# GUIDELINES FOR EVALUATION OF THE NUTRITIONAL STATUS AND GROWTH IN REFUGEE CHILDREN DURING THE DOMESTIC MEDICAL SCREENING EXAMINATION

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## Summary

- History and physical examination
    - Dietary history - including habits, restrictions, and cultural dietary norms; food allergies; and known current and past nutritional deficiencies.
    - A complete physical examination, including:
        - Weight and height/length – to initiate longitudinal growth monitoring
            - Recommended anthropometric indices used to characterize malnutrition include:
                - Weight-for-Height (to assess wasting)
                - Height-for-Age (to assess stunting)
                - Weight-for-Age (to assess underweight)
                - Body mass index (BMI) calculation for children older than 2 years and all adults -
            - For children younger than 2 years of age, growth indicators should be compared to WHO standardized growth references while Center for Disease Control and Prevention/National Center for Health Statistics (CDC/NCHS) references may be used for those over 2 years of age.
        - Examination for specific physical findings indicating undernutrition/ overnutrition or micronutrient deficiencies (see text)
    - Laboratory testing
        - Complete blood count (CBC) with differential, including red blood cell indices
        - Population-specific testing may be suggested in future guidelines when specific nutritional issues are identified (e.g., vitamin B12 deficiency in Bhutanese refugees)
    - Prevention and Counseling
        - All children 6 months-59 months of age should be prescribed an age-appropriate daily multivitamin.
        - Children (> 6 years) and adults may benefit from specific supplementation (see text)
        - Culturally appropriate nutritional counseling and social support for food access should be provided.
        - Primary care should be established for ongoing monitoring of growth and development, age-appropriate nutritional screening as well as ongoing counseling and nutrition education.

## Background

### General issues of nutrition in newly arriving refugees

Much of our understanding of the nutritional and developmental status of newly arrived refugees in the United States is based on studies of specific ethnic cohorts during defined periods. For example, during the influx of Southeast Asian refugees in the late 1970s and early 1980s, significant growth and nutritional disorders were reported within these cohorts. [1] In fact, the large number of U.S. entries from Southeast Asia during this period likely contributed to the increases observed in overall rates of stunting among the general U.S. Asian population. [2]

Since the 1980s, refugee populations arriving in the United States have become more diverse, with increasing numbers of refugees arriving from Africa, Europe, and the Middle East. For example, in 2005, populations originating from 10 countries constituted 86% of all newly arrived refugees: Cuban, Ethiopian, Iranian, Laotian, Liberian, Russian, Somali, Sudanese, Ukrainian, and Vietnamese. Undernutrition has been documented in many of these populations. [3, 4] Poor growth and nutrition have also been reported in refugee children arriving in the United States, although studies suggest that most refugee children experience catch-up growth and reach normal weight within 6-24 months of arrival in the United States. [5, 6]

Although undernutrition is often associated with refugee status, concerns are increasing about overweight/obesity among refugees resettling to developed countries. [7-9] Overweight and obesity are frequently assumed to be associated with assimilation to a U.S. lifestyle (increased availability of high-calorie foods, reduced physical activity), compounded by lack of nutritional education. However, one study identified a population of African children who had a high prevalence of overweight/obesity at the time of arrival,5 and other data have identified overweight/obesity and associated medical consequences in the newly arriving Iraqi population. [10] This trend may reflect the overall rising global prevalence of overweight/obesity and/or the changing socioeconomic status of newly arriving refugees. Several studies have identified overweight/obesity to be a prevalent condition in both children and adult refugees after arrival in the United States; this condition is particularly evident among those from low-income countries in Latin America, the Caribbean, the Middle East, North Africa, certain nations of Sub-Saharan Africa, Central Eastern Europe, and the former Soviet Union. [11] Several factors have been identified that increase the risk of obesity among refugees, including length of stay in the host country [12-14], level of acculturation to U.S. lifestyles [15-17], existing cultural beliefs and values [18], and poor quality of housing. [19] Information on obesity in the United States is available at: www.cdc.gov/obesity/index.html and www.cdc.gov/healthyyouth/obesity/facts.htm. Therefore, these populations may increasingly be at risk for both undernutrition, a condition associated with development and cognitive delays, and overweight/obesity, a condition associated with chronic medical conditions, including hypertension, diabetes, and cardiovascular disease.

## Common micronutrient deficiencies among refugees

### Iron deficiency

Iron deficiency is the most common nutritional deficiency globally, estimated to affect half the children living in developing countries. [20] High-risk groups include infants and young children during periods of rapid growth (especially between 6 and 24 months of age) [20] and women of childbearing age. Infants and young children are also at increased risk if they continue to breastfeed after 6 months of age without iron supplementation [21], or if they consume weaning foods low in iron content.

Iron-deficiency anemia typically results from inadequate bioavailable dietary iron. This condition is more common among groups with a history of infrequent consumption of animal sources of iron, and also results from the presence of dietary inhibitors of iron absorption, such as tannins (e.g. tea) and phytates from certain plants. Non-dietary factors associated with anemia include parasitic infections such as intestinal parasites, particularly hookworm and malaria infection (both clinical and subclinical), hemoglobinopathies such as sickle cell trait/disease, thalassemias, and chronic infections. [22] Thalassemias are more prevalent in certain parts of the world, including Southeast Asia, India, the Middle East, Eastern Europe, and Africa. In addition, other micronutrients deficiencies (e.g., vitamin B12, folate, and vitamin A) may also cause or contribute to anemia. Vitamin B12 and folate are classically associated with a megaloblastic anemia.

Moderate to severe iron deficiency leads to anemia which can have long-term impact, particularly among children. Chronic iron deficiency is associated with impaired psychomotor and mental development among infants and cognitive impairment in adolescents. [23-25] Iron deficiency has also been linked to negative infant social-emotional behavior. [26] In adults, anemia is associated with fatigue, low productivity at work, and may result in impairment of reproductive functions.

Anemia is particularly prevalent among refugee children. Studies of children in refugee camps from Syria, Jordan, the West Bank, the Gaza strip, Lebanon, and Thailand (Burmese) reported overall anemia prevalence rates ranging from 54% to 85%. [27, 28] Although dietary iron deficiency is the most common condition associated with anemia, refugees frequently have multiple etiologies contributing to this condition. Almost half (48%) of Burundian refugee children living in a Tanzanian refugee camp where malaria and hookworm prevalence rates were high had severe anemia, defined as a mean Hb level below 80.0 g/L. [29] A study of Burmese refugee children found 10% to be severely anemic by this same standard. [28]

The CDC and World Health Organization (WHO) consensus statement on best measures of iron status reiterate the challenge in finding an affordable, field-friendly method for measuring iron deficiency that is more sensitive than hemoglobin levels and indices. [30] Although a complete discussion of anemia is beyond the scope of this section, other common etiologies and initial evaluation are addressed in the General Section of the Domestic Refugee Medical Screening Guidelines. Given the potential long-term effects of iron deficiency anemia on cognitive function and productivity, screening, treatment, and prevention are of particular importance. [31-34]

### Vitamin D deficiency

High rates of vitamin D deficiency have been reported in both resource-rich as well as resource-limited countries, placing both children and adults at risk of complications (e.g., rickets and osteoporosis, respectively). [35-37]

Although inadequate dietary intake of vitamin D and calcium, [38, 39] as well as inadequate sources of dietary iron, [38, 40, 41] may contribute to vitamin D deficiency in resource-limited settings, most vitamin D is derived from non-dietary sources. Therefore, the etiology of vitamin D deficiency is multifactorial and heavily dependent on non-dietary determinants such as limited sun exposure (protective or religious clothing, moving to temperate climates, and the tradition of keeping infants indoors), increased skin pigmentation [42], reduced in-utero exposure [43], and reduced capacity to synthesize vitamin D with increasing age. [44] Consequently, those at particularly high risk are persons with dark skin, those who cover most of their skin when outdoors, infants with history of prolonged breastfeeding without supplements, infants whose mothers are vitamin D deficient, pregnant and lactating women, those living in temperate regions, those with chronic malabsorptive states such as celiac disease, and the elderly. These factors converge for several refugee groups, placing them at particular risk, so that vitamin D deficiency among veiled, dark-skinned immigrant women has been reported to be as high as 80% [45], although most immigrant groups appear to be affected by vitamin D deficiency. [42, 46-48] The Domestic Refugee Medical Screening Guidelines address vitamin D deficiency in detail in a specific Vitamin D section (www.placeholder).

### Others micronutrient deficiencies

Micronutrient deficiencies are well documented in many populations in resource-limited settings where refugees originate. A few studies have noted refugees to be at risk for less common micronutrient deficiencies due to the tenuous dietary intake of families just prior to entering refugee camps, a dependence on grain-based external food aid, and reduced access to traditional sources of diversified foods. [49] However, little is known about the prevalence or impact of these deficiencies on migrating refugees prior to and after arrival in the United States. The clinician should be aware of common deficiencies as well as their characteristic findings, since these may be encountered during the new refugee arrival medical evaluation.

### Vitamin A

While vitamin A deficiency is seldom encountered in industrialized countries, it is a common nutritional deficiency in the developing world. Vitamin A deficiency is the leading cause of preventable blindness among children in the world with 500,000 children losing their vision annually, and approximately half of these children dying within a year of losing their sight. [50]

Vitamin A deficiency produces a spectrum of vision and ocular changes ranging from poor night vision and Bitot spots (areas of abnormal squamous cell proliferation and keratinization of the conjunctiva), progressing to more severe ocular forms of xerophthalmia, keratomalacia, corneal perforation, and, in its most severe form, permanent blindness. In addition, vitamin A deficiency leads to impaired bone growth, dry skin and hair, and impaired humoral and cell-mediated immune response in turn increasing the risk for infections.

Although there is an established policy in refugee camps for vitamin A supplementation and increasingly for vitamin A fortification, several studies have demonstrated high rates of vitamin A deficiency among refugees, particularly among children [51-53], but there is little report of vitamin A deficiency among refugees resettled in developed countries. Additional information on vitamin A is available here.

### Zinc

While zinc deficiency is widespread, those at greatest risk are concentrated in areas of the world consuming plant-based diets. [54] Zinc is required for the catalytic activity of over 100 enzymes and plays an important role supporting growth and development during pregnancy, childhood, and adolescence. Zinc deficiency is characterized by growth retardation, loss of appetite, and impaired immune function. In more severe cases it may cause hair loss, diarrhea, delayed sexual maturation, impotence, and, in males, hypogonadism. Weight loss, delayed healing of wounds, eye and skin lesions, taste abnormalities and lethargy may also occur.

Little data are available on the risk of zinc deficiency among refugee populations, although reports of suboptimal levels of zinc among food rations for refugees have been reported. [55]

Additional information on zinc deficiency is available here. There are no data on zinc deficiency in refugees resettled to the United States.

### B12

The global prevalence of vitamin B12 deficiency is uncertain due the lack of nationally representative data. Vitamin B12 occurs naturally in animal products (e.g., eggs, meat, milk), and its deficiency results from decreased dietary intake as well as impaired absorption (e.g., intrinsic factor deficiency), and malabsorption (e.g., chronic gastritis from Helicobacter pylori, bacterial overgrowth). Although commonly asymptomatic, several nonspecific symptoms, such as fatigue, decreased mental work capacity, decreased concentration and memory, irritability, depression and other psychiatric symptoms, have been associated with B12 deficiency. Neurologic signs and symptoms may develop with the earliest signs being diminished vibratory sensation and proprioception. Other signs and symptoms include weakness, numbness or tingling of the extremities, impaired sense of smell, loss of coordination and ataxic gait, and, in severe cases, subacute combined degeneration of the spinal cord.

Bhutanese refugees have been documented to be at particular risk of B12 deficiency with rates as high as 64% among overseas refugees and 27% of postarrival medical screenings. [56]

Classically vitamin B12 deficiency is associated with macrocytic red cells with or without anemia, presence of hypersegmented neutrophils, and occasionally pancytopenia. Additional information on B12 deficiency is available here.

### B3/Niacin and tryptophan

Pellagra is the deficiency of niacin and/or tryptophan, usually in combination with lack of other amino acids and micronutrients. Inadequate intake of either niacin or tryptophan is most common in areas where corn is the primary constituent of the diet. In addition, pellagra occurs in areas of South Asia where people eat millet with a high leucine content, which may contribute to pellagra. Secondary deficiency may occur due to diarrhea, cirrhosis, or alcoholism.

Advanced pellagra may cause a symmetric photosensitive dermatitis (e.g., "Casal's necklace, butterfly-shaped rash on the face, "glove-like rash"), diarrhea, stomatitis, and neurologic symptoms including anxiety, tremors, and peripheral neuritis. The classic symptoms of pellagra are generally not well observed in infants and children, although anorexia, irritability, anxiety and apathy have been observed.

Outbreaks have been reported among refugees dependent upon external food supplies through the years, often precipitated by changes in the diversity and quality of food rations. [57] Although sporadic cases are known to be detected in newly arriving refugees there are no published data in of the prevalence of this disorder in refugees resettled to the United States. Additional information of pellagra is available here [PDF - 42 pages].

### Iodine

Iodine deficiency is estimated to affect 2 billion individuals worldwide, including an approximately 31.5% of school-aged children, and is the world's most prevalent cause of thyroid disease. [58] Iodine, a trace element found in soil and seafood, is an essential component of the thyroid hormones involved in regulating the body's metabolic processes. Deficiency disorders include physical and mental retardation (including severe congenital form known as cretinism), hypothyroidism, goiter, and varying degrees of other growth and developmental abnormalities.

The universal salt iodization has been an effective approach to reducing the burden of iodine deficiency disorders. However, reports of excessively high levels of iodine have been reported among refugee camps in Africa raising a concern for a risk for iodine-induced hyperthyroidism (IIH). IIH can occur among previously iodine deficient populations, particularly females over 40 years of age, during a short period following the introduction of iodized salt. [59] While this risk for IIH remains, there are currently no reports of its occurrence among resettled refugees.

Additional information on iodine deficiency is available at: www.cdc.gov/immpact/micronutrients/index.html and http://www.iccidd.org/pages/iodine-deficiency.php.

### Thiamine/B1 deficiency

Thiamine, or vitamin B1, plays an important role in energy metabolism and building of tissues. Low levels may result from poor intake (e.g. associated with diets heavily consisting of white or milled rice, or heavy alcohol intake combined with poor food intake), altered metabolism (e.g. fever, pregnancy, breastfeeding, chronic liver disease, hyperthyroidism), from losses (e.g. extended diarrhea), or rarely, by the intake of food that contain thiaminases or antithiamine compounds.

Thiamine deficiency may result in the condition termed beriberi, that is associated with a spectrum of symptoms, including loss of appetite, constipation, fatigue, irritability, memory loss, peripheral neuropathy, muscle weakness and pain, areflexia, foot drop ("dropsy"), tachycardia, and heart failure. In adults, beriberi is grouped into two main syndromes. Wet, or edematous, beriberi is characterized by cardiac failure and, although a chronic disease, may have an acute presentation. Dry beriberi is multifocal peripheral and/or central nervous system dysfunction, which includes Wernicke encephalopathy and Korsakoff syndrome.

Several outbreaks of thiamine deficiency have been documented among refugees in camps,60 although there is little evidence of significant deficiencies among refugees after resettlement.

### Vitamin C deficiency

Vitamin C deficiency (ascorbic acid) has been estimated to occur in 14% of males and 10% of females in the United States61 with individuals most at risk being those with chronic malnutrition, alcoholism, and restrictive diets devoid of fruit and vegetables.

The clinical signs and symptoms of vitamin C deficiency, also known as scurvy, are manifest due to impaired collagen synthesis, and include ecchymoses, petechiae, bleeding gums, hyperkeratosis, and impaired wound healing. Other systemic symptoms include weakness, malaise, joint pain and swelling, edema, depression, and neuropathy.

Outbreaks of scurvy have been reported in refugee camps located in Somalia, Bhutanese refugees in Nepal, Ethiopia, Kenya, Somalia, and Sudan. [62] There are no published data of vitamin C deficiency in refugees resettled to the United States.

### Overseas Pre-Departure Nutritional Screening for Refugees

Nutritional assessment is not a required component of the overseas pre-departure examination, which is focused on diseases of public health significance. Prior to departure for the United States, refugee children may have measurements of height, weight, and head circumference (infants) performed either in the refugee camp setting or during the panel physician examination.

The refugee may have records of measures and plots on either local or international standardized growth charts (located in their "International Organization for Migrations (IOM) bag", the blue and white medical bag containing their health information). When available, these records are useful as an historic record of the child's growth. Depending on the pre-departure setting, measurements from a single point in time, rather than serial measurements, may be the only recorded anthropometric information. Increasingly, refugees who originate in camp settings, especially children, have benefited from supplemental feeding programs, which has resulted in catch-up growth and likely will decrease the degree of acute malnutrition observed in resettled children. [63] However, increasingly refugees arriving in the United States are not originating from camps but rather from urban settings where they do not receive supplemental feeding or nutrition programs.

### Nutrition Evaluation during the Domestic Medical Examination

The main goal of nutritional status screening of refugees after arrival is to identify those with nutritional deficiencies that require further evaluation and/or treatment. In addition, when specific issues in certain populations are identified (e.g. a recent report of B12 deficiency in large numbers of Bhutanese refugees), feedback to the State and CDC authorities may lead to initiation of an investigation and possible overseas, pre-departure evaluation and/or preventive health interventions.

### Medical History and Physical Examination

A standard comprehensive medical history will provide important insight into the risk for malnutrition as well as the etiology for the malnourished state that may be observed in the newly arrived refugee (see history and physical examination section).

**Relevant medical history** for assessing risk factors and signs/symptoms of nutritional deficiencies include:

- Review of Systems
    - A complete review of systems with particular attention to a history of chronic diarrhea, wasting, weight loss, failure to thrive, skin rashes, and vision or hearing difficulties.
- Past Medical History
    - Birth History (pediatric refugees): any history of prematurity or small-for-gestational-age birth weight in a setting where catch-up growth may not have been possible due to poor dietary resources. This may lead to a better understanding of the etiology for poor growth parameters and risk for micronutrient deficiencies, such as iron deficiency.
    - Past hospital admissions, surgical procedures, blood transfusions, and major infections such as meningitis, severe malaria, or frequent or severe diarrhea.
    - A history of failure to thrive, hospitalization for nutritional issues, enrollment in a supplementary feeding program, or feeding children with special formulas or packaged foods may indicate known history of malnutrition.
- Dietary, Family, and Social History
    - Past periods of food insecurity or social and/or economic duress.
    - A history of limited consumption of fruits, vegetables, and meat (depending on cultural norms) may provide insight into access to healthy diversity of foods or

cultural or religious food exclusions and may heighten suspicion for micronutrient deficiencies.
    - A history of supplement intake of specific micronutrients, such as vitamin A or zinc, as frequently provided in many settings in the developing world, may decrease the likelihood of current deficiency.
    - For young children, current or past breastfeeding is important when providing counseling or information to the resettling family.

**Anthropometric measurements** of weight and height/length should be done on all newly arriving refugees. Accurate measurements of weight, height/length, and age are required for the identification of malnutrition to be made. Criteria for obtaining data of good quality include using the right equipment to collect the data and employing standard measuring techniques.64 For example, children should be weighed in their underwear without shoes; children under the age of 2 years should lie on a suitable board to have their length measured, and children over 2 should stand up to have their height determined.

To interpret anthropometric data among children less than 5 years of age, the child's height and weight should be compared with reference curves of height-for-age, weight-for-age, and weight-for-height by using the WHO (World Health Organization) growth standards or 2000 CDC Growth charts. Most clinician use the CDC growth chart cut points for children > 2 years of age in the U.S.; less than 5th percentile for "under-nutrition", 85th-95th percentile for "overweight" and > 95th percentile as "obese". For children <24 months of age the American Academy of Pediatrics and CDC now recommend using the WHO growth standard. A body mass index (BMI) should be calculated for all refugees older than 2 years. Three different classification systems can be used to distinguish "normal" from "not normal" growth in childhood: z-scores, percentiles, and percent of median. Although percentiles are typically used in the United States*, WHO recommends the use of the z-score (a z-score of 1 represents 1 standard deviation from the reference median). Malnutrition is defined as a z-score of less than -2 for weight-for-height (e.g., wasting), height-for-age (e.g., stunting), or weight-for-age (e.g., underweight). A cutoff point of a z-score of -3 is used to identify severely malnourished children. Refugees may present with severe malnutrition (SAM) or more commonly in a state of chronic undernutrition and/or overweight/obesity (i.e., stunting, or weight/height <-2 or overweight/obesity or BMI/age >2).

**Physical examination** findings associated with either protein-energy or micronutrient malnutrition might include:

- Hair depigmentation and dryness from past severe states of undernutrition
- Poor dentition (often associated with consumption of refined sugars and betel nuts, as well as poor oral hygiene and possible vitamin D deficiency), which may exacerbate undernutrition if it interferes with chewing
- Clinical ocular signs of vitamin A deficiency in children, such as xerosis or Bitots spots (uncommon unless past severe episodes of undernutrition resulted in permanent ocular damage)
- A palpable goiter, which may indicate iodine deficiency
- A low-grade cardiac flow-murmur, which may indicate moderate to severe anemia
- Signs or symptoms of heart failure, such as third or fourth heart sounds, cardiomegaly, shortness of breath, cough, or edema may suggest thiamine deficiency

- Among children, typical signs and symptoms of rickets including skeletal manifestations may include:
    - Bone pain and tenderness
    - History of fractures or skeletal deformities (e.g., genu varum, genu valgu, frontal bossing)
    - Costrochondral swelling ("rachitic rosary")
    - Craniotabes
    - Enlargement of the wrist and bowing of the distal radius and ulna
    - Muscle weakness ("floppy baby" or "slinky baby" syndrome)
    - Retarded growth
    - Tetany (laboratory investigation may include hypocalcemia)
    - Dental problems
- Dermatitis, which may indicate micronutrient deficiencies such as zinc and niacin
- Thorough neurologic evaluation may suggest thiamine, niacin/tryptophan or B12 deficiency (e.g., altered proprioception or vibratory sensation, ataxia, loss of deep reflexes, peripheral neuropathy)

### Laboratory Screening

Initial laboratory screening for nutritional status of refugees in the United States should include the following:

- Complete blood count (CBC) with differential, including red blood cell indices (see "General Screening" section of the domestic guidelines).
    - Serum ferritin, a good indicator of body stores of iron, may be used as a supplemental test to indicate iron status. Many practitioners will provide iron supplements and measure ferritin in a broader evaluation only in those who do not respond as expected to appropriate replacement. Ferritin is an acute-phase reactant and will be falsely elevated during states of liver disease, infection, inflammation, and malignancy. An acute-phase marker, such as C-reactive protein (CRP), may be measured with ferritin to assist in interpretation (elevated CRP indicates an underlying process that may be causing a falsely elevated ferritin due to acute-phase reaction). Other iron measurements (e.g., transferrin) may be useful in diagnosing and evaluating the extent of iron deficiency. Detailed discussion and recommendations can be found here [PDF - 36 pages].
- The ZPP/H (zinc protophyrin to heme ratio) is a more sensitive indicator of iron-deficient states than hemoglobin.65 However, this measurement does not provide the additional information found on a CBC with differential that may be valuable for other conditions, such as the absolute eosinophil and platelet counts. In addition, the ZPP/H has limited availability and may also be falsely elevated among those with thalassemia, lead toxicity, and anemia of chronic infection. [66]
    - *Note*: Although full discussion of evaluation and treatment of anemia is beyond the scope of this section, more information is available in the General Section. Failure to respond to iron therapy would signal the possibility of another cause of anemia, such as a hemoglobinopathy. In those who fail to respond to therapy, further evaluation is necessary, such as hemoglobin electrophoresis, to identify

refugees with other conditions, such as sickle cell or thalassemia. Patients with beta-thalassemia and concomitant iron deficiency can have normal HbA2 levels.67 Hence, iron deficiency should be treated prior to electrophoresis testing.

## Age determination of refugee children

Accurate interpretation of the child's anthropometric measurements and nutritional status requires accurate age determination to account for the rapid growth occurring during childhood. For many refugee children, an accurate age is not known. The age displayed on their legal documentation may be inaccurate (often showing a standardized birth date of January 1), raising concern that the year of birth is also incorrect. For example, in a sample from Massachusetts a January 1 birth date was found among 60% of Somali refugees. [9] This finding could be intentional, or simply because some cultures do not keep track of dates of birth or age in years. Although the child may appear bigger or smaller than their stated age, if the age is not correct, the weight-for-height should not be affected, since this measurement is age-independent.

When a child's age is substantially over- or under-reported there may be implication for several important areas for the child's care and support. From a medical standpoint, in addition to impacting the interpretation of a child's nutritional status, inaccurate age reporting influences the validity of several important clinical measures including age-appropriate vaccinations, determination of anemia based on age norms, and objective assessment of developmental attainment. Enrollment in school at an age-appropriate level is also important, so that refugee children can start their new classes at a level that will optimize their educational experience and socialization with peers. Finally, accurate estimation of age is essential for authorities' efforts to support vulnerable groups such as unaccompanied minors, and also ensures that the child is emotionally and developmentally mature enough to carry out certain activities and decisions such as driving and voting.

If concern arises for a discrepancy between observed and recorded age that may cause adverse clinical or social outcomes, the provider may use narrative history along with developmental milestones, height and weight (plot on 50th percentile and find matching age), and sexual maturity (when culturally appropriate) to estimate the number of months' difference between the estimated age and official age. [68] Narrative history may include the following:

- Request for/review of records that may show child's age – immunization/health records/school transcripts
- Location of the family at the time of birth (many refugees can estimate time according to their location)
- Time of year at birth (winter, summer, wet season, dry season)
- Age that child was able to walk independently (approximately 1 year, although may vary by culture)
- Age of the child in relationship to the other children the family
- Dental evaluation may assist in determining approximate age

Traditionally bone radiography has been used in efforts to estimate age. Confounding factors such as past states of undernutrition, inadequate vitamin D and calcium intake, ethnic differences in bone maturation, and/or history of serious illness may all significantly impact the rate of bone ossification and maturation. [69] Therefore, use of radiographs to estimate age is discouraged.

If the family desires to make an official age change, inquiries regarding age change may be submitted to the U.S. Citizenship and Immigration Service. For school-aged children who have already been registered, the school administration may consult the state's Department of Education regarding steps to correct the age in school records and to understand the consequences of an age change. [70]

### Treatment and Prevention

A full discussion of treatment is beyond the scope of this document. However, given the high risk nature of their past and current diet, refugee children 6 months – 59 months of age should be given an age-appropriate multivitamin. Children with clinical evidence of undernutrition (weight-for-height < 5th percentile) who do not gain weight over the initial 3 months in the setting of nutritionally balanced food offerings should be considered as having failure to thrive. These children should undergo a comprehensive medical and nutritional evaluation, including detailed assessment of dietary intake, screening for other medical conditions (e.g. giardia), consideration of a limited-trial of caloric supplements such as high-calorie formulas, and nutrition referral.

Refugees > 6 years of age with clinical or laboratory evidence of poor nutrition may benefit from a multivitamin or specific supplementation according to published standards of practice (e.g. vitamin D).

### Nutrition Counseling

Traditional food habits vary enormously between different refugee groups and also change in response to new conditions, increased access to foods, availability of cooking facilities, and cultural adjustment, among other factors. Little is known about the impact of dietary changes after migration to the United States. Adequate medical follow-up and continuity of care after initial screening are essential to ensure identification of nutritional and other health issues, monitor growth and development, as well as to provide preventive services and education. In addition, refugees are particularly vulnerable after arrival and may not understand the complex health and social safety net to assure access to food, enrollment in the Special Supplemental Nutrition Program for Women, Infants and Children (WIC) and food stamps, may be essential.

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