Improving Consistency in Midwifery Screening and Management of Antepartum Iron Deficiency Anemia: A Quality Improvement Project

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Problem Description

Iron deficiency anemia (IDA) is the most common hematologic disorder in pregnancy and is defined as a type of microcytic anemia that occurs when iron stores are insufficient to meet the body's needs for hemoglobin production, resulting in a reduced ability of red blood cells to carry oxygen (American College of Gynecologists and Obstetricians [ACOG], 2020). According to the American College of Obstetricians and Gynecologists (ACOG), iron deficiency (ID) is the primary cause of anemia in pregnancy, and, without adequate treatment, often will progress to IDA (ACOG, 2020). The diagnosis of IDA during pregnancy is based on low hemoglobin ferritin levels. Anemia is defined as hemoglobin concentrations below trimester-specific thresholds: less than 11g/dL in the first and third trimesters, and less than 10.5 g/dL in the second trimester. Confirmatory evidence of iron deficiency includes a serum ferritin level below 15-30 ng/mL, depending on the guideline used. Additional supportive findings include a mean corpuscular volume (MCV) below 80 fL, elevated serum transferrin receptor levels, or a poor hematologic response to iron supplementation (Camaschella, 2015). Together, these findings distinguish IDA from other types of anemia in pregnancy.

Pregnancy increases iron demands approximately threefold due to fetal development, the expansion of maternal blood volume, placental growth, and postpartum blood loss (Sangkhae et al., 2023). Total daily needs rise from about 1 mg/day of absorbed iron in the first trimester to 6-7.5 mg/day in the third trimester (Milman, 2011). The recommended dietary allowance during pregnancy is 27 mg of elemental iron daily, substantially higher than the 15-18 mg recommended for non-pregnant people of reproductive age assigned female at birth (Cochrane et al., 2022, US Preventive Services Task Force, 2024). Without adequate supplementation or early detection, iron stores can become depleted and potentially progress to IDA. Moreover,

physiologic changes during pregnancy, like hemodilution, can further obscure the detection of IDA, and make early diagnosis difficult. The signs and symptoms of iron deficiency in pregnancy can include feelings of fatigue, difficulty focusing, and dizziness, with more severe cases progressing to iron deficiency anemia, which may symptomatically present with shortness of breath, restless leg syndrome, tachycardia, postpartum depression and impaired cognitive function (Shi et al., 2022, Corwin et al., 2003). Recent research underscores a significant association between IDA during pregnancy and an increased risk of postpartum hemorrhage (PPH) (Lao et al., 2022).

The challenge is further compounded by conflicting clinical guidelines. The U.S. Preventive Services Task Force (USPSTF) concludes that there is insufficient evidence to recommend universal screening for iron deficiency in asymptomatic pregnant individuals (US Preventive Services Task Force, 2024). This conclusion reflects an absence of trials directly comparing universal screening and treatment strategies versus no universal screening methods for anemia in pregnant populations. In this way, the USPSTF found no direct evidence evaluating the clinical effectiveness of screening for iron deficiency anemia in primarily asymptomatic pregnant individuals. The USPSTF notes that existing randomized control trials (RCTs) primarily evaluating universal iron supplementation regardless of screening status, demonstrated consistent improvement in laboratory measures such as hemoglobin and ferritin, but inconsistent or minimal effects on clinically meaningful differences in outcomes, such as incidence of postpartum hemorrhage, blood transfusion, hypertensive disorders, preterm delivery, low birth weight, and neonatal morbidity or mortality (US Preventive Services Task Force et al., 2024). The RCT evidence underlying the USPSTF's conclusion that iron supplementation does not consistently improve maternal or infant outcomes has important

limitations. Most trials were conducted in high-income settings, enrolled predominately low-risk, asymptomatic pregnant individuals, and evaluated universal iron supplementation rather than treatment targeted to those with documented iron deficiency or iron deficiency anemia. The USPSTF does not recommend against screening for iron deficiency anemia in pregnancy but instead issued an "I statement," indicating there is insufficient evidence to determine whether universal screening improves maternal or infant outcomes. As a result, the USPSTF cannot confirm that screening all pregnant individuals is more beneficial than treating those who are symptomatic or high-risk (US Preventive Services Task Force et al., 2024).

ACOG, the Centers for Disease Control and Prevention (CDC), and the International Federation of Gynecology and Obstetrics (FIGO) offer differing recommendations. ACOG advises screening for anemia with a CBC in the first and third trimesters, followed by ferritin testing only if anemia is detected (ACOG 2020). The CDC endorses universal anemia screening and iron supplementation during pregnancy, citing evidence that iron deficiency alone, prior to the development of anemia, can still result in adverse maternal and fetal outcomes (CDC, 1998). FIGO supports the assessment of both hemoglobin and iron status as early as possible and again between 26 and 28 gestational weeks (International Federation of Gynecology and Obstetrics, 2023).

These inconsistencies lead to confusion in clinical practice and disparities in care. Without a unified, evidence-based approach, some providers may delay or miss early intervention, while others may overtreat or rely on less sensitive diagnostic tools. This lack of standardization also creates insurance and access barriers, particularly for intravenous (IV) iron therapy, which can be crucial for patients who cannot tolerate side-effects or absorb oral iron.

Although the USPSTF concludes that there is insufficient evidence to recommend universal screening for iron deficiency anemia in asymptomatic pregnant individuals, primarily due to the absence of studies directly evaluating screening pathways, other professional and public health organizations like the CDC, ACOG, and FIGO continue to endorse routine screening. These organizations emphasize the physiological plausibility that early detection and treatment of iron deficiency can improve maternal well-being and perinatal outcomes, the simplicity and low cost of screening, and the potential equity implications of relying on symptom-based, reactive testing rather than proactive universal screening. Given that this discordance illustrates the gap between research evidence and pragmatic clinical or public health approaches, it is imperative to reevaluate the current patchwork of recommendations and standardize uniform, proactive iron deficiency anemia screening and management practices to ensure equitable, timely, and effective care.

Available Knowledge

Iron Deficiency

Iron deficiency is both a common and consequential health concern in pregnancy. Despite widespread use of iron-containing prenatal supplements, the overall estimated prevalence of iron deficiency during pregnancy is greater than 50% in North America (Benson et al., 2024). Iron plays a critical role in both maternal and fetal health, as fetal iron is derived from maternal iron stores, even if this consequentially results in iron deficiency in the pregnant person. Because maternal iron is preferentially used to support blood formation, adverse effects of iron deficiency on fetal muscular and neurologic development can occur before the development of anemia in the pregnant person (Georgieff, 2023). Symptomatic individuals with iron deficiency may experience aggravating to debilitating fatigue, pagophagia, irritability, dyspnea, headache,

hair loss, poor concentration, and restless leg syndrome (Benson et al., 2022). Despite the expected physiologic expansion of red blood cell mass by 25% and blood volume expansion by approximately 50%, iron deficiency is a pathologic, not physiologic condition in pregnancy. While hemodilution in pregnancy leads to an expected decrease in hemoglobin concentration, true iron deficiency reflects inadequate iron availability to meet the demands of both maternal erythropoiesis and fetal development. This can impair red blood cell production, compromise oxygen delivery to the fetus, and contribute to adverse outcomes such as iron deficiency anemia, preterm birth, placental hypertrophy, and maternal hypothyroidism (Benson et al., 2022).

A prospective cohort study of non-anemic, primiparous pregnant Irish women with low-risk, singleton pregnancies were evaluated for iron deficiency at fifteen, twenty, and thirty-three weeks of gestation. Using a serum ferritin cutoff of <15 ng/L, 4.5% of individuals were iron deficient at 15 weeks, with 51.2% becoming iron deficient by 33 weeks. Using a serum ferritin threshold of <30 ng/mL, 20.7% of individuals were iron deficient at 15 weeks, with 83.8% developing iron deficiency by the third trimester (McCarthy et al., 2024). Despite 73.6% of individuals reporting oral iron supplementation in early pregnancy, the research highlights the strain that can commonly be placed on maternal iron levels, even in high-resourced populations with access to oral iron supplementation therapies. Furthermore, the study speaks to the ineffectiveness of oral iron in treating iron deficiency, largely due to its poor bioavailability as well as adverse gastrointestinal symptoms, which may inhibit patient adherence (Benson et al., 2023). In the United States, a 2021 study found that the highest prevalence of pregnant individuals with iron deficiency occurred in Mexican American (20.5%) and non-Hispanic Black women (19.9%) (Campbell et al., 2021), emphasizing the racial and ethnic disparities that occur in healthcare within the United States.

Iron Deficiency Anemia

IDA is a late consequence of ID (Pasricha et al., 2021). IDA is the most common form of anemia and complicates approximately 30-60% of pregnancies globally. By the third trimester of pregnancy, nearly 75% of individuals will have either iron deficiency or iron deficiency anemia (Benson et al., 2022). IDA is a risk factor for placenta abruption, preeclampsia and eclampsia, preterm labor, preterm birth, low birth weight, small for gestational age (SGA) babies, postpartum hemorrhage, as well as increases the risk of maternal, perinatal, and neonatal mortality (Daru et al., 2018, Hamm et al., 2022, Rahmati et al., 2020). Maternal consequences of IDA may also include an increased risk of abnormal thyroid function, cesarean birth, antenatal and postnatal maternal sepsis, poor wound healing, cardiac failure, and need for blood transfusion (Benson et al., 2022). These complications of IDA are rooted in the essential physiological roles of iron in oxygen transport, cellular metabolism, and immune function. Abnormal thyroid function can arise due to iron's role as a cofactor for thyroid peroxidase, the enzyme required for thyroid hormone synthesis. Iron deficiency impairs this enzyme, leading to reduced thyroxine (T4) production and an increased risk of hypothyroidism and thyroid autoimmunity during pregnancy (Moreno-Reyes et al., 2021). The risk of cesarean birth as well as the need for blood transfusion increases in patients with IDA due to the proposed mechanisms of impaired myometrial contractility due to tissue hypoxia, which may contribute to the severity of a postpartum hemorrhage. (Lao et al., 2022). Ajepe et al. recorded six-fold odds of peripartum blood transfusion among participants with IDA compared to non-anemic pregnant individuals (Ajepe et al., 2020). Antenatal and postnatal maternal sepsis and poor wound healing are consequences of impaired immune function and tissue oxygenation. Iron is critical for the proliferation and function of immune cells, including neutrophils and lymphocytes;

subsequently, IDA can lead to decreased phagocytic activity and reduced cytokine production, which collectively compromise the maternal immune response and increase susceptibility to infections, including puerperal sepsis and wound infections after cesarean birth (Benson et al., 2022). Additionally, IDA reduces oxygen delivery to tissues, further impairing wound healing and local immune defense, thereby increasing the risk of infectious complications. These mechanisms are supported by clinical data exemplifying higher rates of maternal infectious morbidity, such as puerperal pyrexia and wound infection in patients with IDA (Ajepe et al., 2020).

IDA in pregnancy increases the risk of PPH through two key mechanisms: the impairment of adequate oxygen transference as well as decreased coagulation function. Iron deficiency anemia can impair oxygen delivery to tissues, potentially compromising uterine muscle function, increasing the risk of uterine atony, the leading cause of PPH. A retrospective cohort study investigated the relationship between IDA and the risk of atonic PPH. Pregnant individuals with IDA had a higher incidence of total PPH (4.5 % versus 3.2%, $p = 0.024$) and atonic PPH (3.1% versus 2.0%, $p = 0.011$) compared to those without IDA. Adjusting for confounding factors such as age, body mass index, parity, the incidence of induction or augmentation of labor, instrumental delivery, and cesarean delivery, researchers demonstrated IDA to be independently associated both with total PPH (adjusted relative risk, aRR: 1.455, 95% confidence ratio, CI: 1.040-2.034) and atonic PPH (aRR: 1.588, 95% CI: 1.067-2.364) (Lao et al., 2022).

Furthermore, IDA can adversely influence and impair coagulation function (Nair et al., 2021). According to Nair et al., pregnant individuals with IDA often exhibit significant changes in coagulation profiles, including prolonged prothrombin time (PT) and activated partial thromboplastin time (aPTT), indicating impaired blood clotting mechanisms. The researchers

suggest that the higher incidence of PPH in anemic individuals indicates that IDA may compromise hemostasis, thereby increasing the risk of excessive bleeding at birth. They found pregnant individuals with severe anemia (Hb <7 g/dL) to have D-dimer levels 27% higher and average fibrinogen levels to be 117 mg/dL lower than individuals in the study with no or mild anemia. The D-dimer to fibrinogen ratio was 69% higher for individuals with severe anemia, indicating a marked increase for potential clot instability due to the patient's hypofibrinolytic state. Overall, the researchers found low hemoglobin and elevated international normalized ratio (INR) to be independently associated with an increased risk of PPH. The research indicated a graded increase in INR with increasing anemia severity, due to elevated INR levels signifying an impairment in adequate clot formation, ultimately worsening coagulation and hemostasis in the patient (Nair et. al, 2021).

Screening Methods, Clinical Assessment, and Diagnostic Criteria

Iron Deficiency

Ferritin is an intracellular protein that stores and releases iron; its serum concentration subsequently reflects the amount of iron stored in the body. Ferritin is the most specific and sensitive biomarker for detecting depleted iron stores before the development of anemia (Garcia-Casal et al., 2021). The USPSTF highlights the lack of consensus on ferritin cutoffs and states the evidence is insufficient to recommend for or against routine ferritin screening for iron deficiency (USPSTF, 2024). Both the CDC and ACOG recommend ferritin screening for iron deficiency levels specifically in the presence of anemia (ACOG, 2021, CDC, 1998). Both organizations consider a ferritin level <30 ng/mL diagnostic of iron deficiency. FIGO does not publish formal diagnostic criteria, however clinical opinion in the FIGO journal supports serum ferritin <30 ng/mL as a diagnostic threshold for iron deficiency in pregnancy and suggests that

percent transferrin saturation (TSAT) may be more reliable in early pregnancy, due to inflammatory processes of pregnancy that may acutely inflate serum ferritin levels. FIGO states that routine reassessment of hemoglobin and iron status should be assessed as early as possible, with reassessment occurring at the end of the second trimester, preferably between 26 and 28 weeks. By emphasizing that anemia is a late sign of ID, FIGO states that a CBC should not be relied upon to assess iron status, and ID, with or without IDA, should be appropriately treated (International Federation of Gynecology and Obstetrics, 2023). This statement is further supported by Chao et al., as their research demonstrates that hemoglobin and MCV are poor predictors of iron deficiency throughout pregnancy. They conducted a retrospective analysis of 20,550 pregnancies from 2009 to 2022 at the University of California, San Francisco. They determined that by screening for first-trimester iron deficiency via detection of microcytosis or anemia, 59 out of 100 patients with iron deficiency will go undetected. According to authors, "this screening failure becomes even more concerning as pregnancy progresses and iron deficiency becomes more prevalent (Chao et al., 2025)." The study concluded that relying on CBC parameters for detecting iron deficiency in pregnancy could result in a significant number of missed diagnoses. The authors suggest that a direct measurement of ferritin levels may be a more effective screening approach, aligning with the recommendations of FIGO.

In contrast to guidelines in the United States, the British Society for Haematology (BSH) endorses either prophylactic, empirical iron supplementation and/or the measurement of serum ferritin in non-anemic pregnant people at risk for iron deficiency. This may include patients with a history of anemia, multiparity ≥P3, twin gestation, interpregnancy interval <1 year, inaccessibility to iron-rich foods, a vegan or vegetarian diet, teenage pregnancy, or a recent history of clinically significant bleeding. For non-anemic patients with a high-risk of bleeding

during pregnancy or birth or who may decline blood products due to religious practices, serum ferritin may be necessary. Serum ferritin should be measured in patients with a known hemoglobinopathy to identify ID as well as prevent iron overload. BHS considers a serum ferritin <30 ng/mL to be diagnostic of iron deficiency in pregnancy, and further states that clinical symptoms such as fatigue, irritability, and poor concentration cannot be relied upon for diagnostic purposes (Pavord et al., 2020).

In 2024, the Iron Consortium at Oregon Health & Science University (OHSU) convened an international panel of twenty-six experts in hematology, primary care, pediatrics, obstetrics, gastroenterology, cancer, and patient advocacy to facilitate evidence-based guidelines regarding the management and treatment of iron deficiency and iron deficiency anemia. They concluded that for individuals who are planning pregnancy or are currently pregnant and have confirmed iron deficiency with or without anemia, treatment is recommended to prevent adverse maternal and fetal consequences of iron deficiency anemia. Laboratory confirmation of iron deficiency is further recommended before initiating treatment. Hemoglobin levels should be assessed four weeks after starting therapy, regardless of route, to evaluate efficacy and tolerability. The expert consensus guidelines from the Iron Consortium recommends oral supplementation as first-line therapy in the first trimester, and intravenous iron in the second and third trimesters for correction of iron deficiency. No specific guidance is provided on iron formulation selection for neonatal outcomes (Benson et al., 2025).

Iron Deficiency Anemia

While the USPSTF does not recommend for or against screening for anemia in pregnant individuals, the CDC, ACOG, and the American Academy of Family Physicians (AAFP) recommend all pregnant people be screened for anemia with a CBC at their first prenatal visit,

preferably during the first trimester of pregnancy and again in the third trimester (ACOG, 2021, Short, 2013, CDC, 1998). Both the CDC and ACOG consider a hemoglobin less than 11.0 g/dL in the first and third trimesters and less than 10.5 g/dL in the second trimester to meet diagnostic criteria for iron deficiency anemia in pregnancy. If a patient meets criteria for anemia, ACOG recommends clinicians first determine the cause and subsequently recommend low-dose supplemental iron for those with iron deficiency anemia. IV iron therapy is not recommended during the first trimester of pregnancy due to a lack of robust safety data for IV iron use in early gestation. The recommended approach to reserving IV iron for later trimesters when oral iron is not tolerated, absorbed, or effective is based on the principle that the first trimester is a critical period for organogenesis, and minimizing exposure to parenteral medications with uncertain fetal safety profiles is prudent (Achebe & Gafter-Gvili, 2017).

Regardless of anemia, the CDC recommends universal supplementation for all pregnant individuals with an oral low-dose iron supplement (30 mg/d). Similarly, ACOG also recommends universal supplementation with low-dose iron, except in the setting of conditions such as hemochromatosis.

For patients experiencing anemia, BHS recommends serum ferritin testing prior to iron supplementation, especially if there is a known hemoglobinopathy. If anemia without an obvious other cause is detected, a diagnostic trial of oral iron should be given without delay, with a repeat CBC in 2-3 weeks. As similarly defined by FIGO, ACOG, and the CDC, anemia according to the BHS is defined as hemoglobin levels below 11.0 g/dL in the first trimester, and 10.5 in the second and third trimester. Intravenous iron is recommended in cases where oral iron is not tolerated, in patients with a hemoglobin <10 g/dL, if there is no response to oral iron after two weeks, or if the individual is beyond 34 weeks pregnant.

The OHSU Iron Consortium guidelines recommend confirming iron deficiency as the underlying cause of anemia through laboratory testing. Additionally, a low TSAT (<20%) and an elevated soluble transferrin receptor (sTfR) level (>4.4 mg/L) may further support the diagnosis of IDA. Patients who are treated with intravenous iron should be reassessed four weeks after the infusion to evaluate the treatment response. For those treated with oral iron, clinicians should assess both the tolerability and hemoglobin response after four weeks of beginning treatment. If the individual is unable to tolerate oral iron, or if the hemoglobin response is insufficient, a transition to IV iron is recommended during the second or third trimester (Benson et al., 2025).

Rationale

The Model for Improvement (MFI) is a framework established by the Institute for Healthcare Improvement (IHI) as a means of accelerating focused improvement within a given organization. The model is built around three essential questions that guide participants: What are we trying to accomplish? How will we know that a change is an improvement? And what change can we make that will result in improvement? The MFI framework then utilizes a Plan-Do-Study-Act (PDSA) cycle as a way of creating change that is systematic, structured, and sustainable. Utilizing a PDSA cycle approach, the evidence-based interventions can be continuously refined, providing ongoing learning opportunities throughout the project as a means of providing more focused workflow implementation strategies surrounding ferritin screening in the antepartum period. The IHI aligns closely with the Knowledge-to-Action (KTA) framework by offering practical tools and strategies that support the translation of evidence into practice (Graham et al., 2006). While the KTA framework provides a structured process for moving knowledge through stages of creation, adaptation, implementation, and sustainability, IHI's MFI and PDSA cycles offer a complementary method for testing and refining changes throughout the

duration of the project. Both frameworks emphasize the importance of stakeholder engagement and iterative learning. IHI's focus on clear aims, measurement, and small-scale testing complements the KTA framework's broader action cycle, particularly in areas such as assessing barriers, tailoring interventions, and evaluating outcomes (Centers for Disease Control and Prevention, 2014). Together, these approaches support sustained practice change by linking evidence with continuous quality improvement.

Variability in the screening and management of iron deficiency during pregnancy can lead to delayed treatment and progression to iron deficiency anemia, increasing the risk of adverse maternal and fetal outcomes. To address this practice gap, a root cause analysis was conducted, (Appendix A) followed by interviews with nurse-midwives to identify contributing factors that result in inconsistencies in the clinical management of iron deficiency and iron deficiency anemia. In alignment with recent expert consensus supporting the treatment of iron deficiency with or without anemia to prevent the adverse effects of iron deficiency anemia, an evidence-based flowchart for antepartum screening and management was developed. This approach standardized key management strategies, including the use of a defined ferritin threshold and trimester-specific treatment recommendations that focused on treating iron deficiency with oral iron in the first trimester and IV iron in the second and third (Benson et al., 2025). Implementation of this standardized pathway aimed to reduce progression to iron deficiency anemia, as well as the symptoms or complications that often may be associated with it.

Specific Aims

- By September 22, 2025, 70% of the nurse-midwives will complete a pre-intervention survey assessing iron deficiency and iron deficiency anemia clinical practices and preexisting knowledge of screening practices, treatment modalities, and prenatal education.
- By November 5, 2025 (end of PDSA cycle 1), 60% of patients seen by nurse-midwives and SNMs will have charted that they utilized the antepartum anemia flowchart and provided appropriate screening, offered treatment options, and provided patient education to all eligible patients.
- By December 17, 2025 (end of PDSA cycle 2), 80% of midwives and SNMs will have charted that they utilized the antepartum anemia flowchart and provided appropriate screening, offered treatment options, and provided patient education to all eligible patients.
- By January 7, 2025, 80% of the midwives will complete a post-intervention survey on understanding, implementation, and documentation of antepartum anemia in the outpatient setting.

Context

This quality improvement project took place within the nurse-midwifery practice of a large academic healthcare center in the Pacific Northwest. Primary stakeholders in this project consisted of twelve midwives with full-time equivalent (FTE) employment status, eight per diem midwives, and thirteen student nurse midwives (SNMs). During the 2025 fiscal year, the group had 567 births, of which 455 were considered normal spontaneous vaginal deliveries, and provided care for 1,209 patients in clinic. Among these patients, 22.55% were covered by private

insurance (including 19.87% were covered by Blue Cross, 1.24% were commercially insured, 1.05% had Tricare, and 0.39% were self-pay), 53.74% were covered under Managed Care plans, and 23.71% were covered by public insurance programs (23.55% Medicaid and 0.16% Medicare). Between January 1 and June 30, 2025, of the 881 patients seen, 197 (22%) were diagnosed with “low ferritin”, “iron deficiency”, or “anemia complicating pregnancy.”

Methods

Interventions

The primary deliverable of this QI project consisted of an evidence-based flowchart (Appendix B) outlining a standardized approach to the screening and management of both iron deficiency and iron deficiency anemia, beginning at the patient’s first prenatal appointment. The flowchart was posted at midwifery workstations throughout the project site. Patients presenting with a ferritin level <30 ng/mL and hemoglobin concentration >11 g/dL were identified as having ID. In such cases, the diagnosis of “low ferritin” was added to the patient’s problem list. The midwife then used the SmartPhrase .CNMIDACHECKLIST (Appendix C) in the “problem description” within the “low ferritin” section of the patient’s problem list. The SmartPhrase (.CNMIDACHECKLIST) included a checklist of interventions that allowed midwives to track if ferritin was drawn at the first prenatal visit, if ferritin and CBC retesting was scheduled if indicated four weeks after initial screening, if oral iron was recommended, if IV iron was recommended, and if ferritin labs were drawn and reviewed in the third trimester. As patients continued with their prenatal care, midwives returned to the patient’s problem list and checked-off what had been done to manage their ID or IDA.

For patients with a ferritin less than 30 ng/mL at their initial prenatal care visit, providers were prompted based on the IDA flowchart posted in clinical rooms and office spaces to

immediately initiate oral iron therapy on as well as provide education on proper iron supplementation in patients' after visit summary (AVS), such as specifically avoiding caffeine and calcium within one to two hours of iron administration. If patients were past their first trimester, the flowchart instead prompted providers to immediately recommend IV iron therapy instead of an oral iron regimen. If patients were recommended oral iron, providers then placed an order to repeat ferritin and CBC labs four weeks after initiating oral iron therapy to monitor and reassess ferritin, hemoglobin, and hematocrit levels and evaluate for potential intolerances to treatment. After the first trimester, if ferritin levels remain at or below 30 ng/mL, providers were recommended to discontinue oral iron and initiate IV iron therapy to more effectively correct iron deficiency. At 28 weeks' gestation, ferritin levels were reassessed in conjunction with routine third-trimester laboratory testing to evaluate for persistent ID or progression to IDA. Within the new obstetric progress note (NOB), the SmartPhrase .CNMNEWOBIRON was added to aid in streamlining documentation of ferritin screening, retesting if indicated, and iron therapies utilized. During the 24-28 week prenatal visit, midwives used the SmartPhrase .CNMTHIRDTRIMESTERIRON to document ferritin screening and treatment in the third trimester.

The QI project was implemented from October 1, 2025, to December 17, 2025, during which two PDSA cycles took place: PDSA Cycle 1 began on October 1 and ended November 5, and PDSA Cycle 2 started November 12 and ended on December 17. Three weeks prior to the start of the intervention, midwives completed a pre-intervention survey (Appendix D) to assess their knowledge, clinical decision making, and level of satisfaction with the current practice management of prenatal ID and IDA. One week prior to the start of the intervention, SNMs and midwives received a voiceover presentation providing a comprehensive overview of the project,

including the literature review, project goals, plan for implementation, and expected outcomes. In healthcare systems, a SmartPhrase is a text shortcut that expands into reusable, standardized content, potentially reducing the mental load and keeping documentation consistent among providers. Three SmartPhrases(Appendix C) were developed to aid in effective documentation of the screening and treatment of ID and IDA in pregnancy. Feedback was obtained based on an informal email-based question-and-answer exchanges conducted in between PDSA Cycles to identify implementation barriers and gather recommendations for improvement. Post-intervention surveys (Appendix D) were distributed electronically to evaluate changes from the pre-intervention responses and to assess midwives' satisfaction with the implemented flowchart.

Study of the Interventions

To evaluate the implementation and effectiveness of the intervention, multiple process measures were monitored throughout the project. An anonymous pre- and post-intervention survey was distributed to assess midwives' knowledge and clinical decision making regarding the practice's management of prenatal ID and IDA. In addition, weekly chart reviews of NOB patients and 24-28 week visits were conducted to track utilization of the three SmartPhrases. This also included monitoring for use of the ferritin screening at the initial prenatal visit, initiation of oral iron therapy if indicated, reassessment of ferritin after four weeks of oral iron therapy, appropriate escalation to IV iron when clinically indicated, as well as third-trimester ferritin screening.

Measures

Process measures included the number of times the midwife documented with the .CNMNEWOBIRON SmartPhrase in the NOB note as well as with the .CNMTHIRDTRIMESTERIRON SmartPhrase in the third trimester progress note where ferritin

screening was completed, reviewed, and per the IDA flowchart, and appropriately managed and reassessed as indicated. An additional process measure included the number of times the midwife added the .CNMIDACHECKLIST when “low ferritin” or “iron deficiency anemia” was added to a problem list within a patient’s chart. Outcome measures focused on changes in midwives’ knowledge and satisfaction related to the screening and management of iron deficiency and iron deficiency anemia. These measures were evaluated using pre- and post-intervention surveys administered electronically. Balancing measures assessed potential unintended consequences of the intervention, including midwives’ perceptions of increased workload and documentation burden related to implementing the flowchart. These measures were evaluated through post-intervention survey questions on workflow impact and overall satisfaction with practice changes.

Analysis

Adherence to ferritin screening done both at the NOB visit as well as with third trimester labs was measured through the use of the SmartPhrase .CNMNEWOBIRON within the patient’s NOB note, .CNMTHIRDTRIMESTERIRON within the patient’s 24-28 week prenatal visit, as well as .CNMIDACHECKLIST within their problem list if a diagnosis of low ferritin or iron deficiency anemia was made.

To evaluate for clinical relevance between PDSA cycles, adherence proportions were compared, and data was graphically displayed to illustrate performance trends. Anonymous pre- and post-intervention surveys were used to assess changes in midwives’ knowledge, clinical decision-making confidence, and satisfaction with ID and IDA management. From these gathered responses, t-tests were applied to assess for statistical significance. Balancing measures, including midwifery perceptions of workflow burden and documentation requirements, were analyzed to ensure improvements did not introduce unintended consequences. This analysis

helped clarify how the intervention influences clinical practices and helped guide future quality improvement efforts to optimize and strengthen prenatal ID and IDA management.

Ethical Considerations

The ethical considerations of screening for low ferritin center on balancing clinical benefit and health equity. The clinical benefit of screening for iron deficiency must be weighed against all potential harms. While low ferritin is a sensitive marker for iron deficiency, particularly in pregnant populations, the choice of ferritin cutoff can have significant implications. Utilizing a higher cutoff increases sensitivity but risks overdiagnosis and overtreatment, while a lower cutoff may miss clinically relevant iron deficiency, delaying intervention and potentially perpetuating complications. Health equity is also central to ethical screening considerations. Iron deficiency disproportionately affects Mexican American and non-Hispanic Black women; thus, screening strategies must be designed to reduce disparities, not exacerbate them. The USPSTF emphasizes social determinants of health, such as food insecurity, poverty, limited access to healthcare, and systemic racism contribute to disparities in iron deficiency anemia (US Preventive Services Task Force et al., 2024). In this way, screening programs must be sensitive to these factors and should aim to proactively identify and support populations at higher risk.

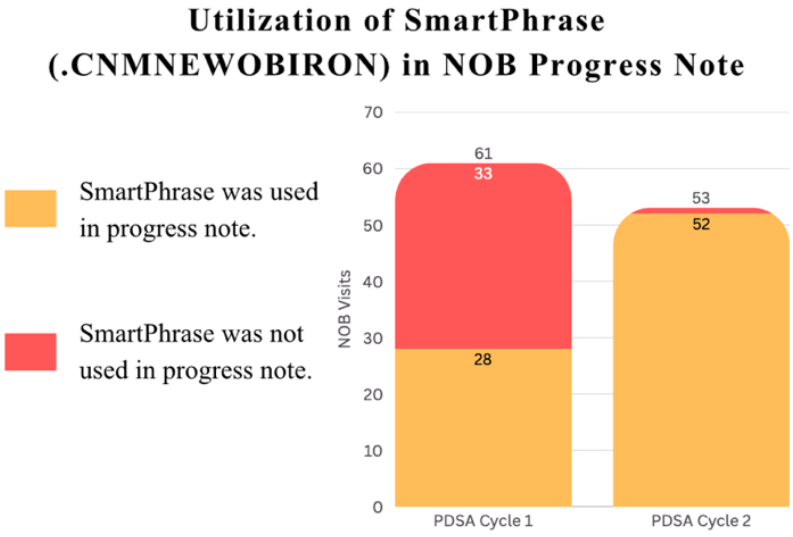
To uphold ethical standards in care, patients were de-identified, and no protected health information (PHI) was included. A request for determination was submitted to the Institutional Review Board (IRB) to confirm this project was not human research. The author has no conflicts of interest or financial relationships to disclose.

Results

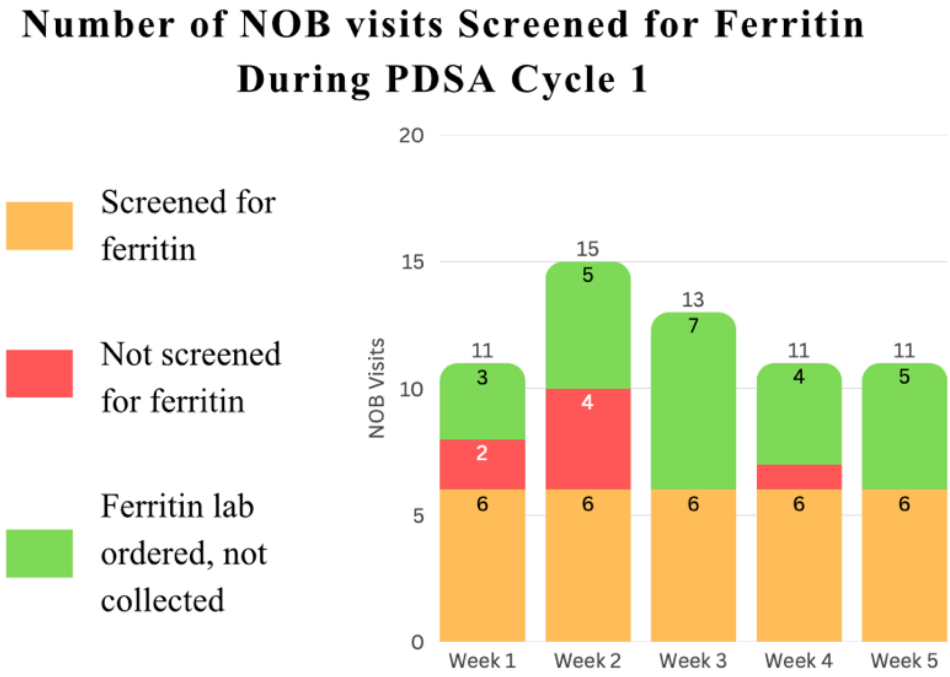
Three weeks before project implementation, an anonymous pre-survey was sent out to midwives on 9/15/26 with 9/12 (75%) completion rate. Between October 1st and December 17th, a total of 114 NOB visits were conducted along with 209 prenatal visits during the 24-32 weeks gestational age timeframe.

Ferritin Screening at NOB Visits

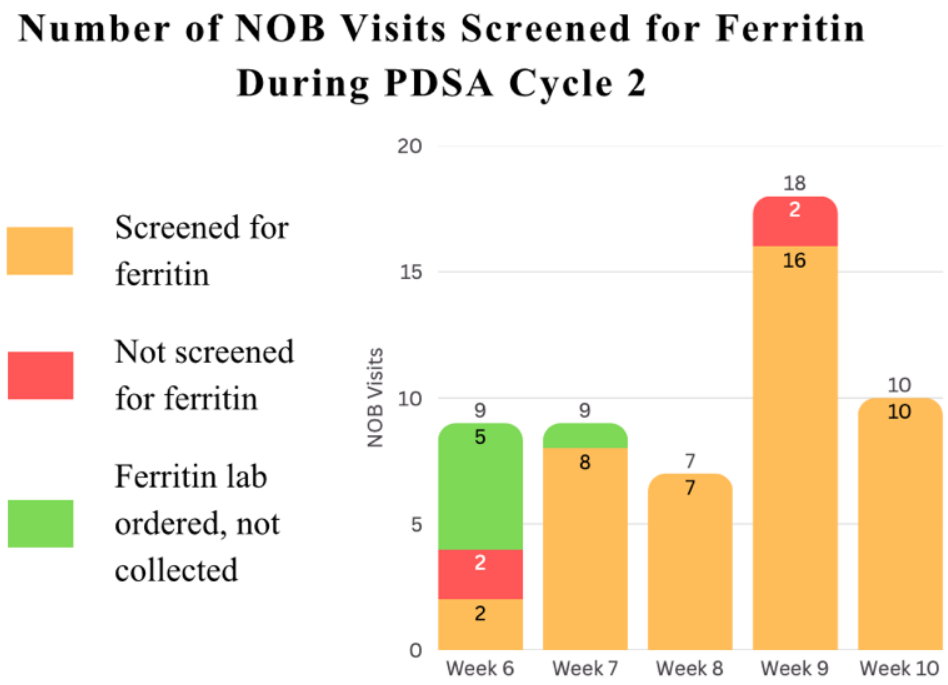
During PDSA Cycle 1, 61 NOB visits were conducted. Twenty-eight of these NOB visits (45.9%) included the .CNMNEWOBIRON SmartPhrase in the progress note. In PDSA Cycle 2, 53 NOB visits occurred, with 52 (98.1%) progress notes were documented with the .CNMNEWOBIRON SmartPhrase, demonstrating a marked improvement in documentation consistency. On 10/15/25 the SmartPhrase .CNMNOBIRON was embedded directly into the NOB template to aid midwifery staff with documentation.



Over the course of PDSA Cycle 1, 61 NOB visits were held over the course of five weeks. Ferritin was screened in 30 of those visits (49.1%); a ferritin lab was ordered, but not collected for 24 visits (39.3%), and 7 NOB visits did not order nor collect a ferritin lab (11.4%).



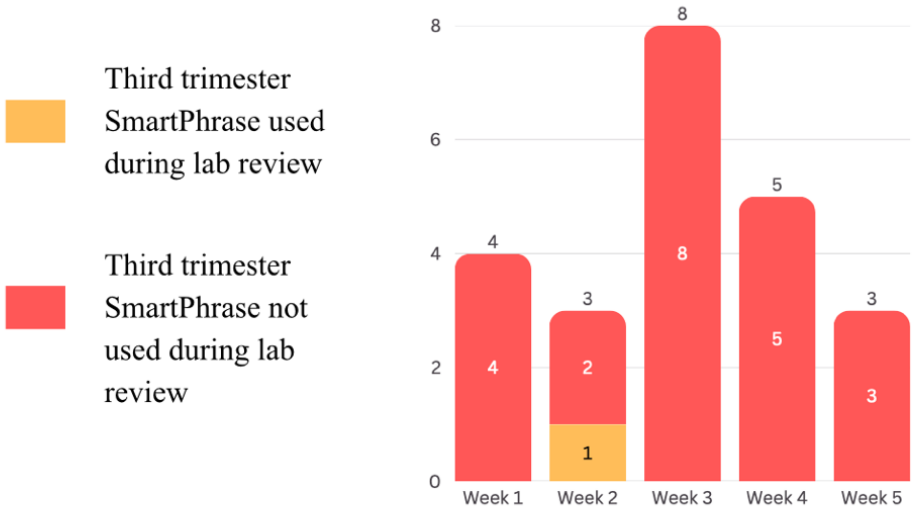
During PDSA Cycle 2, a total of 53 NOB visits were conducted throughout weeks six through ten. Ferritin was screened for at 43 visits (81.1%) and not screened for at 7 visits (13.2%). A ferritin lab was ordered but not collected in 6 visits (11.3%).



Utilization of Third Trimester SmartPhrase

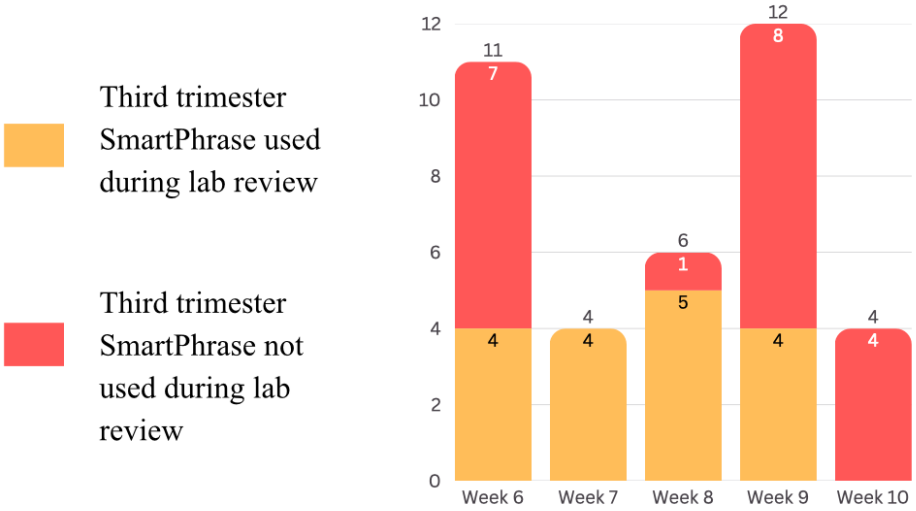
During PDSA Cycle 1, a total of 104 prenatal visits occurring between 24-32 weeks' gestation were conducted throughout weeks one through five. The SmartPhrase, .CNMTHIRDTRIMESTERIRON was indicated for 23 of those visits, and utilized once (4.3%).

Utilization of SmartPhrase (.CNMTHIRDTRIMESTERIRON) During Third Trimester Lab Review: PDSA Cycle 1



During PDSA Cycle 2, a total of 115 prenatal visits occurring between 24-32 weeks' gestation were conducted throughout weeks six through ten. The SmartPhrase .CNMTHIRDTRIMESTERIRON was indicated for 37 of those visits and was utilized 17 times (45.9%).

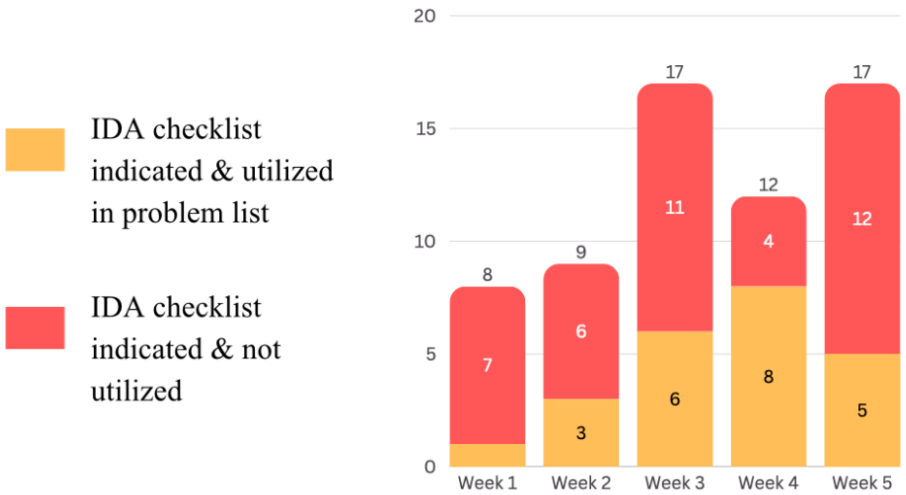
Utilization of SmartPhrase (.CNMTHIRDTRIMESTERIRON) During Third Trimester Lab Review: PDSA Cycle 2



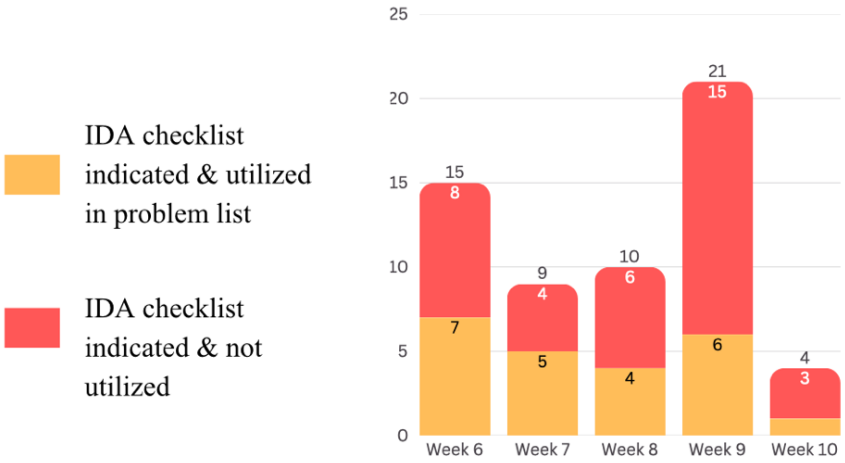
Utilization of the Iron Deficiency Anemia Checklist

During PDSA Cycle 1, application of the IDA checklist was indicated 63 times and utilized in patients' charts 23 times (36.5%). During PDSA Cycle 2, use of the IDA checklist was indicated 59 times and was applied 23 times (39.0%).

Utlization of IDA Checklist During PDSA Cycle 1



Utilization of IDA Checklist During PDSA Cycle 2



Pre-Intervention Survey Results

Pre- and post-intervention surveys were comprised of Likert-scale, multiple-choice, and open-ended questions (Appendix D), and were designed to measure attitudes, confidence, and satisfaction, evaluate clinical decision-making and practice patterns, and obtain qualitative feedback and recommendations.

Pre-intervention survey results demonstrated that while most providers expressed general satisfaction with the practice's current approach to prenatal iron deficiency screening (88.9%), only 33.3% of responders agreed or strongly agreed that there was a consistent ferritin screening process within the practice. Four out of nine (44.4%) midwives reported ordering a ferritin lab for a NOB visit. Similarly, four out of nine (44.4%) reported ordering a ferritin lab along with a CBC four weeks after initiating PO iron therapy. Six out of nine midwives (66.7%) reported ordering a ferritin lab in addition to other third trimester labs. One midwife (11.1%) reported not typically ordering a ferritin lab prenatally, and two providers (22.2%) selected "other" as their

response.

Six out of nine midwives (66.7%) reported using a ferritin threshold below 30 ng/mL to initiate treatment for low ferritin with oral iron supplementation, whereas one responder indicated using a threshold below 15 ng/mL, and two individuals (22.2%) selected “other” as their response. Responses regarding thresholds for initiating intravenous iron therapy for low ferritin demonstrated marked variability among providers, with 66.7% of responders selecting <30 ng/mL, 44.4% selecting <15 ng/mL, and 22.2% selecting “other,” indicating a lack of consensus regarding a specific ferritin cutoff for initiating IV iron therapy in pregnancy. When asked to elaborate if selecting “other,” two respondents clarified they use a ferritin cutoff of <20 ng/mL as a threshold for recommending treatment with IV iron therapy. Despite providers employing different management strategies, eight out of nine midwives (88.9%) reported often or always recommending oral iron therapy, and five out of nine (55.6%) midwives reported recommending IV iron therapy often, reinforcing that these management and subsequent treatment modalities are not rare occurrences within the antepartum time period, and instead reflect a frequently encountered clinical issue during the antepartum period. Respondents identified several recurring challenges related to screening for and treating iron deficiency and iron deficiency anemia during pregnancy. Commonly reported barriers included a lack of standardized institutional guidelines, inconsistent screening practices, and uncertainty regarding optimal laboratory thresholds and treatment pathways. Providers also noted time constraints during clinical encounters, as well as challenges related to adherence to oral iron therapy. Additionally, midwives cited logistical barriers to IV iron administration, including scheduling conflicts and resource availability. Collectively, these challenges highlight both system-level and patient-level factors that complicate consistent

identification and management of iron deficiency and iron deficiency anemia in the antepartum period.

Post-Intervention Survey Results

Post-intervention survey responses demonstrated mixed levels of provider satisfaction with the newly implemented approach to prenatal screening for iron deficiency and iron deficiency anemia, which included the IDA flowchart, SmartPhrases, and checklist. Four out of nine midwives (44.4%) agreed that they were satisfied with the new screening approach, while three respondents (33.3%) reported neutrality, and two respondents (22.2%) disagreed. Seven out of nine midwives (77.8%) agreed or strongly agreed that there is now a consistent ferritin screening process within the practice, while two respondents (22.2%) disagreed. Compared to pre-intervention findings, which demonstrated 33.3% of respondents agreeing or strongly agreeing that ferritin screening was consistent, these results suggest a meaningful improvement in perceived standardization of ferritin screening. Six out of nine midwives (66.7%) agreed or strongly agreed that patient education is provided consistently within the practice, while two respondents (22.2%) selected neutral and one respondent (11.1%) disagreed. When asked about provider confidence in understanding the importance of prenatal ferritin screening, eight out of nine midwives (88.9%) agreed or strongly agreed that they were confident in their understanding, while one respondent (11.1%) selected neutrality. All nine midwives (100%) agreed or strongly agreed that they were confident in their ability to identify patients who may be at risk for iron anemia. When asked when providers typically order a ferritin lab, 100% of midwives report ordering a ferritin lab for NOB visits as well as with third trimester labs. Six out of nine midwives (66.7%) reported ordering a ferritin lab four to eight weeks after initiating PO iron with a patient diagnosed with iron deficiency or iron deficiency anemia. Post-intervention

survey responses demonstrated ongoing variability in provider-reported ferritin thresholds for initiating treatment with oral iron supplementation. Four out of nine midwives (44.4%) reported using a ferritin threshold of 30 ng/mL to recommend oral iron therapy. Three respondents (33.3%) reported using a higher threshold of 50 ng/mL, while one midwife (11.1%) reported a threshold less than 50 ng/mL but greater than 30 ng/mL, and one respondent (11.1%) indicated a threshold of 20 ng/mL. When asked about ferritin thresholds for initiating IV iron therapy, three midwives (33.3%) reported a threshold of 30 ng/mL, three midwives (33.3%) reported a threshold of <30 ng/mL, and one respondent (11.1%) reported a threshold of 20 ng/mL. Two respondents (22.2%) indicated that their decision to initiate IV iron therapy was guided by clinical factors rather than a strict laboratory cutoff, including lack of improvement in ferritin levels with PO iron, proximity to delivery, gastrointestinal intolerance to PO iron, and patient preference.

Post-intervention survey responses demonstrated that oral iron therapy continues to be frequently recommended in clinical practice. Seven out of nine midwives (77.8%) reported recommending oral iron therapy “often”; one respondent (11.1%) reported recommending oral iron therapy “sometimes,” and one respondent (11.1%) reported “rarely” recommending oral iron therapy. Furthermore, seven out of nine midwives (77.8%) reported recommending IV iron therapy “often,” while two respondents (22.2%) stated they “sometimes” recommend IV iron.

Open-ended post-intervention responses identified several ongoing challenges related to the screening and management of iron deficiency and iron deficiency anemia during pregnancy. Reported barriers included delayed or missing ferritin lab values at the time of clinical encounters, inconsistencies in follow-up care by clinicians, variation in clinical practice amongst midwives, as well as access to IV iron appointments. One respondent identified inconsistent

documentation of oral iron therapy as a barrier, reporting that determining whether a patient was taking oral iron was often cumbersome when reviewing laboratory results, particularly when managing patients not previously known to the provider. Providers reported challenges related to patient adherence to and tolerance of oral iron therapy, in addition to uncertainty associated with the evolving evidence base for ferritin screening, citing limited available data to clearly define both the risks of low ferritin in pregnancy and the risks associated with intravenous iron therapy. When asked what additional resources would improve clinicians' ability to manage ID and IDA effectively, responses emphasized the need for continued refinement of clinical tools and workflows. Suggested improvements included easier access to flowcharts, the development of a standardized patient education handout, and more streamlined, user-friendly checklists. Responses also highlighted the need for increased availability at infusion clinics, as well as more additional research to better inform evidence-based decision-making and treatment recommendations.

When asked if the IDA flowchart was useful for screening patients and offering appropriate treatment options, eight out of nine midwives (88.9%) agreed or strongly agreed. One midwife (11.1%) disagreed. Four out of eight (50%) midwives agreed or strongly agreed that the SmartPhrase for the NOB progress note, .CNMNEWOBIRON was useful for streamlining documentation. Three out of eight midwives (37.5%) felt neutral, and one respondent (12.5%) disagreed. Four out of nine midwives (44.4%) stated they were likely or very likely to continue to use the NOB SmartPhrase, while three respondents (33.3%) reported neutrality, and two clinicians (22.2%) stated they were unlikely to continue to utilize the NOB SmartPhrase.

Three out of nine (33.3%) of midwives agreed and two midwives (22.2%) strongly agreed that the SmartPhrase for the third trimester lab review was useful for streamlining documentation. Four out of nine midwives (44.4%) reported neutrality. Four clinicians (44.4%) reported they were likely or very likely to continue to use the third trimester SmartPhrase, while three midwives (33.3%) reported neutrality, and two respondents (22.2%) felt they were unlikely to continue to use this SmartPhrase in the future.

When asked if the IDA checklist was a useful tool for tracking patients' screenings and treatments for ID or IDA throughout their pregnancy, two out of nine midwives (22.2%) agreed, and one midwife (11.1%) strongly agreed. Three out nine clinicians (33.3%) felt neutral, and three out of nine midwives (33.3%) disagreed. Five out of nine (55.5%) of clinicians reported they were likely or very likely to continue to use the IDA checklist with future patients. Two respondents (22.2%) reported neutrality, and two midwives (22.2%) state that it is unlikely they will continue to implement the checklist into their workflow and practice.

When asked the likelihood of continuing to utilize the flowchart into one's practice, three out of nine midwives (33.3%) reported "very likely," five midwives reported "likely," and one midwife (11.1%) reported "neither likely nor unlikely."

Lastly, clinicians were asked how the IDA flowchart, SmartPhrases, and checklist could be improved upon. While some reported "loving" the flowchart, others felt it was lengthy, with key information located near the bottom, making it less efficient to use in clinical encounters. Some noted the checklist felt redundant; however, there was interest in continuing to refine it rather than eliminating it altogether. Suggested improvements included simplifying the checklist into a brief fill-in format focused on essential elements to care. Workflow challenges such as ferritin results often being unavailable at the NOB visit were also highlighted as limiting factors.

Discussion

Summary

Inconsistent screening and management practices along with variable interpretations of guidelines can contribute to delayed identification and treatment of iron deficiency in the antepartum period. Within this midwifery practice, variation in provider practice created a clear opportunity for quality improvement focused on standardizing screening, management, and documentation of iron deficiency and iron deficiency anemia.

This project aimed to improve midwifery consistency in screening and management for antepartum iron deficiency and iron deficiency anemia through the implementation of an evidence-based flowchart, SmartPhrases, and checklist. Over the course of both PDSA cycles, the results demonstrated improved adherence to SmartPhrase usage during initial and third trimester laboratory review visits. In contrast, uptake of the iron deficiency anemia checklist was more inconsistent across providers and visits, reflecting variability in provider workflow integration and clinical use. Both the pre- and post-intervention survey was completed by 75% of midwives, exceeding the project aim of 70% for the pre-intervention survey, but not meeting the project goal of 80% for the post-intervention survey.

Specific aims for this project outlined goals to demonstrate use of the evidence-based flowchart through documentation with the associated SmartPhrases in progress notes from the initial prenatal visit and during third trimester laboratory review. Adherence targets were set at 60% by the end of PDSA Cycle 1 and 80% by the end of PDSA Cycle 2. Implementation of the SmartPhrase .CNMNEWOBIRON was implemented 45.9% during PDSA Cycle1, and 98.1% during PDSA Cycle 2. While the specific aim was not met for the first cycle, PDSA Cycle 2 greatly exceeded original project goals. Midwives identified the embedding of

.CNMNEWOBIRON directly into the initial prenatal visit progress note to be helpful in maintaining adherence to the implemented workflow.

In contrast, adherence to the SmartPhrase .CNMTHIRDTRIMESTERIRON remained lower, with use documented in 4.3% of eligible visits during PDSA Cycle 1 and increased significantly to 45.9% during PDSA Cycle 2. Although this represented improvement over time, the third-trimester documentation target was not met, highlighting ongoing workflow and implementation challenges during later prenatal visits.

While documentation of the checklist was underutilized, survey feedback indicated that this tool could remain helpful with provider-driven modifications, such as a brief, streamlined fill-in format focused on essential elements of care. Utilization of the checklist demonstrated more modest and variable uptake, with documentation occurring in 36.5% of eligible encounters during PDSA Cycle 1 and 39% during PDSA Cycle 2, suggesting that additional refinement may be needed to improve integration into routine clinical practice.

Interpretation

The implementation of an evidence-based flowchart and accompanying documentation tools resulted in meaningful improvements in standardized ferritin screening practices, particularly during initial prenatal visits, with more variable uptake observed in later prenatal workflows. These findings suggest that structured clinical guidance, when embedded into routine documentation, can support more consistent identification and management of iron deficiency in pregnancy, aligning with prior research demonstrating that standardized protocols improve screening adherence and provider confidence (Yefet et al., 2019, Lower et al., 2023). Variability across PDSA cycles highlights the influence of workflow design on sustained implementation.

A majority of respondents indicated that the IDA flowchart was helpful in guiding screening and treatment decisions for patients. Notably, 88.9% of respondents reported they would like to continue using the flowchart in future practice. This level of endorsement suggests that the use of a clear, visual algorithm supports the implementation of a visual tool to aid in guiding providers with evidence-based recommendations.

Because the flowchart functioned as a decision-support tool rather than a documentation requirement, it allowed providers to quickly take patients' laboratory results and identify appropriate next steps in managing a patient's care. Findings from this quality improvement project suggest that tools offering clinical guidance without significantly increasing documentation demands were more readily adopted and demonstrated greater potential for sustainability than other components of the intervention.

The flowchart's flexibility also likely contributed to its broader appeal, as it could be utilized regardless of when or how laboratory results were reviewed. In contrast, the SmartPhrases and checklist were tied to specific documentation workflows, which may have limited their perceived usefulness. Additionally, providers may have viewed these documentation tools as duplicative of existing practices, especially if similar information had already been captured in other various progress notes, problem lists, or patient messaging.

By synthesizing evidence-based recommendations into a single, coherent pathway, the flowchart appeared to provide the greatest perceived value to providers. The flowchart was designed to support shared decision-making between provider and patient. In this way, it ultimately functioned as a collaborative guide, and reinforced the principle that individualized care, even within a standardized framework, is fundamental to patient-centered practice.

SmartPhrases embedded directly into progress notes demonstrated higher uptake, while tools requiring additional steps, such as the checklist and third-trimester SmartPhrase showed lower and more variable adherence, suggesting that overall adoption may depend heavily on seamless integration into existing documentation workflows, thereby minimizing the cognitive load associated with additional documentation steps. Providers frequently relied on problem-based charting to document the progress of a patient's iron deficiency or iron deficiency anemia, often documenting the progression of care, without necessarily using the SmartPhrase indicated during third-trimester laboratory review. This pattern may suggest that the issue was not an absence of documentation, but rather workflow preference and perceived efficiency. This was evident when the SmartPhrase was not embedded directly into the progress note template. Additionally, the third trimester may have introduced greater clinical complexity compared to earlier stages of pregnancy, requiring more tailored documentation that providers may have felt was more efficiently captured through personalized charting.

Frequent utilization of the .CNMNEWOBIRON SmartPhrase during PDSA Cycle 2 suggests that embedding documentation prompts directly into structured prenatal visit templates facilitated adherence and minimized cognitive burden on providers. In contrast, more varied utilization of the third-trimester SmartPhrase and checklist reflect challenges inherent in workflows that occur outside of structured visits or require additional documentation steps.

Findings from the post-intervention survey further contextualize these differences in documentation uptake across intervention components. While some respondents identified the checklist to be valuable for longitudinal tracking of screening and treatment, others reported neutral perceptions or a lower likelihood of continued use. This variability in perceived usefulness parallels the lower and more variable checklist utilization observed during chart

reviews and suggests that the checklist may have been perceived as excessive or misaligned with existing documentation practices. These tools may face adoption barriers if they increase documentation burdens and are not optimally aligned with provider workflow.

Third-trimester laboratory review often occurred through asynchronous communication, which may have limited opportunities for standardized progress note documentation. As a result, SmartPhrase utilization may have subsequently underestimated actual clinical adherence to the flowchart recommendations, as documentation inconsistencies may have reflected workflow complexity rather than a lack of clinical engagement. This underscores documentation as both a facilitator of standardization as well as a limitation of quality improvement measurement strategies, particularly in busy outpatient settings where delivery of care occurs across multiple providers.

Limitations

This project had several limitations; the initiative was conducted within a single academic midwifery practice with a relatively small number of providers, which may limit generalizability to other outpatient settings. Furthermore, the short implementation period spanning ten weeks limited the ability to assess long-term sustainability of practice changes or ongoing adherence to implementation of the SmartPhrases.

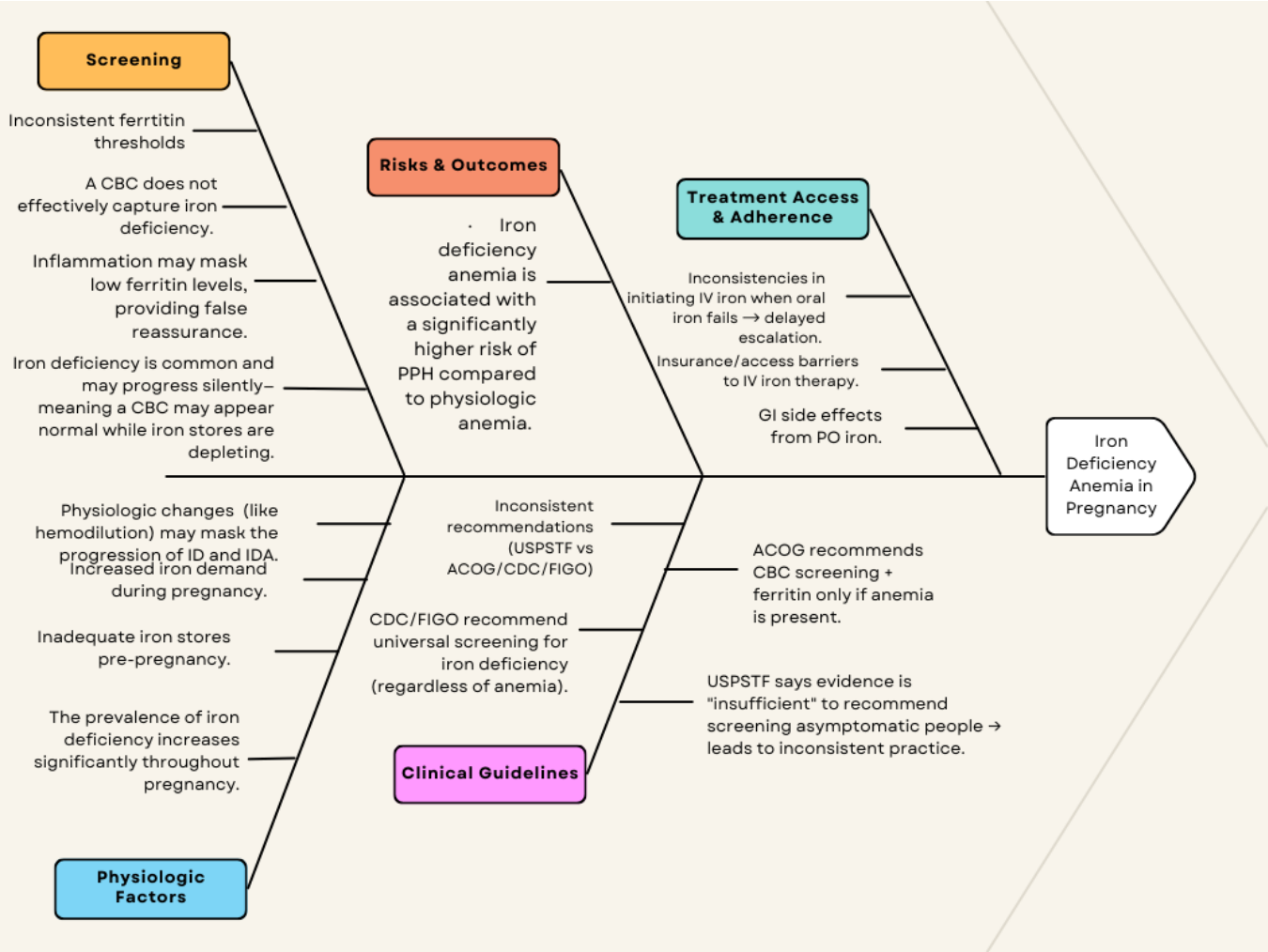
Documentation of SmartPhrase use was utilized as a proxy for guideline adherence. Thus, it is possible that appropriate screening, counseling, and treatment occurred without corresponding documentation. An additional limitation related to documentation variability was the inability to embed the checklist as well as the third-trimester SmartPhrase directly into all relevant workflows. Third-trimester laboratory results were often reviewed at variable time points and through multiple pathways, including prenatal visits, but also through asynchronous

communication via the patient portal. As a result, documentation within a provider's progress note may not have fully captured all instances of laboratory review or patient counseling. Therefore, lower utilization of the third-trimester SmartPhrase may highlight the impact of workflow design on implementation success and overall documentation limitations rather than lack of clinical review or adherence to the flowchart.

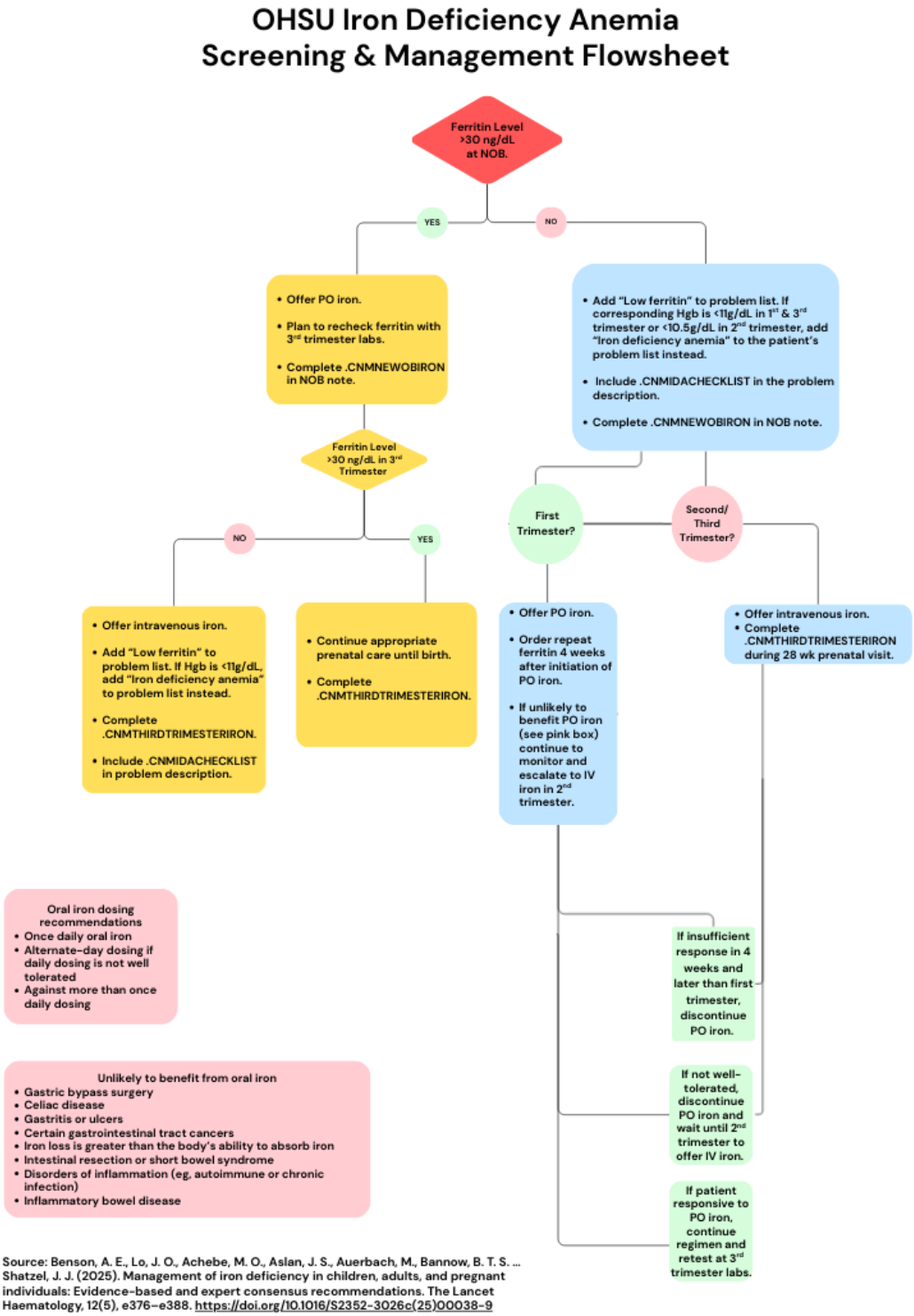
Conclusion

The implementation of the SmartPhrases during initial prenatal and third trimester visits supported the introduction of a standardized approach to antepartum ferritin screening, documentation, and patient education for iron deficiency and iron deficiency anemia within the midwifery practice. This initiative demonstrates the feasibility of integrating evidence-based guidance into outpatient prenatal workflows and highlights the value of structured documentation tools in supporting consistent clinical practice. While uptake of specific components varied across workflows and PDSA cycles, qualitative feedback highlighted the importance of electronic health record integration and indicated that targeted, provider-driven modifications could enhance incorporation of these tools into routine midwifery practice. This project demonstrates that implementation of an evidence-based guideline can support more consistent approaches to antepartum iron deficiency and iron deficiency anemia management and provides a foundation for ongoing refinement and evaluation of practice change and improvement.

Appendix A


Screening
Inconsistent ferrtitin thresholds
A CBC does not effectively capture iron deficiency.
Inflammation may mask low ferritin levels, providing false reassurance.
Iron deficiency is common and may progress silently– meaning a CBC may appear normal while iron stores are depleting.
Risks & Outcomes
· Iron deficiency anemia is associated with a significantly higher risk of PPH compared to physiologic anemia.
Treatment Access & Adherence
Inconsistencies in initiating IV iron when oral iron fails → delayed escalation.
Insurance/access barriers to IV iron therapy.
GI side effects from PO iron.
Iron Deficiency Anemia in Pregnancy
Physiologic changes (like hemodilution) may mask the progression of ID and IDA.
Increased iron demand during pregnancy.
Inadequate iron stores pre-pregnancy.
The prevalence of iron deficiency increases significantly throughout pregnancy.
Physiologic Factors
Inconsistent recommendations (USPSTF vs ACOG/CDC/FIGO)
CDC/FIGO recommend universal screening for iron deficiency (regardless of anemia).
Clinical Guidelines
ACOG recommends CBC screening + ferritin only if anemia is present.
USPSTF says evidence is "insufficient" to recommend screening asymptomatic people → leads to inconsistent practice.

Appendix B



Source: Benson, A. E., Lo, J. O., Achebe, M. O., Aslan, J. S., Auerbach, M., Bannow, B. T. S. ... Shatzel, J. J. (2025). Management of iron deficiency in children, adults, and pregnant individuals: Evidence-based and expert consensus recommendations. The Lancet Haematology, 12(5), e376–e388. https://doi.org/10.1016/S2352-3026c(25)00038-9

Appendix C

IDA SmartPhrases

- **.CNMIDACHECKLIST →** to be put in **description section** of "low ferritin" or "iron deficiency anemia" in patient **problem list**

☐Ferritin drawn at/before New OB visit.
☐New OB ferritin lab reviewed at NOB or via MyChart.
☐Repeat ferritin & CBC ordered for 4 weeks after initiation of PO iron.
☐Initiated oral iron therapy on ***
☐Educational resources provided in patient AVS.
☐Referral placed for IV iron therapy.
☐IV therapy completed on ***
☐Patient declines ferritin screening.
☐Patient declines PO iron therapy.
☐Patient declines IV iron therapy.

- **.CNMNEWOBIRON →** to be put in **New OB progress notes**

☐Ferritin labs completed, >30 ng/mL. Reviewed with patient at NOB or via MyChart.
☐Ferritin labs completed, abnormal results based on flowchart (Below 30 ng/mL). Recommended appropriate iron therapy based on flowchart. Reviewed with patient at NOB or via MyChart.
☐Ferritin not collected per CNM preference.
☐Patient declined screening.
☐Ferritin lab drawn at NOB. Plan to notify patient of results via MyChart and recommend appropriate iron therapy as indicated.
☐"Low ferritin" added to problem list.
☐"Iron deficiency anemia" added to problem list

- .**CNMTHIRDTRIMESTERIRON →** to be put in progress note during review of third trimester labs.

☐ Ferritin labs completed, >30 ng/mL. Reviewed with patient at 24-28 wk visit or via MyChart.
☐Ferritin labs completed, abnormal results based on flowchart (Below 30 ng/mL). Recommended appropriate iron therapy based on flowchart. Reviewed with patient at 24-28 wk visit or via MyChart.
☐Ferritin not collected per CNM preference.
☐Patient declined third trimester ferritin screening.
☐"Low ferritin" added to problem list.
☐"Iron deficiency anemia" added to problem list.

Appendix D
Pre- and Post- Intervention Survey

Pre-Intervention	Post-Intervention	Response
1. I am satisfied with the current approach for screening for iron deficiency and iron deficiency anemia prenatally.	I am satisfied with the new approach to screening for iron deficiency and iron deficiency anemia prenatally.	**Agreement**
2. There is a consistent ferritin screening process in this practice.	There is a consistent ferritin screening process in this practice now with the use of a flowchart and AVS handout.	**Agreement**
3. Midwives in this practice provide consistent education on iron deficiency and iron deficiency anemia during pregnancy.	Midwives in this practice now provide consistent patient education on iron deficiency and iron deficiency anemia during pregnancy with the use of a flowchart and AVS handout.	**Agreement**
4. I am confident in my understanding about why screening for ferritin prenatally is important.	I am confident in my understanding about why screening for ferritin prenatally is important.	**Agreement**
5. I am confident in identifying patients who may be at risk for iron deficiency anemia.	I am confident in identifying patients who may be at risk for iron deficiency anemia.	**Agreement**
6. Do you typically order a ferritin lab?	Do you typically order a ferritin lab?	**Frequency**
7. When do you typically order a ferritin lab?	When do you typically order a ferritin lab?	**Select All That Apply**
8. What is your usual threshold for recommending treatment for low ferritin with oral iron supplementation?	What is your usual threshold for recommending treatment for low ferritin with oral iron supplementation?	**Select One**
9. What is your usual threshold for recommending treatment for iron deficiency with IV iron?	What is your usual threshold for recommending treatment for antepartum iron deficiency with IV iron?	**Select All That Apply**

10. How often do you recommend the following iron therapy? 10.1 Oral iron 10.2 IV iron	How often do you recommend the following iron therapy? 10.1 Oral iron 10.2IV iron	**Frequency**
11. What challenges do you encounter when screening for and treating iron deficiency and iron deficiency anemia?	What challenges do you encounter when screening for and treating iron deficiency and iron deficiency anemia?	**Qualitative**
12. What additional resources or support would improve your ability to manage antepartum ID and IDA effectively?	What additional resources or support would improve your ability to manage antepartum ID and IDA effectively?	**Qualitative**
13. Additional comments?	Additional comments?	**Qualitative**

Post-Intervention Survey Questions: Effectiveness of Intervention

14. The IDA flowchart was useful for screening patients and offering appropriate treatment options.	**Agreement**
15. How likely are you to continue to use the flowchart to improve the consistency of patient screening and treatment of ID and IDA?	**Likelihood**
16. How likely are you to continue using the digital AVS handout to improve the consistency of patient education on PO and IV iron supplementation?	**Likelihood**
17. How likely are you to continue using the digital AVS handout to improve the consistency of patient education on PO and IV iron supplementation?	**Likelihood**
18. Are there aspects of the IDA flowchart or AVS that could be improved upon or clarified?	**Qualitative**

19. Select all that apply: When do you typically order a ferritin lab?	• I do not typically order a ferritin lab. • I order a ferritin lab only for a NOB visit. • I order a ferritin lab 4 weeks after initiating PO iron with a patient diagnosed with low ferritin or IDA. • I order a ferritin lab only for third trimester labs. • I order a ferritin lab for NOB visits and for third trimester labs.
20. Select one: What is your usual threshold for recommending treatment for iron deficiency with oral iron supplementation?	• Ferritin = < 15 ng/mL • Ferritin = < 30 ng/mL • Other
21. Select all that apply: What is your usual threshold for recommending treatment for iron deficiency with IV iron therapy?	• Ferritin = < 15 ng/mL during the second trimester. • Ferritin = < 30 ng/mL during the second trimester. • Ferritin = < 15 ng/mL after third trimester lab results. • Ferritin = < 30 ng/mL after third trimester lab results.

Value	**1**	**2**	**3**	**4**	**5**
Agreement	**Strongly disagree**	**Somewhat disagree**	**Neither agree nor disagree**	**Somewhat agree**	**Strongly agree**
Likelihood	**Very unlikely**	**Unlikely**	**Neither likely nor unlikely**	**Likely**	**Very likely**
Frequency	**Never**	**Rarely**	**Sometimes**	**Often**	**Always**

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