatal depression: a retrospective cohort study. Arch Gynecol Obstet. 2022;306(5):1477-84.(30)

Study type

Retrospective cohort study

Objectives

To determine if IV iron for antenatal anaemia is associated with reduced incidence of postnatal depression within 12 months.

Components of the study

- **Population:** adult women with antenatal anaemia (within 3 months before delivery)
- **Intervention:** IV iron therapy for antenatal anaemia
- **Comparators:** no IV iron therapy for antenatal anaemia
- **Context:** anaemia was defined as Hb <11.0g/dL

Outcomes reported

- Incidence of **post-natal depression** (Edinburgh Postnatal Depression Scale [EPDS] or Patient Health Questionnaire-9 [PHQ-9] ≥10) for the intervention group vs comparator group:
    - Unadjusted analysis, %: 18.5 vs 13.4; p=0.008
    - Multivariable analysis: aOR 1.21 (95% CI 0.89–1.63); p=0.232

Conclusions

IV iron for antenatal anaemia was not associated with significant change in the incidence of post-natal depression.

Citation 4

Westrom J. Safety of intravenous iron isomaltoside for iron deficiency and iron deficiency anemia in pregnancy. Arch Gynecol Obstet. 2020;301(5):1127-31.(31)

Study type

Retrospective cohort study

Objectives

To evaluate the efficacy and safety for mother and child of using IV iron isomaltoside (IV-IIM) during pregnancy.

Components of the study

- **Population:** pregnant women with iron deficiency or iron deficiency anaemia who received the intervention in the maternity ward of Falu Hospital and subsequently gave birth between 6th August 2013 and 31st July 2018
- **Intervention:** single dose of 1000 or 1500 mg IV iron isomaltoside
- **Comparators:** no IV iron isomaltoside

Outcomes reported

- Maternal and foetal outcomes at delivery and postpartum for the intervention vs comparator group:
    - **Hypertension**, n: 2 vs 0; p=0.24
    - **Preeclampsia/HELLP syndrome** (haemolysis, elevated liver enzyme levels, and low platelet levels), n: 5 vs 6; p=1
    - **Primary caesarean**, n: 24 vs 16; p=NR
    - **Average blood loss during delivery**, mL: 553 vs 500; p=0.19
    - **Neonatal ward admission**, n: 12 vs 9; p=0.51

[Confirmed in full-text]

Conclusions

The results support the convenience, safety, and efficacy of a single high-dose (up to 1,500 mg) infusion of IV iron isomaltoside for iron deficiency or iron deficiency anaemia during pregnancy.

Citation 5

Burn MS, Lundsberg LS, Culhane JF, Partridge C, Son M. Intravenous iron for treatment of iron deficiency anemia during pregnancy and associated maternal outcomes. J Matern Fetal Neonatal Med. 2023;36(1):e1-e7.(32)

Study type

Retrospective cohort study.

Objectives

To investigate whether patients with IDA who received IV iron had decreased odds of maternal morbidity compared to patients who did not.

Components of the study

- **Population:** pregnant patients with presumed IDA with term deliveries at a tertiary hospital from 2013 to 2021
- **Intervention:** antepartum IV iron
- **Comparators:** no antepartum IV iron

Outcomes reported

- **Maternal morbidity composite** (including receipt of blood transfusion, hysterectomy, admission to the intensive care unit or death) for the intervention group vs comparator group:
    - Unadjusted OR: 1.47 (95% CI 1.11–1.95)
    - Adjusted OR: 1.37 (95% CI 1.02–1.85)
- **Maternal morbidity composite** among patients who received a full IV iron treatment course for the intervention group vs comparator group:
    - Unadjusted OR: 1.2 (95% CI 0.83–1.90)

Conclusions

Odds of the maternal morbidity composite were increased among patients who received IV iron despite greater increases in haematocrit. The effect was attenuated after adjusting for potential confounders and was not significant among patients who completed a full treatment course.

Citation 6

Sutter C, Freundlich RE, Raymond BL, Osmundson S, Morton C, McIlroy DR, Shotwell M, Feng X, Bauchat JR. Effectiveness of oral iron therapy in anemic inpatient pregnant women: a single center retrospective cohort study. Cureus. 2024;16(3):e56879.(29)

Study type

Retrospective cohort study

Objectives

To evaluate the effect of oral iron therapy versus no therapy during hospitalisation on maternal and neonatal outcomes in women with anaemia who are hospitalised for pregnancy-related morbidities (i.e., preterm premature rupture of membranes, preterm labour, pre-eclampsia, abnormal placentation, or foetal monitoring).

Components of the study

- **Population:** 79 inpatient pregnant women with anaemia admitted from 1st March 2018 to 1st August 2020 (with inpatient stays of more than three days)
- **Intervention:** oral iron treatment
- **Comparators:** no oral iron treatment
- **Context:** anaemia was defined as Hb <11.0g/dL at ≥28 weeks gestation or Hb <10.5g/dL at <28 weeks gestation

[Confirmed in full-text]

Outcomes reported

- Maternal outcomes for the intervention group vs comparator group:
    - Length of stay, median (IQR): 11.4 (7.4, 25.9) vs 7.1 (5.0, 13.7) days; p=0.03
    - Caesarean delivery, %: 72.4 vs 53.7; p=0.181
    - Estimated blood loss at delivery, mL: 662.1+/-337.4 vs 559+/-401; p=0.264
- Neonatal outcomes for the intervention group vs comparator group:
    - Birthweight, kg: 1.9+/-0.7 vs 1.9+/-0.7; p=0.901
    - Birth haemoglobin, g/dL: 16+/-2.2 vs 16.3+/-2.2; p=0.569
    - Neonatal intensive care unit admission, %: 84.8 vs 93.3; p=0.272
    - Neonatal death, %: 3 vs 8.9; p=0.394

Conclusions

Oral iron administered to anaemic inpatient pregnant women was not associated with higher haemoglobin concentrations before delivery. Lack of standardised iron regimens and

short hospital stays may contribute to the inefficacy of oral iron for this inpatient pregnant population.

Citation 7 & 8

Cantor A, Holmes R, Bougatsos C, Atchison C, DeLoughery T, Chou R. Screening and routine supplementation for iron deficiency anemia in pregnancy: an updated systematic review for the U.S. Preventive Services Task Force. Rockville (MD): Agency for Healthcare Research and Quality (US); 2024. Report No. 8.(56)

Cantor AG, Holmes R, Bougatsos C, Atchison C, DeLoughery T, Chou R. Screening and supplementation for iron deficiency and iron deficiency anemia during pregnancy: updated evidence report and systematic review for the US Preventive Services Task Force. JAMA. 2024;332(11):1063-76.(27)

Study type

Systematic literature review (on RCTs)

Objectives

To systematically update the prior USPSTF review (2015) on screening and supplementation for IDA in pregnancy, with the addition of ID without anaemia.

Components of the study

- **Population:** pregnant individuals with ID
- **Intervention:** maternal iron supplementation
- **Comparators:** no maternal iron supplementation or placebo

Outcomes reported

- Rates of maternal outcomes for the intervention vs comparator:
    - **Hypertensive disorders of pregnancy**: 5 studies; N=13,610; 4.7% vs 3.1% [pooled, weighted rates]; relative risk [RR] 1.24 (95% CI 0.75–2.06); I2= 48%
    - **Caesarean delivery**: 8 trials; N=4,919; 42.8% vs 41.5%; RR 1.01 (95% CI 0.90–1.14); I2=42.7%
    - There were no statistically significant differences in **maternal quality of life** (1 trial), rates of **gestational diabetes** (2 trials), or rates of **maternal hemorrhage** (2 trials)
- Rates of infant outcomes for the intervention vs comparator:
    - **Preterm birth**: 5 trials; N=16,827; 5.5% vs 6.0%; RR 0.92 (95% CI 0.81–1.04); I2=0%
    - **Low birth weight**: (6 trials; N=15,591; 2.7% vs 2.9%; RR 0.95 (95% CI 0.79–1.14); I2=0.0%
    - **Small for gestational age**: (4 trials; N=5,386; 15.3% vs 15.2%; RR 0.94 (95% CI 0.67–1.31); I2=75.5%

Conclusions

Routine prenatal iron supplementation reduces the incidence of iron deficiency and iron deficiency anaemia during pregnancy, but evidence on health outcomes is limited or indicates no benefit.

Citation 9

Detlefs SE, Jochum MD, Salmanian B, McKinney JR, Aagaard KM. The impact of response to iron therapy on maternal and neonatal outcomes among pregnant women with anemia. Am J Obstet Gynecol MFM. 2022;4(2):100579.(8)

Study type

Population-based retrospective cohort study

Objectives

To determine whether response to iron therapy among women with anaemia is associated with a change in odds of adverse maternal and neonatal outcomes.

Components of the study

- **Population:** obstetrical patients from 2 delivery hospitals with anaemia (2,695 successfully treated; 3,402 untreated)
- **Intervention:** successfully treated with oral iron therapy (normal haemoglobin at the time of admission for delivery)
- **Comparators:** untreated anaemia or patients with anaemia refractory to treatment
- **Context:** anaemia was defined as those who were treated with an iron supplement outside of a prenatal vitamin, or presented to labour and delivery with Hb <11g/dL in the third trimester of pregnancy or 10.5g/dL if delivered in the second trimester of pregnancy

[Confirmed in full-text]

Outcomes reported

- Rates of maternal outcomes for the successfully treated group vs the untreated group, n (%):
    - **Caesarean delivery**: 874 (32.4) vs 1182 (34.8)
    - **Composite maternal morbidity**: 517 (19.8) vs 935 (30.0)
    - **Intrapartum hemorrhage**: 74 (2.8) vs 89 (2.6)
    - **Postpartum hemorrhage**: 69 (2.6) vs 101 (3.0)
    - **Preterm birth**: 136 (5.1) vs 410 (12.1)
        - <32.0 weeks: 12 (0.4) vs 65 (1.9)
        - 32.0−36.9 weeks: 124 (4.6) vs 343 (10.1)
- Rates of neonatal outcomes for the successfully treated group vs the untreated group, n (%):
    - **Small for gestational age:** 502 (18.6) vs 655 (19.3)
    - **Large for gestational age:** 309 (11.5) vs 502 (14.8)

- **Composite neonatal morbidity:** 261 (10.0) vs 387 (11.7)

[Confirmed in full-text]

Conclusions

Successful treatment of anaemia with oral iron therapy was associated with a reduction in the odds of preterm birth and preeclampsia. Women with refractory anaemia had similar outcomes to those who were untreated, emphasising the importance of monitoring response to iron therapy during pregnancy.

Question 3

Citation 1

Hansen R, Spangmose AL, Sommer VM, Holm C, Jørgensen FS, Krebs L, Pinborg A. Maternal first trimester iron status and its association with obstetric and perinatal outcomes. Archives of Gynecology and Obstetrics. 2022 Oct;306(4):1359-71.(43)

Study type

Prospective cohort study

Objectives

To assess the following in singleton pregnant women: 1) associations between first trimester iron deficiency and obstetric and perinatal outcomes, 2) overall first trimester iron status and 3) post-treatment iron status after intensified iron supplementation.

Components of the study

- **Population**: 5,763 unselected singleton pregnant women screened for anaemia and iron deficiency before 14 weeks' gestation from June 2017 through May 2018
- **Intervention:** The screening included Hb and plasma ferritin measurements from a venous blood sample
- **Comparator:** None
- **Context**: Screening followed referral to standard antenatal care at Copenhagen University Hospital Hvidovre, as an alternative to the Danish standard of routine prophylactic iron supplementation. Based on the screening results, women were recommended daily iron supplementation

[Confirmed in full-text]

Outcomes reported

- Adjusted odds ratio (aOR) for IDA/ID vs iron replete non-anaemic references:
    - **Development of gestational diabetes**, IDA vs references: aOR 3.8, 95% CI 1.4–9.0
    - **Stillbirth**, ID vs references: aOR 4.0, 95% CI 1.0–14.3

[Confirmed in full-text]

Conclusions

In comparison to iron replete non-anaemic women, women with IDA had a higher risk of gestational diabetes, and ID women had a higher risk of stillbirth, although risk estimates were imprecise due to few events, especially for stillbirth. First trimester iron deficiency was present in 15.4% of women screened and often persisted despite 2–8 weeks intensified iron supplementation.

[Confirmed in full-text]

Citation 2

Naidoo P, Frawley N, Mol BW. PRISM study—Pre-natal iron deficiency screening and management within an Australian regional centre. Australian Journal of Rural Health. 2023 Aug;31(4):744-57.(44)

Study type

Retrospective cohort study

Objectives

To evaluate the clinical impact of standardised screening and management for iron deficiency in pregnancy within a regional Australian centre.

Components of the study

- **Population**: 2,773 adult patients presenting to the Ballarat Health Services obstetric unit between 1st October 2017 and 31st May 2020
- **Intervention:** Ferritin testing at the booking and 28-week antenatal appointment
- **Comparator:** None
- **Context**: Screening conducted as part of a 'bundle of care' package comprising three standardised clinical pathways for each trimester of pregnancy. Decision trees were used at booking and 28 weeks using the haemoglobin and ferritin values, to guide clinical management with an emphasis on trialling oral iron supplementation in the first instance. Participants were divided into two groups: pre- and post-implementation of screening and management

[Confirmed in full-text]

Outcomes reported

- Relative risk (RR) in the pre- vs post-implementation groups of **blood transfusion peri/postpartum** (n=2,659): RR 0.40 (CI 0.61, 0.99), p=0.048

[Confirmed in full-text]

Conclusions

This study suggested clinically and statistically significant results of reduced anaemia at birth, reduced blood transfusions and increased antenatal iron infusions after implementation of the Australian national blood bank guidelines where all pregnant women are screened and managed for ID.

[Confirmed in full-text]

Citation 3

Purcell S, Beckmann M. The utility of routine screening for anaemia at 36 weeks gestation. Australian and New Zealand Journal of Obstetrics and Gynaecology. 2022 Aug;62(4):610-3.(45)

Study type

Retrospective cohort study

Objectives

To determine if there is a cohort of women who, based on their routine 28-week blood test, would be able to safely avoid a routine 36-week blood test.

Components of the study

- **Population**: 10,518 women who gave birth between March 2008 and April 2018 at Mater Mother's Hospital, Brisbane
- **Intervention:** Haemoglobin (Hb) testing at 28 and 36 weeks
- **Comparator:** None
- **Context**: Using a number of candidate thresholds for 28-week Hb values between 110 and 130 g/L, the likelihood of 36-week anaemia and 36-week or peripartum thrombocytopaenia were predicted. The number of potentially avoidable 36-week blood tests was calculated.

[Confirmed in full-text]

Outcomes reported

- Percentage of women anaemic after non-anaemia result at 28 weeks, by different Hb results at 28 weeks (%):
    - ≥110g/L: 2.29%
    - ≥115g/L: 0.93%
    - ≥120g/L: 0.30%
    - ≥125g/L: 0.04%
- Potentially avoidable 36-week bloods based on different 28-week Hb thresholds, n/N (%):
    - ≥110g/L: 10,518/14,792 (71.1%)
    - ≥115g/L: 8,573/14,792 (57.9%)
    - ≥120g/L: 4,536/14,792 (30.7%)
    - ≥125g/L: 2,482/14,792 (16.8%)

[Confirmed in full-text]

Conclusions

Using a 28-week Hb threshold of ≥110 g/L, seven out of ten pregnant women could safely forego a routine 36-week full blood count. Less than 2.5% would be anaemic at 36 weeks, none of whom would have a Hb <90 g/L. The rate of peripartum blood transfusion was similar regardless of the 28-week Hb thresholds.

[Confirmed in full-text]

Appendix 3 – List of studies of secondary relevance

Question 1

Reason: unspecified type of anaemia

1. Aballo J, Adokiya MN, Boah M. Trimester-specific trends in gestational anaemia and associations with neonatal outcomes: a retrospective facility-based study in Ghana. Discover public health. 2025;22(1) (no pagination).
2. Agrawal A, Bhandari G, Taya S, Chaudhary V. Role of colour Doppler in predicting foetal outcome in maternal anaemia. J. 2023;12(11):2745-51.
3. Ahmad U, Fehmida, Asmatullah Z, Alam J, Ul Ghafoor A, Khan AB. Maternal Anemia as a Risk Factor for Preterm Delivery and Low Birth Weight. Pakistan Journal of Medical and Health Sciences. 2022;16(1):78-9.
4. Alcalay I, Wainstock T, Sheiner E. Maternal anemia and long-term respiratory morbidity of the offspring-Results of a population-based cohort. Archives of Gynecology and Obstetrics. 2023;308(4):1189-95.
5. Ambedkar D, Mishra C, Sharma R, Kumar V, Yadav YK. Antepartum and Intrapartum Complications in Anemic and Non-Anemic Women. European Journal of Molecular and Clinical Medicine. 2021;8(4):2617-25.
6. Ashwini B, Sowmyashree GS, Manasa K. A Study of Association of Maternal Hemoglobin and Fetal Outcome in Tertiary Care Hospital. Journal of Cardiovascular Disease Research. 2023;14(12):1052-7.
7. Aziz S, Najmusahar S, Anwer S, Baloch N. Maternal anemia during pregnancy and its association with preterm birth. Pakistan Journal of Medical and Health Sciences. 2021;15(8):2216-9.
8. Bashir N, Bashir S, Kuchay A. Impact of Maternal Anemia on Birth Outcomes a Hospital-Based Study. International Journal of Medicine and Public Health. 2024;14(4):1442-8.
9. Basurko C, Kim JS, Louis A, Sobesky M, Kaba A, Nacher M, et al. Maternal anemia associated with postpartum hemorrhage: A retrospective cohort in French Guiana. International Journal of Gynecology and Obstetrics. 2025.
10. Belete NK, Belete AG, Assefa DT, Sorrie MB, Teshale MY. Effects of maternal anemia on low-birth-weight in Sub-Sahara African countries: Systematic review and meta-analysis. Plos One. 2025;20(6 June) (no pagination).
11. Beressa G, Whiting SJ, Kuma MN, Lencha B, Belachew T. Association between anemia in pregnancy with low birth weight and preterm birth in Ethiopia: A systematic review and meta-analysis. PLoS ONE. 2024;19(9 September) (no pagination).
12. Bernhardt GV, Jhancy M, Bernhardt LK, Shivappa P, Kumar S, Pinto JRT. Cord blood neutrophil phagocytic index in neonates born to anemic mothers and in neonates born

with risk of early-onset sepsis. Journal of South Asian Federation of Obstetrics and Gynaecology. 2021;13(1):26-30.

13. Cheng Z, Karra M, Guo M, Patel V, Canning D. Exploring the Relationship between Anemia and Postpartum Depression: Evidence from Malawi. International Journal of Environmental Research and Public Health. 2023;20(4) (no pagination).

14. Chu FC, Shao SSW, Lo LM, Hsieh TT, Hung TH. Association between maternal anemia at admission for delivery and adverse perinatal outcomes. Journal of the Chinese Medical Association. 2020;83(4):400-5.

15. Cozzi GD, Blanchard CT, Edwards JT, Szychowski JM, Subramaniam A, Battarbee AN. Optimal predelivery hemoglobin to reduce transfusion and adverse perinatal outcomes. American Journal of Obstetrics and Gynecology MFM. 2023;5(2) (no pagination).

16. Diaz-Lopez A, Ribot B, Basora J, Arija V. High and Low Haemoglobin Levels in Early Pregnancy Are Associated to a Higher Risk of Miscarriage: A Population-Based Cohort Study. Nutrients. 2021;13(5):08.

17. dos Santos CC, da Silva SL, Costa Caminha MDF, Maia SB, Figueiroa JN, Batista Filho M. Anemia in pregnant women according to two different assessment criteria (WHO versus CDC). International Journal of Gynecology and Obstetrics. 2022;159(3):928-37.

18. Edelson PK, Cao D, James KE, Ngonzi J, Roberts DJ, Bebell LM, et al. Maternal anemia is associated with adverse maternal and neonatal outcomes in Mbarara, Uganda. J Matern Fetal Neonatal Med. 2023;36(1):2190834.

19. Fallatah AM, Bifari AE, Alshehri HZ, Wali SM, Alghamdi SA, Almusallam SA, et al. Anemia and Cost-Effectiveness of Complete Blood Count Testing Among Pregnant Women at King Abdulaziz University Hospital: A Single Tertiary Center Experience. Cureus. 2020;12(9):e10493.

20. Firatligil FB, Akay A, Kaya M, Reis YA, Dereli ML, Ozkan S, et al. Maternal Pre-Labor Hematocrit Level: Does It Affect Fetal Outcomes?: A Case-Control Study. Eastern Journal of Medicine. 2025;30(1):127-32.

21. Hakimzadeh A, Dolatian M, Bagherinia M, Hosseinpour K. Anemia in pregnant mothers and the risk of low birth weight: A systematic review and meta-analysis. [Persian]. Iranian Journal of Obstetrics, Gynecology and Infertility. 2024;27(10):93-121.

22. Hansen M, Singh G, Barzi F, Brunette R, Howarth T, Morris P, et al. Maternal Anaemia in Pregnancy: A Significantly Greater Risk Factor for Anaemia in Australian Aboriginal Children than Low Birth Weight or Prematurity. Maternal and child health journal. 2020;24(8):979-85.

23. Harrison RK, Lauhon SR, Colvin ZA, McIntosh JJ. Maternal anemia and severe maternal morbidity in a US cohort. American Journal of Obstetrics and Gynecology MFM. 2021;3(5) (no pagination).

24. Jain K, Dubey A, Jain A. A cross-sectional study to evaluate association between maternal hemoglobin level and poor pregnancy outcomes. International Journal of Life Sciences Biotechnology and Pharma Research. 2024;13(3):461-4.

25. Kabir MA, Rahman MM, Khan MN. Maternal anemia and risk of adverse maternal health and birth outcomes in Bangladesh: A nationwide population-based survey. PLoS ONE. 2022;17(12 December) (no pagination).

26. Kaur J, Dhar T, Varughese PV. To study maternal and perinatal outcome in pregnancies affected by moderate and severe anaemia: a case control study. European Journal of Cardiovascular Medicine. 2023;13(2):59-67.

27. Kemppinen L, Mattila M, Ekholm E, Huolila L, Pelto J, Karlsson H, et al. Gestational anemia and maternal antenatal and postpartum psychological distress in a prospective FinnBrain Birth Cohort Study. BMC Pregnancy and Childbirth. 2022;22(1) (no pagination).

28. Kemppinen L, Mattila M, Ekholm E, Perasto L, Karlsson H, Makikallio K, et al. Effect of gestational anemia on breastfeeding- a prospective follow-up -study. BMC Pregnancy and Childbirth. 2025;25(1) (no pagination).

29. Khoshdel Z, Tomas S. A Prospective Study on Impact of Anemia and Iron Supplementation in Pregnancy, Baptist Hospital, Bangalore, India. Pakistan Journal of Medical and Health Sciences. 2021;15(5):1456-9.

30. Kwak DW, Kim S, Lee SY, Kim MH, Park HJ, Han YJ, et al. Maternal Anemia during the First Trimester and Its Association with Psychological Health. Nutrients. 2022;14(17) (no pagination).

31. Kwak DW, Kim S, Lee SY, Park HJ, Han YJ, Kim MY, et al. Effects of anaemia development during pregnancy on maternal psychological health. BMJ mental health. 2025;28(1).

32. La Verde M, Luciano M, Fordellone M, Brandi C, Carbone M, Di Vincenzo M, et al. Is there a correlation between prepartum anaemia and an increased likelihood of developing postpartum depression? A prospective observational study. Archives of Gynecology and Obstetrics. 2024;310(2):1099-108.

33. Lauer JM, Bhaise S, Dhurde V, Gugel A, Shah M, Hibberd PL, et al. Maternal Anemia during Pregnancy and Infant Birth Outcomes: A Prospective Cohort Study in Eastern Maharashtra, India. Current Developments in Nutrition. 2024;8(11) (no pagination).

34. Li J, Fang J, Luo J, Duan Y, Xiao X, Li Y, et al. The Association Between Severity of Anemia During Pregnancy and Severe Maternal Outcomes: A Retrospective Cohort Study. Clinical Epidemiology. 2022;14:1427-37.

35. Liu X, An H, Li N, Li Z, Zhang Y, Zhang L, et al. Preconception Hemoglobin Concentration and Risk of Low Birth Weight and Small-for-Gestational-Age: A Large Prospective Cohort Study in China. Nutrients. 2022;14(2) (no pagination).

36. Mitsuda N, J-P NA, Eitoku M, Maeda N, Fujieda M, Suganuma N, et al. Association between maternal hemoglobin concentration and placental weight to birthweight ratio: The Japan Environment and Children's Study (JECS). Placenta. 2020;101:132-8.

37. Nivas S, Sahay V. Clinical Evaluation of Anemia Severity in Pregnant Women and Its Association with Maternal Morbidity and Neonatal Outcomes. International Journal of Pharmaceutical Quality Assurance. 2025;16(2):393-8.

38. Okunade KS, Adejimi AA, Olumodeji AM, Olowe A, Oyedeji OA, Ademuyiwa IY, et al. Prenatal anaemia and risk of postpartum haemorrhage: a cohort analysis of data from the Predict-PPH study. BMC public health. 2024;24(1):1028.

39. Pathirathna ML, Haruna M, Sasaki S, Yonezawa K, Usui Y, Hagiwara Y. Maternal Hemoglobin Concentrations in Early and Late Pregnancy and Adverse Birth Outcomes: A Nationwide Cohort Study in Sri Lanka. The Journal of nutrition. 2025;03.

40. Purandare P, Ravikumar MS. Anemia in Third Trimester of Pregnancy and Birth Weight: A Retrospective Case Control Study in a Tertiary Care Hospital in Rural Maharashtra. International Journal of Academic Medicine and Pharmacy. 2023;5(1):113-6.

41. Salman EA, Qasim IK, Al-Haidari T. Maternal hemoglobin concentration and pregnancy outcome in a sample of iraqi women. Medico-Legal Update. 2020;20(4):848-54.

42. Shah T, Warsi J, Laghari Z. Effect of maternal anemia on the anthropometric indices of newborn. Journal of the Liaquat University of Medical and Health Sciences. 2020;19(3):191-4.

43. Shi H, Chen L, Wang Y, Sun M, Guo Y, Ma S, et al. Severity of Anemia during Pregnancy and Adverse Maternal and Fetal Outcomes. JAMA Network Open. 2022;5(2) (no pagination).

44. Suryani D, Kusdalinah, Yandrizal, Krisnasary A, Siregar A, Jumiyati, et al. The relationship between Hemoglobin levels in pregnant women and liner growth of New Borns in Bengkulu City Bengkulu Province of Indonesia. Pakistan Journal of Medical and Health Sciences. 2020;14(4):1900-3.

45. Tian Q, Chen S, Jiang D. Effects of anemia during the third trimester of pregnancy on postpartum depression and pregnancy outcomes in pregnant women older than 35 years: a retrospective cohort study. Annals of palliative medicine. 2022;11(3):1048-57.

46. Tsamantioti E, Alfven T, Hossin MZ, Razaz N. Maternal anaemia and risk of neonatal and infant mortality in low- and middle-income countries: A secondary analysis of 45 national datasets. BMJ Global Health. 2025;10(3) (no pagination).

47. Uzunov AV, Cirstoiu MM, Secara DC, Cringu-Ionescu A, Matei A, Mehedintu C, et al. Mode of Delivery and Neonatal Outcome in Adolescent Pregnancy (13-16 Years Old) Associated with Anemia. Medicina. 2022;58(12).

48. Vani PYS, Mantena S, Soujanya B, Priyanka A. Comparison of Maternal 2D-Echo Findings in Normal Pregnancy and Anaemia Complicating Pregnancy at 34-36 Weeks Antepartum and at 6 Weeks Postpartum in a Tertiary Care Teaching Hospital. NeuroQuantology. 2022;20(7):3716-25.

49. Wang R, Xu S, Hao X, Jin X, Pan D, Xia H, et al. Anemia during pregnancy and adverse pregnancy outcomes: a systematic review and meta-analysis of cohort studies. Front. 2025;6:1502585.

50. Xiong J, Zhou W, Huang S, Xu K, Xu Y, He X. Maternal anaemia and birth weight: a cross-sectional study from Jiangxi Province, China. Family Practice. 2023;40(5-6):722-7.

51. Yovera-Aldan M, Reategui-Estrad X, Acuna-Hualp E. Relationship between first trimester anemia and low birth weight in four mother-and-child health centers in Lima sur during 2019. [Spanish]. Acta Medica Peruana. 2022;38(4):264-72.

52. Zhang B, Liu H, Li H, Wang J, Zhu H, Yu P, et al. Obstetric blood transfusion in placenta previa patients with prenatal anemia: a retrospective study. BMC Pregnancy and Childbirth. 2024;24(1) (no pagination).

53. Zia E, Tariq A, Ayub F, Khan TM, Bukhsh A, Suleiman AK, et al. Association of Gestational Iron-deficiency Anemia with Antenatal Depression among Pregnant Women: A Case-control Study from Tertiary Care Hospitals, Lahore. Dental Research Journal. 2024;13(1):7-13.

Question 2

Reason: LMIC

54. Abioye AI, Hughes MD, Sudfeld CR, Premji Z, Aboud S, Hamer DH, et al. The effect of iron supplementation on maternal iron deficiency anemia does not differ by baseline anemia type among Tanzanian pregnant women without severe iron deficiency anemia. European Journal of Nutrition. 2023;62(2):987-1001.

55. Dixit R, Mittal A, Singhal P, Dey S. Evaluation of the Effect of Iron Sucrose and Ferrous Ascorbate for the Treatment of Anaemia during Pregnancy: A Randomised Controlled Trial. International Journal of Pharmaceutical and Clinical Research. 2023;15(7):409-14.

56. Dorsamy V, Bagwandeen C, Moodley J. The prevalence, risk factors and outcomes of anaemia in South African pregnant women: a systematic review and meta-analysis. Systematic Reviews. 2022;11(1) (no pagination).

57. Keats EC, Oh C, Chau T, Khalifa DS, Imdad A, Bhutta ZA. Effects of vitamin and mineral supplementation during pregnancy on maternal, birth, child health and development outcomes in low- and middle-income countries: A systematic review. Campbell syst. 2021;17(2):e1127.

58. Oh C, Keats EC, Bhutta ZA. Vitamin and mineral supplementation during pregnancy on maternal, birth, child health and development outcomes in low-and middle-income countries: A systematic review and meta-analysis. Nutrients. 2020;12(2) (no pagination).

59. Prasad S, Rukhaiyar N. A Hospital-Based Assessment of the Impact of Corrected Maternal Anemia on Perinatal Outcome its Comparison with Babies Born to Anemic Mothers. International Journal of Pharmaceutical and Clinical Research. 2023;15(1):170-6.

60. Thomas MS, Demirchyan A, Khachadourian V. How Effective Is Iron Supplementation During Pregnancy and Childhood in Reducing Anemia Among 6-59 Months Old Children in India? Frontiers in Public Health. 2020;8:234.

61. Toolan M, Barnard K, Lynch M, Maharjan N, Thapa M, Rai N, et al. A systematic review and narrative synthesis of antenatal interventions to improve maternal and neonatal health in Nepal. AJOG Global Reports. 2022;2(1) (no pagination).

62. Zhang L, Ma S, Dai F, Li Q, Wu L, Yu L, et al. Anemia in pregnancy and sleep of 6-month-old infants: A prospective cohort study. Frontiers in Nutrition. 2023;10:1049219.

Question 3

None

References

1. Benson AE, Shatzel JJ, Ryan KS, Hedges MA, Martens K, Aslan JE, et al. The incidence, complications, and treatment of iron deficiency in pregnancy. European journal of haematology. 2022;109(6):633-42.
2. Agarwal AM, Rets A. Laboratory approach to investigation of anemia in pregnancy. International Journal of Laboratory Hematology. 2021;43(S1):65-70.
3. Churchill D, Ali H, Moussa M, Donohue C, Pavord S, Robinson SE, et al. Maternal iron deficiency anaemia in pregnancy: Lessons from a national audit. Br J Haematol. 2022;199(2):277-84.
4. Pavord S, Myers B, Robinson S, Allard S, Strong J, Oppenheimer C, et al. UK guidelines on the management of iron deficiency in pregnancy. British journal of haematology. 2012;156(5):588-600.
5. UK National Screening Committee. Antenatal screening programme: Anaemia. 2021.
6. Banavathu HB, Kolluru K, Hasamnis VA. Maternal and Perinatal Outcome in Anaemic Pregnancies with Iron Deficiency and Non-Anaemic Pregnancies. European Journal of Cardiovascular Medicine. 2025;15(3):474-80.
7. Ibsen CP, Scavenius C, Frederiksen KD, Wonsbek L, Ammitzboll ILA, Vojdeman FJ, et al. Impact of second trimester iron deficiency on maternal and infant outcomes: A Danish cohort study. European Journal of Obstetrics and Gynecology and Reproductive Biology. 2025;311(no pagination).
8. Detlefs SE, Jochum MD, Salmanian B, McKinney JR, Aagaard KM. The impact of response to iron therapy on maternal and neonatal outcomes among pregnant women with anemia. American Journal of Obstetrics and Gynecology MFM. 2022;4(2) (no pagination).
9. Evanchuk JL, Kozyrskyj A, Vaghef-Mehrabani E, Lamers Y, Giesbrecht GF, Letourneau N, et al. Maternal Iron and Vitamin D Status during the Second Trimester Is Associated with Third Trimester Depression Symptoms among Pregnant Participants in the APrON Cohort. Journal of Nutrition. 2024;154(1):174-84.
10. Faruk S, Sanusi KO, Ibrahim KG, Abubakar B, Malami I, Bello MB, et al. Age and sex-based impacts of maternal iron deficiency on offspring's cognitive function and anemia: A systematic review. European Journal of Clinical Nutrition. 2024;78(6):477-85.
11. Fite MB, Tura AK, Yadeta TA, Oljira L, Roba KT. Prevalence, predictors of low birth weight and its association with maternal iron status using serum ferritin concentration in rural Eastern Ethiopia: a prospective cohort study. BMC Nutrition. 2022;8(1) (no pagination).
12. Hameed S, Naser IA, Al Ghussein MA, Ellulu MS. Is iron deficiency a risk factor for postpartum depression? A case-control study in the Gaza Strip, Palestine. Public health nutrition. 2022;25(6):1631-8.
13. Rahman SM, Siraj MS, Islam MR, Rahman A, Ekstrom EC. Association between maternal plasma ferritin level and infants' size at birth: a prospective cohort study in rural Bangladesh. Global health action. 2021;14(1):1870421.
14. Zhang Y, Huang X, Chen Z, Yang Q, Li X, Zhang R, et al. Iron deficiency, a risk factor for thyroid autoimmunity during second trimester of pregnancy in China. Endocrine Practice. 2020;26(6):595-603.
15. Pecher AC, Bach S, Pauluschke-Frohlich J, Abele H, Henes J, Henes M. Anemia and iron deficiency in pregnant women with rheumatic diseases. Joint Bone Spine. 2024;91(1) (no pagination).

16. Nyarko SH, Greenberg LT, Saade GR, Phibbs CS, Buzas JS, Lorch SA, et al. Association between iron deficiency anemia and severe maternal morbidity: A retrospective cohort study. Annals of Epidemiology. 2024;100:10-5.
17. Aringazina R, Kurmanalina G, Bazargaliyev Y, Kononets V, Kurmanalin B, Bekkuzhin A. Impact of anemia in pregnant women on the neonatal conditions. Open Access Macedonian Journal of Medical Sciences. 2021;9:1185-8.
18. Lao TT, Wong LL, Hui SYA, Sahota DS. Iron Deficiency Anaemia and Atonic Postpartum Haemorrhage Following Labour. Reproductive Sciences. 2022;29(4):1102-10.
19. Ozyurt R, Bulutlar E. Effect of Iron Deficiency Anemia on Fetal and Maternal Morbidity. Bagcilar Medical Bulletin. 2024;9(2):87-92.
20. Safarzadeh S, Banihashemi F, Montazeri F, Roozbeh N, Darsareh F. Maternal and Neonatal Outcomes of Iron Deficiency Anemia: A Retrospective Cohort Study. Cureus. 2023;15(12):e51365.
21. ElAlfy MS, Ali El-Farrash R, Mohammed Taha H, Abdel Rahman Ismail E, Ahmed Mokhtar N. Auditory brainstem response in full-term neonates born to mothers with iron deficiency anemia: relation to disease severity. Journal of Maternal-Fetal and Neonatal Medicine. 2020;33(11):1881-8.
22. Arica G, Davutoglu EA, Buldum D, Kucuksuleymanoglu D, Najmeddin S, Madazli R. Fetal Fornix-Hippocampus Complex and Hippocampus Height Measurements Between 18 and 24 Weeks of Gestation and the Effect of Maternal Iron Deficiency Anemia. J Clin Ultrasound. 2025;53(6):1288-95.
23. Berenji F, Shamsian SA, Teimourisani Z, Bagherpoor MR, Zarean M, Jamali J, et al. Assessment of Blastocystis hominis as a Risk Factor for Iron Deficiency Anemia in Pregnant Women. Iranian Journal of Parasitology. 2025;20(1):75-82.
24. Long XJ, Chen CW, Sun N, Yang GY, Chen CH. Study on the correlation between maternal iron deficiency anemia and ROP in premature or low birth weight infants. [Chinese]. International Eye Science. 2022;22(5):853-7.
25. Mohamed KJ, Yaqoub NK. Maternal Iron Deficiency Anemia as A risk Factor for Preterm Labor in Salaheddin Governorate, Iraq, 2022. NeuroQuantology. 2022;20(11):1024-31.
26. Zhao B, Sun M, Wu T, Li J, Shi H, Wei Y. The association between maternal anemia and neonatal anemia: a systematic review and meta-analysis. BMC Pregnancy Childbirth. 2024;24(1):677.
27. Cantor AG, Holmes R, Bougatsos C, Atchison C, DeLoughery T, Chou R. Screening and supplementation for iron deficiency and iron deficiency anemia during pregnancy: updated evidence report and systematic review for the US Preventive Services Task Force. Jama. 2024;332(11):914-28.
28. Luik K, Rull K. Anaemia and iron supplement usage in pregnancy: association with pregnancy complications. [Estonian]. Eesti Arst. 2021;100(2):79-89.
29. Sutter C, Freundlich RE, Raymond BL, Osmundson S, Morton C, McIlroy DR, et al. Effectiveness of oral iron therapy in anemic inpatient pregnant women: a Single Center retrospective cohort study. Cureus. 2024;16(3).
30. Tan HS, Guinn NR, Fuller ME, Habib AS. The association between intravenous iron for antenatal anemia and postnatal depression: a retrospective cohort study. Archives of Gynecology and Obstetrics. 2022;306(5):1477-84.
31. Wesström J. Safety of intravenous iron isomaltoside for iron deficiency and iron deficiency anemia in pregnancy. Archives of Gynecology and Obstetrics. 2020;301(5):1127-31.
32. Burn MS, Lundsberg LS, Culhane JF, Partridge C, Son M. Intravenous iron for treatment of iron deficiency anemia during pregnancy and associated maternal outcomes. The Journal of Maternal-Fetal & Neonatal Medicine. 2023;36(1):2192855.

33. Oskovi-Kaplan ZA, Kilickiran H, Buyuk GN, Ozyer S, Keskin HL, Engin-Ustun Y. Comparison of the maternal and neonatal outcomes of pregnant women whose anemia was not corrected before delivery and pregnant women who were treated with intravenous iron in the third trimester. Archives of Gynecology and Obstetrics. 2021;303(3):715-9.
34. Dorsamy V, Bagwandeen C, Moodley J. The prevalence, risk factors and outcomes of anaemia in South African pregnant women: a systematic review and meta-analysis. Systematic Reviews. 2022;11(1) (no pagination).
35. Keats EC, Oh C, Chau T, Khalifa DS, Imdad A, Bhutta ZA. Effects of vitamin and mineral supplementation during pregnancy on maternal, birth, child health and development outcomes in low- and middle-income countries: A systematic review. Campbell syst. 2021;17(2):e1127.
36. Oh C, Keats EC, Bhutta ZA. Vitamin and mineral supplementation during pregnancy on maternal, birth, child health and development outcomes in low-and middle-income countries: A systematic review and meta-analysis. Nutrients. 2020;12(2) (no pagination).
37. Toolan M, Barnard K, Lynch M, Maharjan N, Thapa M, Rai N, et al. A systematic review and narrative synthesis of antenatal interventions to improve maternal and neonatal health in Nepal. AJOG Global Reports. 2022;2(1) (no pagination).
38. Abioye AI, Hughes MD, Sudfeld CR, Premji Z, Aboud S, Hamer DH, et al. The effect of iron supplementation on maternal iron deficiency anemia does not differ by baseline anemia type among Tanzanian pregnant women without severe iron deficiency anemia. European Journal of Nutrition. 2023;62(2):987-1001.
39. Dixit R, Mittal A, Singhal P, Dey S. Evaluation of the Effect of Iron Sucrose and Ferrous Ascorbate for the Treatment of Anaemia during Pregnancy: A Randomised Controlled Trial. International Journal of Pharmaceutical and Clinical Research. 2023;15(7):409-14.
40. Prasad S, Rukhaiyar N. A Hospital-Based Assessment of the Impact of Corrected Maternal Anemia on Perinatal Outcome its Comparison with Babies Born to Anemic Mothers. International Journal of Pharmaceutical and Clinical Research. 2023;15(1):170-6.
41. Zhang L, Ma S, Dai F, Li Q, Wu L, Yu L, et al. Anemia in pregnancy and sleep of 6-month-old infants: A prospective cohort study. Frontiers in Nutrition. 2023;10:1049219.
42. Thomas MS, Demirchyan A, Khachadourian V. How Effective Is Iron Supplementation During Pregnancy and Childhood in Reducing Anemia Among 6-59 Months Old Children in India? Frontiers in Public Health. 2020;8:234.
43. Hansen R, Spangmose AL, Sommer VM, Holm C, Jørgensen FS, Krebs L, et al. Maternal first trimester iron status and its association with obstetric and perinatal outcomes. Archives of Gynecology and Obstetrics. 2022;306(4):1359-71.
44. Naidoo P, Frawley N, Mol BW. PRISM study—Pre-natal iron deficiency screening and management within an Australian regional centre. Australian Journal of Rural Health. 2023;31(4):744-57.
45. Purcell S, Beckmann M. The utility of routine screening for anaemia at 36 weeks gestation. Australian and New Zealand Journal of Obstetrics and Gynaecology. 2022;62(4):610-3.
46. Flores CJ, Sethna F, Stephens B, Saxon B, Hong FS, Roberts T, et al. Improving patient blood management in obstetrics: snapshots of a practice improvement partnership. BMJ Open Quality. 2017;6(1):e000009.
47. Abdulrehman J, Lausman A, Tang GH, Nisenbaum R, Petrucci J, Pavenski K, et al. Development and implementation of a quality improvement toolkit, iron deficiency in pregnancy with maternal iron optimization (IRON MOM): a before-and-after study. PLoS Medicine. 2019;16(8):e1002867.
48. Department of Health, Government of South Australia. South Australia Perinatal Practice Guidelines Anaemia in Pregnancy. .

49. Department of Health. Clinical Practice Guidelines: Pregnancy Care. Canberra: Australian Government Department of Health, 2019.
50. Pavord S, Daru J, Prasannan N, Robinson S, Stanworth S, Girling J, et al. UK guidelines on the management of iron deficiency in pregnancy. Br J Haematol. 2020.
51. NICE. Antenatal Care. Routine Care for the Healthy Pregnant Woman. National Collaborating Centre for Women's and Children's Health. Commissioned by the National Institute for Health and Clinical Excellence. London: RCOG Press, 2008.
52. RANZCOG (2008 modified 2019). Vitamin and Mineral Supplementation in Pregnancy. .
53. Australian Red Cross Lifeblood, Sethna F, Stephens B, Crispin P. Haemoglobin assessment and optimisation in maternity. Australian Red Cross Lifeblood. 2019.
54. NACCHO/RACGP. National guide to a preventive health assessment for Aboriginal and Torres Strait Islander people –, 2nd edition. South Melbourne: The RACGP, 2012.
55. Mater Mothers Hospital. Antenatal Appointment Schedule for Normal Healthy Women with Singleton Pregnancies. Mater Misericordiae Health Services Brisbane.
56. Cantor A, Holmes R, Bougatsos C, Atchison C, DeLoughery T, Chou R. Screening and routine supplementation for iron deficiency anemia in pregnancy: an updated sys-tematic review for the U.S. Preventive Services Task Force. Agency for Healthcare Research and Quality. 2024;8.