

IRON DEFICIENCY (ID) AND Iron Deficiency Anemia (IDA)

RATIONALE:

Iron deficiency (ID), without anemia, continues to be one of the most common nutrient deficiencies in the United States and worldwide. While the United States has made great strides in decreasing the incidence of iron deficiency anemia (IDA), ID and IDA still remain serious health concerns, especially for young children.¹ Recognizing the negative impact of IDA on the health and development of children and others, the United States Department of Health and Human Services implemented Healthy People 2020 goals aimed at reducing the prevalence of IDA in young children, adolescent females, and women of childbearing age.

The prevalence of anemia in children and adolescents in the California Child Health and Disability Prevention (CHDP) program was tracked by the Centers for Disease Control and Prevention (CDC) Pediatric Nutrition Surveillance System (PedNSS) through 2010. California PedNSS data from 2010 showed the prevalence of anemia by age was: 18.7% for infants 6 – 11 months old, 14.8% for toddlers 12 – 17 months old, 13.9% for toddlers 18 – 23 months old, 14.8% for toddlers 24 – 35 months old, and 10.2 for children 36 – 59 months old. When considering all factors including ethnicity, the highest prevalence of IDA was found among Black, non-Hispanic infants (23.2%) and children and adolescents between the ages of 5 years to 20 years (24.6%).² While rates of anemia steadily declined for many years in California, between 1999 and 2010, there was an upward trend in most age and ethnic categories for IDA. This data clearly demonstrates that anemia remains an important health concern for children in California.

For young children, the Healthy People 2020 target for the prevalence rates of anemia in 1 – 2 year olds is 14.3% and 4.3% in 3 – 4 year olds.³ In California, the Healthy People 2020 goals for 1 - 2 year olds may be tangible over the next few years for most ethnic groups. However, meeting the Healthy People 2020 goal for 3 – 4 year olds will likely remain a substantial challenge since the most recent data shows that one out of every ten children has IDA in this age group. By accurately identifying and treating children with IDA, the CHDP provider can play a significant role in achieving the Healthy People 2020 goals for reducing anemia in children and in the prevention of adverse health and developmental consequences associated with IDA.

Inadequate iron intake is associated with long-term, negative consequences for infants, children, and adolescents. For infants and toddlers, some of the consequences associated with ID and IDA remain long after iron stores are replete. “ID (without anemia) in children may adversely affect long-term neurodevelopment and behavior; some of the effects are irreversible.”⁴ Neuro-developmental and behavioral disturbances include decreased motor activity, decreased social interaction, and diminished attention to tasks. In addition, longitudinal studies have shown that adolescents who had IDA in infancy continued to score lower than their non-anemic peers in IQ, social problems, and inattention, even though they received iron treatment

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as infants.⁵ ID has also been linked to negative impacts in older children and adolescents. School- aged children with IDA perform lower on cognitive tests and adolescents with ID and IDA have been reported to have impaired cognitive function⁶ and decreased exercise capacity.⁷

Inadequate iron intake is the most common cause of IDA, especially in young children. Dietary factors that contribute to inadequate iron intake include the use of low iron infant formula, early introduction of cow's milk before 12 months of age, excessive intake of cow's milk or other low iron beverages, strict vegetarian or other highly restrictive diets, special therapeutic diets, and limited access to food. Pica, the ingestion of non-food items such as clay, dirt, or laundry starch, may be an indicator of IDA as well as a behavior that exacerbates IDA. Additional causes of IDA include lead poisoning, anemia of chronic disease, malabsorption syndromes, gastrointestinal blood loss, hemoglobinopathies such as sickle cell disease and thalassemia, excessive menstrual blood loss, and a previous diagnosis of IDA. Premature and low birth weight infants are at an increased risk for the development of ID and IDA as iron stores may be inadequate before birth in this population.

Primary prevention of ID and IDA in infants and children can be achieved with the consumption of a varied and healthy diet that contains adequate amounts of nutrients associated with red blood cell production. The key nutrients include: iron, vitamin C, folic acid, cobalamin, and protein. For a detailed analysis of ID and IDA, please refer to the November 2010 clinical report from the American Academy of Pediatrics (AAP).⁸

SCREENING REQUIREMENTS

Bright Futures*

Please refer to the [AAP Bright Futures Recommendations for Preventive Pediatric Health Care](#) for hematocrit and hemoglobin risk assessments and testing guidelines. CHDP providers who treat Women, Infants and Children (WIC) Supplemental Nutrition and Head Start beneficiaries should also refer to additional WIC or Head Start hemoglobin and hematocrit testing requirements.^{#1}

CHDP providers should perform a nutrition assessment on all children. Providers should assess for unbalanced, deficient or excessive dietary intake, such as excessive consumption of cow's milk, vegetarianism, etc. For nutrition and growth assessment resources, please refer to the CHDP nutrition tools located at:

¹ ≠ Electronic Code of Federal Regulations, Part 246 – Special Supplemental Nutrition Program for Women, Infants and Children.” U.S. Government Publishing Office. http://www.ecfr.gov/cgi-bin/text-idx?SID=a42889f84f99d56ec18d77c9b463c613&node=7:4.1.1.1.10&rgn=div5#se7.4.246_17

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CHDP Information Brochure – Helping Medical Providers with Nutrition and Growth Assessment

<http://www.dhcs.ca.gov/formsandpubs/publications/Documents/CMS/FlyerNutrition.pdf>

- Provider Support and Education Materials
<http://www.dhcs.ca.gov/services/chdp/Pages/Training.aspx>
- What Does Your Child Eat? (DHCS 4035 A)
<http://www.dhcs.ca.gov/formsandpubs/publications/Pages/CHDPPubs.aspx> and
- Youth Nutrition and Activity Assessment for Ages 8 to 21 (DHCS 4466)
<http://www.dhcs.ca.gov/formsandpubs/publications/Pages/CHDPPubs.aspx>

Assess for risk factors (or multiple risk factors) associated with ID/IDA:

- History of prematurity or low birth weight (< 2500 g)
- Exposure to lead
- Exclusive breastfeeding beyond six months of age without supplemental iron or introduction of iron fortified foods and/or pureed meats
- Early weaning to whole milk before 12 months of age
- High consumption of low-iron foods
- Consumption of more than 20 ounces of milk per day for children 1 to 5 years of age
- Behavioral or oral motor feeding problems
- Poor growth, inadequate nutrition associated with special health care needs and/or low socioeconomic status especially in children of race/ethnic groups with high prevalence rates
- Consumption of highly restrictive diets
- Chronic disease and gastrointestinal blood loss
- Pica (excess consumption of non-food items)
- Overweight and obesity

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Signs and Symptoms of IDA

Without screening, ID and IDA frequently go unnoticed, as most individuals with low iron stores are asymptomatic. As iron stores continue to be depleted and anemia worsens some of the following, symptoms may be noticed:

- Extreme fatigue
- Pale skin
- Weakness
- Shortness of breath
- Chest pain
- Frequent infections
- Headache
- Dizziness or lightheadedness
- Cold hands and feet
- Inflammation or soreness of the tongue
- Fast heartbeat
- Unusual cravings for non-nutritive substances, such as ice, dirt or starch
- Poor appetite, especially in infants and children with iron deficiency anemia
- An uncomfortable tingling or crawling feeling in the legs (restless legs syndrome)
- Brittle fingernails and toenails.
- Cracked lips.
- Smooth, sore tongue.
- Muscle pain during exercise.

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- Trouble swallowing.

Infants and small children with iron deficiency anemia may not grow as expected and may have delays in developmental skills such as walking and talking. Children may be irritable and have a shorter than normal attention span.

Screen for signs and symptoms of pica, especially in young children. This may include repetitive consumption of non-food items over a period of 1 month or more despite efforts to restrict it. (See resource on pica listed in the Resources section of this guideline.)

Bright Futures recommends universal screening for anemia at approximately 12 months of age with determination of hemoglobin concentration and an assessment of risk factors associated with ID/IDA. Selective screening can be performed at any age starting at 4 months when risk factors for ID/IDA have been identified, including risk of inadequate iron intake according to dietary history. Additionally, California WIC requires anemia screening with determination of hemoglobin concentration at 12 months, 24 months, 3 years, and 4 years for all WIC participants.

Determine whether hemoglobin is low by referring to the following table. Hematocrit value is approximately three times the hemoglobin value.

TABLE 1: World Health Organization Hemoglobin Concentration Cutoff Values for Anemia⁹

Endorsed by the American Academy of Pediatrics¹⁰

Age in Years	Hemoglobin Concentration, g/dl
6 months to 6 years	11
6 to 14 years	12
Female	
> 15 (nonpregnant)	12
> 15 (pregnant)	11
Male	
<u>> 15</u>	13

NOTE: Treatment with iron is recommended for hemoglobin values below the cutoff values for anemia listed above.

CONSIDERATIONS FOR REFERRAL TREATMENT AND/OR FOLLOW-UP

- Based on the findings of the nutrition assessment, provide nutrition counseling for all children at risk for ID/IDA. Other nutrient deficiencies may coexist with IDA. Look

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for multiple and chronic dietary inadequacies during the nutrition assessment. For adequate dietary iron intake, see Table 4: Dietary Reference Intake for Iron by Age.

- Provide supplemental iron for fully or partially breastfed preterm and term infants until infant is consuming sufficient amounts of high iron foods to meet the Dietary Reference Intake for age. See Table 2: Recommended Iron Supplementation for Breastfed Infants - for recommended supplementation.
- Refer the family to the [Supplemental Nutrition Program for Women, Infants, and Children \(WIC\)](#) to obtain supplemental nutrient enriched foods and nutrition education.

For children with documented low hemoglobin/hematocrit:

- For health assessment-only providers, refer children with low hemoglobin/hematocrit levels to designated follow-up health provider.
- If hemoglobin is in the range of 10-10.9 g/dL or hematocrit is 30-32.9% and no other cause of anemia is identified, consider treating presumptively as IDA using iron replacement therapy and nutrition counseling. Recheck in 1 month, and if hemoglobin has increased by 1 gram, the diagnosis of IDA is confirmed. Please see Table 3: Recommended Iron Replacement Therapy and Medical Management of Childhood Anemia, for dosages of iron replacement.
- If hemoglobin is <10 g/dL or hematocrit <30%, or if history is not consistent with ID, or if treatment with iron replacement therapy has not been effective, additional laboratory testing should be done to determine the cause. This may include a complete blood count with red blood cell indices, serum ferritin, reticulocyte hemoglobin concentration, or hemoglobin electrophoresis.

NOTE: *The CHDP Program has moved away from using CHDP local program procedure codes and is requiring CHDP providers to use national CPT-4 codes on the CMS-1500 or UB-04 forms. CHDP providers should continue to check for additional coding updates through the dhcs.ca.gov CHDP newsflash bulletins or through their local CHDP program.*

- Caution families to keep iron tablets out of reach of children at all times to prevent accidental iron overdose.
- Check for elevated lead levels if not previously done in children under 6 years of age. Please refer to CHDP Health Assessment Guideline #6: Blood Lead Test and Anticipatory Guidance.

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Recheck hemoglobin/hematocrit after four to six weeks of iron replacement therapy. Rescreen for risk factors, signs, and symptoms of anemia. This follow-up visit is recommended to provide additional anticipatory guidance to the parent or legal guardian.

- Follow-up visits are important when there is a history of peri- or postnatal problems. These are associated with low iron stores in preterm or low-birth weight infants.
- If the child has not responded to iron replacement treatment, evaluate for adherence to treatment. Consider obtaining additional laboratory studies that are more specific and sensitive, such as serum ferritin and reticulocyte hemoglobin concentration assay to confirm ID. Refer to an appropriate specialist to identify other causes of low hemoglobin/hematocrit.
- If hemoglobin/hematocrit has normalized, reinforce nutrition counseling and continue iron treatment for at least 2 additional months, then recheck hemoglobin/hematocrit. Reassess hemoglobin/hematocrit approximately 6 months after successful treatment is completed.

HEMOGLOBIN OR HEMATOCRIT TESTING

Accuracy, low cost, ease of use, and increased provider office availability make finger stick testing of hemoglobin/hematocrit the most commonly used screening technique/method for the detection of IDA. Changes in hemoglobin/hematocrit only occur at late stages of ID; therefore, finger-stick testing is a late indicator of iron deficiency. This test, however, remains the standard methodology by which most initial screening for IDA is accomplished. More specific tests are available to diagnose iron deficiency, such as serum ferritin concentration and reticulocyte hemoglobin concentration.

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Basics of Finger Stick Testing

Proper procedure includes using an antiseptic technique: cleanse the site (usually distal lateral aspect of finger) with alcohol and wipe dry with clean gauze or air dry. Use a lancet finger puncture device to make a puncture lateral to the ball of the finger. Use the opposite hand to support the finger and squeeze *lightly* to stimulate blood flow. When a well-rounded drop has formed, touch a heparinized (or other anticoagulant) capillary collection tube horizontally to the drop (do not touch tube to patient finger). After collection, gently mix the tube containing anticoagulant to prevent hemolysis.

Proper technique is important when obtaining the blood sample to ensure accurate results. A low reading may arise from squeezing or milking the finger or from the presence of alcohol on the fingertip. A high reading may result from blood clotting or incomplete filling in the capillary collection tube. Specific techniques may vary depending on manufacturer guidelines.

Quality Assurance for Hemoglobin or Hematocrit Testing

Providers who test or examine any material from the human body must obtain a Clinical Laboratory Improvement Amendments of 1988 (CLIA) certificate to demonstrate compliance with CLIA standards and pertinent California law. The hemoglobin and hematocrit tests are either CLIA-waived or non-waived as determined by CLIA guidelines. A waived test is one that is a “simple laboratory procedure which...has an insignificant risk of an erroneous result.”⁵

Finger stick testing is a CLIA-waived test. Clinical laboratories or offices only conducting waived tests are exempt from routine federal inspections but must follow the manufacturers’ recommendations for quality assurance and must maintain a CLIA certificate of waiver. Any FDA approved CLIA-waived test system is acceptable for determining hemoglobin or hematocrit. The FDA website is updated regularly and has more information on [waived tests](#).

When providers use CLIA-waived tests they are required to perform quality assurance checks according to the manufacturer’s instructions. Providers should ensure that individuals who draw blood and process hemoglobin or hematocrit tests meet CLIA and California requirements and are appropriately trained and rechecked on procedures, including appropriate finger stick technique.

A non-waived test is moderately or highly complex and therefore requires a higher level of knowledge, training, and judgment to be performed properly. Clinical laboratories performing non-waived tests are required to comply with a series of quality standards (including participation in a proficiency testing program) and to obtain a CLIA certificate of registration or accreditation.

For additional information on laboratory testing, please contact your local CHDP program or the [California Department of Public Health, Laboratory Field Services](#).

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Resources

The following nutrition education resources provide guidance and prevention tips for Iron Deficiency/Iron Deficiency Anemia and are freely downloadable. Most are available in English and Spanish.

General

Centers for Disease Control and Prevention, [SuperTracker](#) (foods high in iron and vitamin C)

National Library of Medicine – National Institutes of Health, [Anemia Caused by low Iron – children](#).

Nemours, [Kids Health](#) (parent, child and teen materials); [Kids Health in Spanish](#)

Women, Infants and Children

California Women, Infants and Children (WIC) Program, [Foods High in Iron](#);

United States Department of Agriculture (USDA): [WIC Works Resource System](#)

TABLE 2: Recommended Iron Supplementation for Breastfed Infants ⁸

Category	Age Group	Dosage of Elemental Iron*	Supplement Type
Term Infants, fully or partially breastfed	Begin at age 4 months*	1 mg/kg/day	Drop
Preterm Infants, breastfed	Begin by 1 month of age and continue up to 12 months of age*	2 mg/kg/day	Drop

*Provide supplemental iron until infant is consuming sufficient quantity of high iron foods to meet the Dietary Reference Intake for age.

TABLE 3: Recommended Iron Replacement Therapy and Medical Management of Childhood Anemia 7, 8

Category	Age Group	Dosage of Elemental Iron*	Supplement Type
Infants	< 5 years	3-6 mg/kg/day	Drop or elixir
Children	5 – 12 years	60 mg/day	Tablet or elixir
Female adolescents	12 – 18 years	60 -120 mg/day	Tablet
Male adolescents	12 – 18 years	120 mg/day	Tablet

*The choice of preparation and dosage should be determined by the health provider.

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Common Oral Forms of Iron¹⁴

- Infants: Ferrous Sulfate drops (ex.: Fer-In-Sol): 37.5 mg Ferrous Sulfate/0.5mL which yields 7.5 mg elemental iron/0.5 mL
- Children: Use Ferrous Sulfate Elixir: 220 mg Ferrous Sulfate/5 mL which yields 44 mg elemental iron/5 mL
- Older Children/Adolescents: Use Ferrous Sulfate: 325 mg Ferrous Sulfate/tablet which yields 65 mg elemental iron/tablet

NOTE: *Because product dosage forms and strengths may change at any time, it is recommended that providers specify the mg dose required rather than mL needed.*

TABLE 4: Dietary Reference Intakes for Infants, Children, and Adolescents¹⁵

Category	Age	Iron (mg/day)
Infant	0.0 – 0.5 year	0.27 mg*
	0.5 – 1.0 year	11 mg
Children	1 – 3 year	7 mg
	4 – 8 year	10 mg
Adolescents by sex	Females: 9 – 13 years	8 mg
	14 – 18 years	15 mg
	Add for pregnant teens	27 mg
	Males: 9 – 13 years	8 mg
	14 – 18 years	11 mg

*For healthy breastfed infants, adequate intake is defined as mean intake.

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