



## DRAFT: Iron Deficiency – Investigation and Management

**DRAFT FOR EXTERNAL REVIEW:** The online questionnaire is available at <https://survey.health.gov.bc.ca/iron>

### Scope

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This guideline provides recommendations for the investigation and management of iron deficiency in patients of all ages. **An underlying disorder may be the cause of an iron deficiency. If so, this needs to be identified and managed.** The investigation for the cause of iron deficiency is beyond the scope of this guideline.

Diagnostic codes: 280 (Iron Deficiency Anemias)

### Key Recommendations

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- Having first identified patients at risk of iron deficiency and iron deficiency anemia, use a case-finding approach by testing ferritin and complete blood count (CBC) respectively.
- Serum iron, iron binding capacity, transferrin saturation/fraction saturation are not routinely useful for investigation of iron deficiency anemia.
- Determine the cause of iron deficiency. Consider age and clinical presentation when investigating for cause.
- Take thorough dietary history and provide dietary counselling to caregivers of infants and toddlers with iron deficiency, including maximum daily cow's milk intake, and selection of iron-rich solid foods.
- In cases where there is an obvious cause, a trial of treatment and monitoring response may be appropriate.
  - Regular blood donation increases the risk of iron deficiency.
  - Menorrhagia is the most frequent cause of iron deficiency and iron deficiency anemia among pre-menopausal women.
- Even when there is an obvious cause, consider serious co-contributors (e.g. colon cancer in adult males and post-menopausal females).
- Consider prescribing IV iron when there is: inadequate response to oral iron (malabsorption or ongoing blood loss), or intolerance to oral iron therapy.
  - Do not prescribe intramuscular (IM) iron, due to high frequency of unacceptable side effects.

### Identification of Patients with Iron Deficiency and Iron Deficiency Anemia

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Iron deficiency is common throughout the lifespan. Iron deficiency may develop from decreased dietary intake, increased requirements for iron, decreased iron absorption, or increased iron loss. Screening of the general population for iron deficiency is not recommended<sup>1</sup>. Use a case-finding approach to investigate all patients at high risk of iron deficiency and iron deficiency anemia (Table 1) by testing ferritin and complete blood count (CBC) respectively.

**Table 1: Causes of and risk factors for iron deficiency and iron deficiency anemia (IDA) in adults**

**Note:** refer to *Iron Deficiency in Children* and *Iron Deficiency in Obstetrics* on page 5 for causes and risk factors in children, pregnancy and the perinatal period.

Increased Requirements	Decreased Intake
<ul style="list-style-type: none"> <li>Menstruating girls and women<sup>2,3</sup> (at least 10% are estimated to have iron deficiency)<sup>4</sup></li> <li>Multiparity</li> </ul>	<ul style="list-style-type: none"> <li>Low socioeconomic status</li> <li>Vegetarian or vegan diet</li> <li>Lack of balanced diet or poor intake</li> <li>Alcohol use disorder</li> <li>Men and women &gt; age 65<sup>4</sup></li> <li>Recent immigration from developing countries<sup>5</sup>, especially in Southeast Asia, Africa<sup>6</sup></li> </ul>
Increased Loss	Decreased Absorption
<ul style="list-style-type: none"> <li>Menorrhagia</li> <li>GI bleeding                             <ul style="list-style-type: none"> <li>colon cancer</li> <li>peptic ulcer disease</li> <li>inflammatory bowel disease</li> </ul> </li> <li>Regular blood donation</li> <li>Post-operative patients with significant blood loss</li> <li>Hematuria (overt or microscopic)</li> <li>Intravascular hemolysis</li> <li>Extreme physical exercise (endurance athletes)</li> <li>Pathological (hemolytic anemias)</li> </ul>	<ul style="list-style-type: none"> <li>Upper GI pathology:                             <ul style="list-style-type: none"> <li>Chronic gastritis (incl. H pylori gastritis, atrophic gastritis/pernicious anemia)</li> <li>Gastric lymphoma</li> <li>Celiac disease</li> <li>Crohn's disease</li> </ul> </li> <li>Medications that decrease gastric acidity or bind iron, e.g. antacid/PPI use</li> <li>Gastrectomy or intestinal bypass</li> <li>Duodenal pathology</li> <li>Chronic renal failure</li> </ul>

## Signs and Symptoms in Adults

The clinical consequences of iron deficiency are both due to anemia and to non-anemic iron deficiencies.

Early stage iron deficiency can exist without overt anemia, but with other non-hematological symptoms<sup>7</sup>, due to deficiency of iron containing cellular enzymes. Non-hematologic symptoms include decreased aerobic work performance, hair loss, adverse pregnancy outcome, and impaired immune function.

Investigate based on clinical suspicion, not only on presence of anemia. Other symptoms include: hair loss, fatigue, cold intolerance, restless leg syndrome, irritability/depression, nail changes, angular cheilitis, pica/phagophagia (ice craving).

Refer to *Iron Deficiency in Children* on page 5 for signs and symptoms in children.

## Diagnosis/Investigation

Identify patients at risk of iron deficiency based upon a directed history (including dietary history and history of blood loss, including blood donation, and family history including colorectal cancer<sup>8</sup>), symptom review, and physical examination.

Iron deficiency anemia in adult men and postmenopausal women is most likely to have a serious underlying cause of blood loss including malignancy. Consider upper and lower endoscopy<sup>8</sup>. Bleeding from the gastrointestinal tract accounts for approximately two-thirds of all causes in iron deficient patients<sup>9,10</sup>. Menorrhagia is the most frequent cause of iron deficiency among pre-menopausal women. Testing for malabsorption is recommended if small bowel disease is clinically suspected, or if oral iron supplementation results in refractory response despite compliance.

## Testing

First, determine the cause of iron deficiency. The etiology is often multifactorial; even when there is an obvious cause, investigation of serious underlying causes (e.g. colon cancer in adults) is recommended.

Individualize disease-specific management depending on underlying cause<sup>11</sup>. Consider age and clinical presentation when investigating for cause; refer to Table 1 for common causes.

**The initial recommended tests for iron deficiency and for iron deficiency anemia are serum ferritin and CBC respectively.**

**Table 2: Initial Investigational Tests**

Investigation	Application	Notes
<b>Hematology Profile (CBC)</b>	<ul style="list-style-type: none"> <li>Hemoglobin value is required to assess severity of anemia</li> <li>Can suggest iron deficiency</li> <li>Not diagnostic test of choice for iron deficiency</li> </ul>	<p>A constellation of the following findings on CBC and peripheral smear is highly suggestive of iron deficiency:</p> <ul style="list-style-type: none"> <li>anemia</li> <li>microcytosis</li> <li>hypochromia</li> </ul>
<b>Serum Ferritin</b>	<ul style="list-style-type: none"> <li>Diagnostic test of choice for iron deficiency<sup>12</sup></li> <li><b>Adults (ug/L)</b><sup>13-15</sup> <ul style="list-style-type: none"> <li>less than 15 → diagnostic of iron deficiency</li> <li>15-45 → probable iron deficiency</li> <li>more than 45 → iron deficiency unlikely</li> </ul> </li> <li><b>Children (ug/L)</b> <ul style="list-style-type: none"> <li>less than 12 → diagnostic of iron deficiency</li> </ul> </li> </ul>	<p>These values occur on a continuum; cut-offs are suggested:</p> <ul style="list-style-type: none"> <li>The likelihood of iron deficiency increases with lower ferritin concentrations, including those that overlap with the normal reference interval. The normal reference interval is derived from healthy outpatients without signs of iron deficiency or chronic illness.</li> <li>In adults, iron deficiency is unlikely if ferritin &gt;45 ug/L (or &gt;70 in a patient with chronic inflammatory disease)</li> <li>Ferritin is an acute phase reactant. May be unreliable in patients with chronic disease, active inflammation, or malignancy</li> <li>Non-hematologic symptoms can occur when the serum ferritin is in the low normal range (less than 45 ug/L)</li> </ul>

**Note:** In most situations, there is no benefit to ordering serum iron, transferrin, transferrin saturation, or total iron binding capacity. An investigation for anemia of chronic disease (ACD) as a co-contributor to anemia begins with a clinical assessment for an underlying (inflammatory) disorder.

## Management

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The objective of treatment is to replenish iron stores: normalize hemoglobin levels and ferritin<sup>16</sup>.

Iron replacement therapy may begin as soon as iron deficiency is detected, whether or not anemia is also present; however, it is essential to determine and correct the underlying causes of iron deficiency (see Appendix B and Table 1)<sup>1</sup>.

Certain medications, such as anticoagulants, non-steroidal anti-inflammatory drugs (NSAIDs), and selective serotonin reuptake inhibitors (SSRIs), may increase the risk of gastrointestinal bleeds. Evaluate the patient's overall risk of bleeding. Evaluate the risk-benefit ratio of continuing these medications in an iron-deficient patient.

### ► Lifestyle Modification

Encourage all individuals to consume a diet with sufficient iron to prevent iron deficiency. Refer to *Patient and Caregiver Resources* for recommended daily intake and foods high in iron.

### ► Treatment with Oral Iron

**Oral iron replacement is almost always preferred to intravenous (IV) therapy.** It is safer, more cost-effective, and convenient when compared to IV therapy. Refer to Appendix for a list of commonly used oral iron preparations, doses, and costs.

Oral iron intolerance is very common:

- Oral iron preparations may cause nausea, vomiting, dyspepsia, constipation, diarrhea or dark stools.
- Strategies to minimize these effects include: start at a lower dose and increase gradually over 4 to 5 days; giving divided doses or the lowest effective dose, or taking supplements with meals (note: iron absorption is enhanced if supplements are taken on an empty stomach; however, it may not be tolerated).
- Although sustained release iron preparations tend towards less gastrointestinal side effects, they may not be as effective as standard film coated products due to reduced/poor iron absorption<sup>17</sup>.

Iron absorption can be decreased by various medications and supplements; space dosing apart by at least 2 hours.

Iron absorption from iron salts can be enhanced by taking them on an empty stomach (at least 1.5 to 2 hours after a meal), with acidic juices or vitamin C, and not with other multivitamin, calcium, or antacid tablets. This does not apply to other types of iron preparations such as polypeptides, which are more easily absorbed.

### ► Monitoring Response to Oral Iron

1. The frequency of subsequent monitoring depends upon the severity of the anemia, the underlying cause of the iron deficiency, and the clinical impact on the patient. Reassess patients with moderate to severe anemia by testing CBC as early as 2-4 weeks. Hemoglobin should increase by 10-20 g/L by 4 weeks.
2. Hemoglobin will correct within 2 to 4 months if appropriate iron dosages are administered and underlying cause of iron deficiency is corrected.
3. Continue iron therapy an additional 4 to 6 months (adults) after correction of anemia to replenish the iron stores<sup>18</sup>. Target normal ferritin >100 µg/L.
4. If ferritin and hemoglobin are not responding as anticipated, consider adherence, ongoing bleeding, malabsorption, or alternate diagnosis.
5. If the patient's clinical status is compromised by moderate to severe anemia, consider admission to an acute care facility and blood transfusion. Once the patient is stable, iron replacement can commence.

## ▶ IV Therapy

**Complete or partial failure of oral iron therapy trial (in compliant patients) may be due to insufficient absorption, inadequate dosing, or ongoing loss (e.g. hemorrhage).**

Intravenous therapy may be initiated when there is:

- inadequate iron absorption,
- continued blood loss,
- intolerance to oral iron therapy,
- urgent surgery in an iron-deficient patient/pre-operative indication,
- chronic kidney disease, including dialysis patients<sup>19</sup>

## ▶ Intramuscular (IM) Therapy

**Intramuscular (IM) iron therapy is not recommended** because risks include unpredictable absorption, anaphylaxis, and local complications (e.g. pain, permanent staining of the skin, sarcoma formation)<sup>20</sup>.

## ▶ Iron supplementation: ongoing care

Once anemia has corrected and iron stores have normalized, a low maintenance dose may be prescribed if there is an ongoing need for additional iron (e.g. menorrhagia, growth spurt, regular blood donation). Dietary modification may also be considered (refer to Appendix A). Consider similar supplementation for patients who have iron depletion but not anemia.

## Iron Deficiency and Iron Deficiency Anemia in Infants, Children and Adolescents

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Iron deficiency and iron deficiency anemia in children is associated with motor and cognitive deficits which may be irreversible<sup>21</sup>.

### Common causes and risk factors

- **All ages:** Increased requirements due to growth, bleeding from any source, e.g. frequent nosebleeds, GI diseases including short gut syndrome, cow's milk protein colitis
- **Infants < 6 months:** maternal iron deficiency, fetal-maternal hemorrhage, twin-twin transfusion, prematurity (low blood volume at birth, phlebotomy)
- **Toddlers (age 1-3 years):** cow's milk before 12 months, bottle use beyond 12-15 months, excessive cow's milk, exclusive breastfeeding beyond 6 months, picky eating (insufficient intake or diversity of solid food), prematurity, obesity<sup>22</sup>
- **Adolescents:** disordered eating, menorrhagia, low body weight, extreme physical exercise/endurance athletes, vegetarian diet (refer to Vegetarian and Vegan Diets on page 6)

### Signs and symptoms

- Note that some patients may be asymptomatic
- **All ages:** tiredness, restless legs, inattention, poor school performance, irritability/depression, growth retardation, unexplained cognitive and intellectual impairment, pica/phagophobia, breath-holding spells, developmental delay
- **Infants:** poor feeding, lethargy, failure to thrive, cardiomegaly, tachypnea
- **Adolescents:** presyncope, syncope, headache, irritability, fatigue, exercise intolerance, restless legs

## Diagnosis

- Serum ferritin is the diagnostic test of choice for iron deficiency. Ferritin <12 ug/L is diagnostic of iron deficiency. Refer to Table 2 for guidance on interpreting ferritin levels.

## Treatment

- Consider the introduction of iron rich foods/formula or routine iron supplementation for asymptomatic children aged 6-12 months who are at increased risk for iron deficiency anemia<sup>1</sup>.
- Take a thorough dietary history and provide dietary counselling to all pediatric patients with iron deficiency. For children aged 1-3, provide specific guidance on recommended daily amounts of cow's milk and introduction of iron-rich solid foods. Consider referral to a dietician. Infants 6-24 months should not consume more than 750 mL per day of cow's milk<sup>23</sup> because its volume can displace other iron rich foods, and large amounts may lead to intestinal blood loss due to cow's milk protein colitis.
- Recommend infants and toddlers with suspected iron deficiency anemia begin treatment with oral ferrous sulphate. Recommended treatment dose for infants and children is 3 to 6 mg of elemental iron/kg/day in either once a day or divided doses.
- For optimal absorption, oral iron should be taken on an empty stomach with water or juice, and not with dairy. If this is not tolerated (e.g. constipation), try administering oral iron with food.
- **Advise patients that iron can be toxic to children and should always be safely stored.**
- Blood transfusion is very rarely required for iron deficiency anemia in children. Judicious transfusion is indicated for very severe anemia in the setting of hemodynamic compromise / severe signs of anemia requiring emergent correction. In this case, transfused blood should be administered in small aliquots of 5 mL / kg over 4 hours with close monitoring, for prevention of fluid overload / cardiac failure.

## Monitoring response

- Refer to adult Monitoring Response section for guidance.
- Reticulocyte count may be helpful in monitoring response.
- Consider switching formulations if oral iron preparation is not tolerated.
- If hemoglobin is correcting by 4 weeks, continue oral iron and check CBC and ferritin at three months.

## Iron Deficiency and Obstetrics

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There is an increase in iron requirement (about 1000 mg total) during pregnancy, parturition and lactation.<sup>24,25</sup>

**Iron is essential for normal fetal development.** It is important to prevent iron deficiency in the fetus by preventing iron deficiency in pregnant women<sup>26</sup>. Assess risk of iron deficiency among women planning pregnancy, especially women in high-risk groups (Table 1).

### ► Iron supplementation for non-anemic pregnant women

Most pregnant women need to take a supplement to get enough iron<sup>27</sup>. An increase in iron consumption by about 15-30 mg elemental iron/day is recommended for non-anemic women, an amount readily met by most prenatal vitamin formulations. Health Canada recommends that pregnant women take a daily multivitamin that includes B12, 0.4mg of folic acid, and 16-20 mg of iron<sup>27</sup>.

For more information including advice on optimizing dietary iron intake and iron absorption, refer to: [Health Canada Prenatal Nutrition Guidelines for Health Professionals: Iron](#) and [Prenatal Nutrition Guidelines for Health Professionals – Frequently Asked Questions](#).

## ► Iron deficiency anemia in pregnant women

Iron deficiency anemia is the most frequent form of anemia in pregnant women. Anemia in pregnancy is defined as<sup>28-30</sup>:

- 1<sup>st</sup> trimester: hemoglobin < 110 g/L
- 2<sup>nd</sup> trimester: hemoglobin < 105 g/L
- 3<sup>rd</sup> trimester: hemoglobin < 105 g/L

If necessary, intravenous iron is considered to be safe for the second and third trimester (refer to Appendix B)<sup>26</sup>.

## Iron Deficiency in the Elderly

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Anemia in the elderly is a common clinical finding, often multifactorial, and has significant impact on quality of life, functional decline, and mortality. Treatment of iron deficiency and its underlying cause(s) may improve outcomes.

Investigation of anemia in the elderly is recommended if the life expectancy is more than a year<sup>31</sup>.

Replacement options are similar to younger patients. If standard dosing is not tolerated, low dose iron therapy (15 mg elemental iron per day, or 30 mg every other day) is an effective treatment in octogenarians, with significantly reduced adverse effects (refer to Appendix B)<sup>32-35</sup>. Note: iron stores take longer to replete with lower iron doses.

## Vegetarian and Vegan Diets

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Well-balanced vegetarian and vegan diets can provide sufficient iron intake for children, adolescents<sup>36</sup> and adults. Vegetarians require 1.8 times higher iron intake than non-vegetarians because non-heme iron is not absorbed as well as heme iron<sup>37</sup>. If uncertain, consider referral to a registered dietician.

For information on getting enough dietary iron and choosing iron-rich foods, refer to [HeathLink BC: Plant-based Diet Guidelines](#). Patients in BC can also phone a dietician at 8-1-1.

## Indications for specialist referral

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- Failure of oral supplementation trial
- Suspected anemia of chronic disease
- Suspected GI bleeding
- Anemia with unknown cause

## Resources

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### ► Practitioner Resources

- **RACE: Rapid Access to Consultative Expertise Program** – [www.raceconnect.ca](http://www.raceconnect.ca)

A telephone consultation line for select specialty services for physicians, nurse practitioners and medical residents.

**If the relevant specialty area is available through your local RACE line, please contact them first.**

Contact your local RACE line for the list of available specialty areas. If your local RACE line does not cover the relevant specialty service or there is no local RACE line in your area, or to access Provincial Services, please contact the Vancouver Coastal Health Region/Providence Health Care RACE line.

- **Vancouver Coastal Health Region/Providence Health Care:** [www.raceconnect.ca](http://www.raceconnect.ca)  
Available Monday to Friday, 8 am to 5 pm  
☎ 604-696-2131 (Vancouver area) or 1-877-696-2131 (toll free)
  - **Northern RACE:** ☎ 1-877-605-7223 (toll free)
  - **Kootenay Boundary RACE:** [www.divisionsbc.ca/kb/race](http://www.divisionsbc.ca/kb/race) ☎ 1-844-365-7223 (toll free)
  - **For Fraser Valley RACE:** [www.raceapp.ca](http://www.raceapp.ca) (download at Apple and Android stores)
  - **South Island RACE:** [www.raceapp.ca](http://www.raceapp.ca) (download at Apple and Android stores) or see [www.divisionsbc.ca/south-island/RACE](http://www.divisionsbc.ca/south-island/RACE)
- **Pathways** – [PathwaysBC.ca](http://PathwaysBC.ca)  
An online resource that allows GPs and nurse practitioners and their office staff to quickly access current and accurate referral information, including specialist wait times. Pathways also makes available hundreds of patient and physician resources that are categorized and searchable.

### ► Patient and Caregiver Resources

- Caring for Kids (Canadian Pediatric Society): Feeding Your Baby in the First Year: [https://www.caringforkids.cps.ca/handouts/feeding\\_your\\_baby\\_in\\_the\\_first\\_year](https://www.caringforkids.cps.ca/handouts/feeding_your_baby_in_the_first_year)
- HealthLink BC Handouts (available in English, Chinese, Farsi, French, Korean, Punjabi and Vietnamese):
  - “Iron and Your Health”: <https://www.healthlinkbc.ca/healthlinkbc-files/iron-health>
  - “Iron in Foods” – HealthLink BC: <https://www.healthlinkbc.ca/healthlinkbc-files/iron-foods>
- Translated patient handouts available from Refugee Health Vancouver: <https://www.refugeehealth.ca/>
  - “Anemia” (Arabic, French, Somali, Spanish)
  - “Iron-rich foods” (Farsi, Swahili)
- First Nations Traditional Foods Fact Sheets, including traditional foods high in iron: [http://www.fnha.ca/Documents/Traditional\\_Food\\_Fact\\_Sheets.pdf](http://www.fnha.ca/Documents/Traditional_Food_Fact_Sheets.pdf)

### ► List of Abbreviations

ACD	anemia of chronic disease
ADHD	attention-deficit/hyperactivity disorder
CBC	complete blood count
ID	iron deficiency
IDA	iron deficiency anemia
IM	intramuscular
IV	intravenous

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This draft guideline is based on scientific evidence current as of September 2018.  
 The draft guideline was developed by the Guidelines and Protocols Advisory Committee.

### THE GUIDELINES AND PROTOCOLS ADVISORY COMMITTEE

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- encourage appropriate responses to common medical situations
- recommend actions that are sufficient and efficient, neither excessive nor deficient
- permit exceptions when justified by clinical circumstances

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The Clinical Practice Guidelines (the guidelines) have been developed by the guidelines and Protocols Advisory Committee on behalf of the Medical Services Commission. The guidelines are intended to give an understanding of a clinical problem, and outline one or more preferred approaches to the investigation and management of the problem. The guidelines are not intended as a substitute for the advice or professional judgment of a health care professional, nor are they intended to be the only approach to the management of clinical problem. **We cannot respond to patients or patient advocates requesting advice on issues related to medical conditions. If you need medical advice, please contact a health care professional.**

## ► Appendix A: Dietary Aspects of Iron

Foods contain iron in two forms: “Heme” iron is present in red meat, fish and poultry, while the non-heme iron is present in fruits, vegetables, cereals and dairy products etc. “Heme” iron is absorbed very well (15-35% vs. 2-5% non-heme iron), and its absorption is independent of other factors present in food, while absorption of non-heme iron is markedly affected by other factors: Factors that inhibit iron absorption include decreased gastric acidity, *Helicobacter pylori* infection, tannins (tea), polyphenols (coffee, herbal teas and cocoa containing beverages – taken within one hour of the meal), phytates (legumes, grains, rice) and calcium and phosphate (antacids and calcium tablets). Factors that enhance absorption of non-heme iron are: meat, citrus juices, vitamin C (e.g. from broccoli, strawberries, tomato, spinach, citrus fruit), and EDTA fortification of foods.

Recommended Dietary Allowance for Iron		
<b>Men</b>	Adult	8 mg
<b>Women</b>	Adult (age 50 on)	8 mg
	Adult (ages 19 to 50)	18 mg
	Pregnant	27 mg
	Lactating	9 mg to 10 mg
<b>Adolescents (ages 9 to 18)</b>	Girls	8 mg to 15 mg
	Boys	8 mg to 11 mg
<b>Children (birth to age 8)</b>	Ages 4 to 8	10 mg
	Ages 1 to 3	7 mg
	Infants (7 months to 1 year)	11 mg
	Infants (birth to 6 months)	0.27 mg

Table cited from: Panel on Micronutrients, Food and Nutrition Board, Institute of Medicine–National Academy of Sciences (2001). *Dietary reference intakes: Recommended intakes for individuals, vitamins. Dietary Reference Intakes for Vitamin A, Vitamin K, Arsenic, Boron, Chromium, Copper, Iodine, Iron, Manganese, Molybdenum, Nickel, Silicon, Vanadium, and Zinc*, pp. 772–773. Washington, DC: National Academy Press.

## ► Appendix B: Iron Preparations

One preparation is not preferred over another; patient tolerance should be the guide. The usual adult dose is 180 mg of elemental iron/day in divided doses<sup>32</sup>. Therapeutic doses can range from 100 to 200 mg of elemental iron/day, depending on severity of symptoms, ferritin levels, age of the patient, and gastrointestinal side effects.

Iron salt	Formulation (elemental iron)	Usual Adult Daily Dose	Incidence of Adverse Reactions	Therapeutic Considerations <sup>1*</sup>	Cost per 30 Days <sup>†</sup>
<b>Oral Formulations</b>					
Adverse GI reactions may include: nausea, vomiting, dyspepsia, constipation, diarrhea, dark stools, bloating					
<b>ferrous sulfate</b> (Generics, Fer-in-Sol®, Ferodan®, Pediafer®)	Tablets 300 mg (60 mg Fe)	300 mg (60 mg Fe) PO TID	+++	<ul style="list-style-type: none"> <li>Needs acid in the stomach to get absorbed.</li> <li>Take on an empty stomach — at least 1 hour before or 2 hours after eating, with orange juice or vitamin C.</li> <li>Absorption may be decreased if taking antacids or medications that reduce stomach acid.<sup>‡</sup></li> </ul>	\$2-5 (Regular coverage for generics)
	Drops 75mg/mL (15mg Fe/mL)	300 mg (60 mg Fe) PO TID	++		\$74-144 (Regular coverage for generics)
	Suspension 30mg/mL (6 mg Fe/mL)		++		\$ 35-39 (Regular coverage for generics)
<b>ferrous gluconate</b> (Generics)	Tablet 300 mg (35 mg Fe)	600 mg (70 mg Fe) TID	++	<ul style="list-style-type: none"> <li>Taken with or without food.</li> <li>Does not need acid in the stomach to get absorbed. Good choice if taking medications that reduce stomach acid.</li> <li>Capsule can be opened and contents mixed into water or sprinkled over soft food.</li> <li>Virtually tasteless.</li> </ul>	\$9-10 (Regular coverage for generics)
<b>ferrous fumarate</b> (Generics, Palafer®, Eurofer®)	Tablet 300 mg (100 mg Fe)	300 mg (100 mg Fe) PO BID	++		\$10-11 (Regular coverage for generics)
	Suspension 300 mg/5mL (20 mg Fe/mL)		+		\$ 35 (Regular coverage for generics)
<b>polysaccharide iron</b> (Generics, Feramax®)	Polysaccharide iron capsules 150mg (150 mg Fe)	150 mg Fe PO DAILY	+	<ul style="list-style-type: none"> <li>Very easily absorbed. Taken with or without food.</li> <li>Does not need acid in the stomach to get absorbed. Good choice if taking medicines that reduce stomach acid.</li> <li>Do not take if allergic to cow products.</li> </ul>	\$16-24 (No coverage)
	Powder 60 mg/teaspoon (60 mg Fe)	60 mg Fe PO TID	+		\$161 (No coverage)
<b>heme iron polypeptide</b>  (Generics, Proferrin®)	11 mg heme Fe	11 mg Fe PO DAILY to TID	+		\$51-100 (No coverage)

i Treatment with oral iron may take as long as six to eight weeks in order to fully ameliorate the anemia, and as long as six months to replenish iron stores.

ii Prices are estimates as of August 2018 based on the maximum adult dose; prices of all oral formulations include an estimated retail markup. Parenteral formulations are expected to be administered in an institution setting (e.g. hospitals) where PharmaCare coverage is irrelevant. All prices are subject to change.

iii Iron absorption may be decreased by antacids or supplements containing aluminum, magnesium, calcium, zinc, proton pump inhibitors, and histamine2 receptor antagonists.

\* Treatment with oral iron may take as long as six to eight weeks in order to fully ameliorate the anemia, and as long as six months to replenish iron stores.

† Prices are estimates as of August 2018 based on the maximum adult dose; prices of all oral formulations include an estimated retail markup. Parenteral formulations are expected to be administered in an institution setting (e.g. hospitals) where PharmaCare coverage is irrelevant. All prices are subject to change.

‡ Iron absorption may be decreased by antacids or supplements containing aluminum, magnesium, calcium, zinc, proton pump inhibitors, and histamine2 receptor antagonists.

Iron Product	Formulation (elemental iron)	Usual Adult Daily Dose	Adverse Reactions	Incidence of Adverse Reactions	Therapeutic Considerations <sup>1§</sup>	Cost per 30 Days <sup>**</sup>
<b>Parenteral Formulations</b>						
<b>iron sucrose</b> (Venofer®)	Injection (IV): 20 mg/mL Fe	100 to 300 mg IV intermittent per session, given as a total cumulative dose of 1000 mg over 14 days	<b>CNS:</b> headache, fever <b>CVS:</b> hypotension <b>GI:</b> metallic taste, nausea, vomiting <b>MSK:</b> muscular pain, cramps	+	<ul style="list-style-type: none"> <li>Hypotension may occur from rapid IV administration; doses greater than 300 mg associated with significant hypotension.</li> </ul>	\$405/1000mg
<b>iron dextran complex</b> (Dexiron®)	Injection (IV or IM): 50 mg/mL Fe	Based on body weight and hemoglobin; IV intermittent (maximum 1000 mg/day); or IM up to 100 mg Fe per site (maximum 250 mg/day)	<b>CNS:</b> fever <b>MSK:</b> arthralgia, myalgia	+++	<ul style="list-style-type: none"> <li>A test dose of 25mg elemental iron (0.5 mL) must be given before administering the first therapeutic dose.<sup>2</sup></li> <li>Total dose depends on patient's weight and hemoglobin level.<sup>2</sup></li> </ul>	\$297/1000 mg
<b>ferric gluconate complex</b> (Ferrlecit®)	Injection (IV): 12.5 mg/mL Fe	125 mg IV per dose; up to 1000 mg over 8 sessions	<b>CNS:</b> generalized seizures <b>CVS:</b> hypotension, hypertension, vasodilation <b>GI:</b> diarrhea, nausea	+++	<ul style="list-style-type: none"> <li>Indicated for treatment of iron-deficiency anemia in patients 6 years and older with chronic kidney disease undergoing hemodialysis in conjunction with supplemental erythropoietin therapy.</li> </ul>	\$285/1000 mg

**Abbreviations:** **BID** twice daily; **CNS** central nervous system; **CVS** cardiovascular system; **Fe** elemental iron; **GI** gastrointestinal; **IV** intravenous; **IM** intramuscular; **max** maximum; **mg** milligrams; **mL** milliliters; **MSK** muscular skeletal; **PO** orally; **Tabs** tablets; **TID** three times daily.

#### References

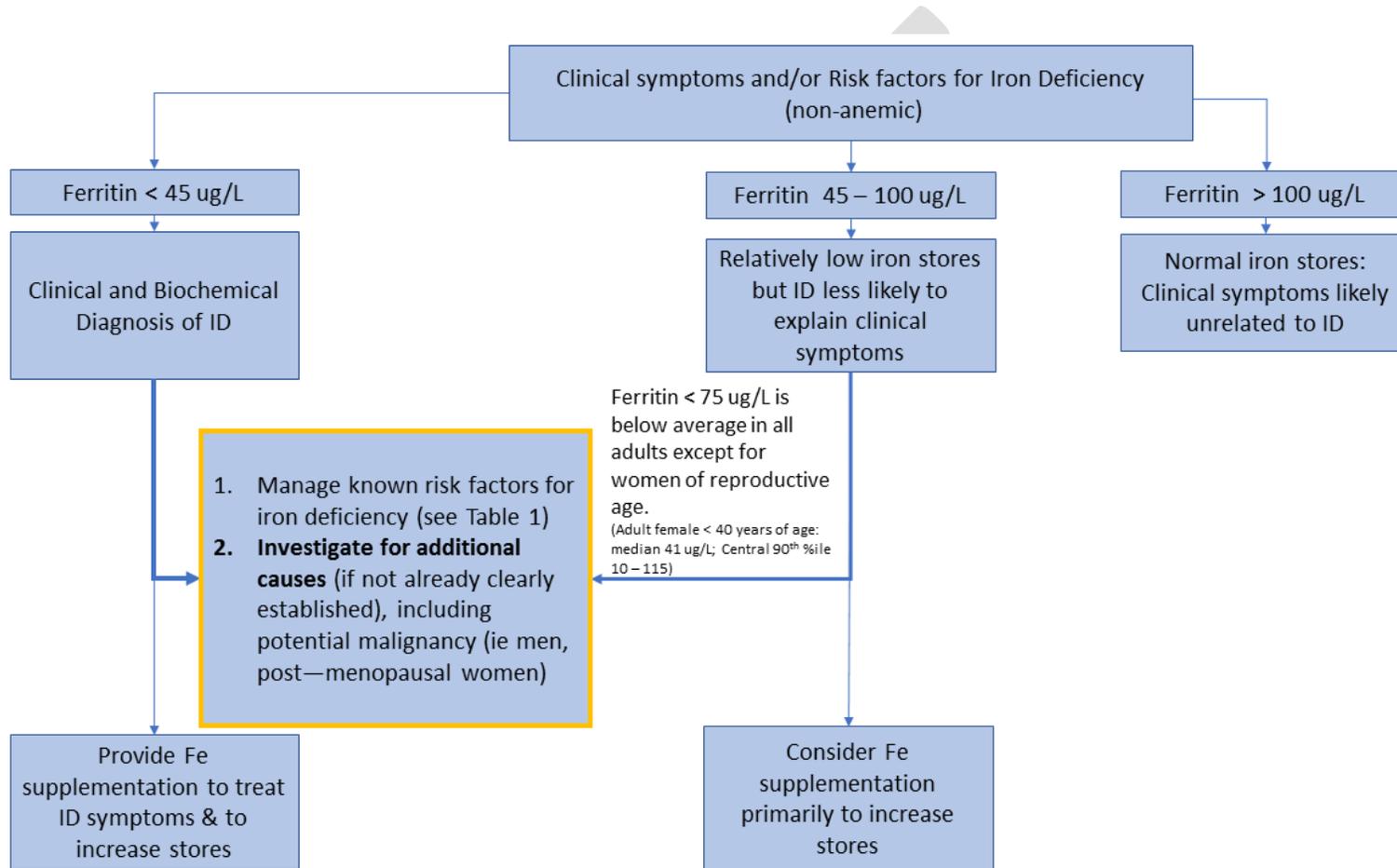
- Ontario Transfusion Coordinators Program. Choosing an Iron Pill. Hamilton Health Sciences. Jan 2016
- Vancouver Coastal Health Pharmaceutical Sciences Clinical Services Unit. Iron Dextran and Iron Sucrose. Vancouver Coastal Health Parenteral Drug Manual. Vancouver British Columbia. Vancouver Coastal Health – 2008.  
Iron Dextran dose: total dose (mg) required to restore hemoglobin (Hgb in g/L) to normal:  $50 \times (0.00442 [\text{desired Hgb} - \text{observed Hgb}] \times \text{LBW} + [0.26 \times \text{LBW}])$   
LBW in kg (male) =  $50 \text{ kg} + (2.3 \times \text{inches over 5 feet})$   
LBW in kg (female) =  $45.5 \text{ kg} + (2.3 \times \text{inches over 5 feet})$

§ Treatment with oral iron may take as long as six to eight weeks in order to fully ameliorate the anemia, and as long as six months to replenish iron stores.

\*\* Prices are estimates as of August 2018 based on the maximum adult dose; prices of all oral formulations include an estimated retail markup. Parenteral formulations are expected to be administered in an institution setting (e.g. hospitals) where PharmaCare coverage is irrelevant. All prices are subject to change.

► **Appendix C: Algorithm for investigation of iron deficiency in adults**

Please note that Appendix C is undergoing review for applicability to pediatric patients and may be updated.

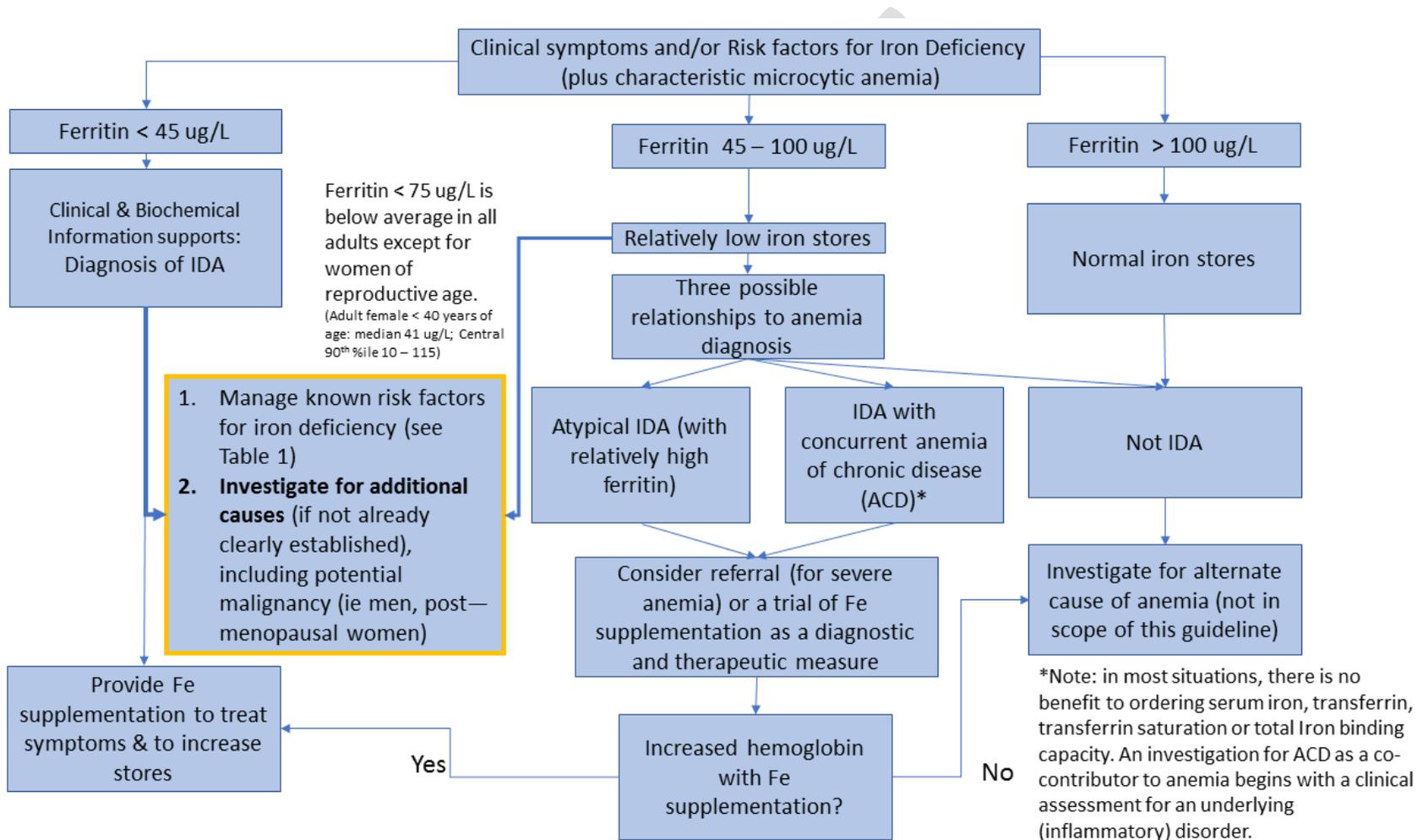


**Reference:**

1. Government of Canada SC. Canadian Health Measures Survey: Cycle 2 Data Tables: Table 51 — Distribution of ferritin measured in serum for the household population, by age and sex, Canada, 2009 to 2011 [Internet]. Available from: <https://www150.statcan.gc.ca/n1/pub/82-626-x/2013001/t053-eng.htm>

► **Appendix D: Algorithm for investigation of iron deficiency anemia in adults**

Please note that Appendix D is undergoing review for applicability to pediatric patients and may be updated.



**Reference:**

1. Government of Canada SC. Canadian Health Measures Survey: Cycle 2 Data Tables: Table 51 — Distribution of ferritin measured in serum for the household population, by age and sex, Canada, 2009 to 2011 [Internet]. Available from: <https://www150.statcan.gc.ca/n1/pub/82-626-x/2013001/t053-eng.htm>