Texas Preventable Disease NEWS

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CDC CRITERIA FOR ANEMIA IN CHILDREN AND CHILDBEARING-AGED WOMEN*

Hemoglobin (Hb) and hematocrit (Hct) measurements are the laboratory tests used most commonly in clinical and public health settings for screening for anemia. Because most anemia in children and women of childbearing age is related to iron deficiency, the main purpose of anemia screening is to detect those persons at increased risk for iron deficiency. Proper anemia screening requires not only sound laboratory methods and procedures but also appropriate Hb and Hct cutoff values to define anemia. The "normal" ranges of Hb and Hct change throughout childhood and during pregnancy and are higher for men than women. Thus, criteria for anemia should be specific for age, sex, and stage of pregnancy. Current major reference criteria for anemia, however, are not based on representative samples and fail to take into account the normal hematologic changes occurring during pregnancy. To address these limitations, CDC has formulated new reference criteria for use in clinical practice for public health and nutrition programs and the CDC Pediatric and Pregnancy Nutrition Surveillance Systems. The new criteria may also be useful for defining anemia in clinical research and nutrition surveys.

The anemia reference values for children, nonpregnant women, and men are derived from the most current nationally representative sample--the Second National Health and Nutrition Examination Survey, 1976-1980 (NHANES II). Because representative data are not yet available for pregnant women, anemia reference values are based on the most current clinical studies available. Adjustment values of Hb and Hct cutoffs are provided for persons who reside at higher altitudes and for those who smoke cigarettes..

Anemia Cutoffs for Children, Nonpregnant Women, and Men

Because hematologic values normally change as children grow older, it is necessary to use age-specific criteria for diagnosing anemia in children. The best hematologic reference data for the US are available from the NHANES II. The Hb and Hct cutoffs recommended represent the age-specific fifth percentile values for "healthy" persons from NHANES II (Table 1). The healthy sample was defined by excluding persons who were likely to have iron deficiency based on multiple iron biochemical measures. The anemia cutoff values based on these NHANES II studies for younger children are in close agreement with the cutoff values recommended by the American Academy of Pediatrics, which were based on a sample of healthy white middle-class children. Even though no data are available from NHANES II to determine anemia cutoffs for infants <1 year of age, cutoff values for children 1-2 years can be extrapolated back to 6 months of age. In general, anemia screening to detect iron deficiency is not indicated for infants <6 months of age because younger infants usually have adequate iron nutritional status.

Table 1.
Hemoglobin (Hb) and hematocrit (HCT) cutoffs for children, nonpregnant women, and men*

Age (yrs)/Sex	Hb (g/dL)	Hct (%)
Both sexes		
1–1.9	11.0	33.0
2–4.9	11.2	34.0
5–7.9	11.4	34.5
8–11.9	11.6	35.0
Female		
12–14.9	11.8	35.5
15–17.9	12.0	36.0
≥18	12.0	36.0
Male		
12–14.9	12.3	37.0
15–17.9	12.6	38.0
≥18	13.6	41.0

*Based on fifth percentile values from the Second National Health and Nutrition Examination Survey after excluding persons with a higher likelihood of iron deficiency (3,4).

Anemia Cutoffs during Pregnancy

During a normal pregnancy, a woman's hematologic values change substantially. For women with adequate iron nutrition, Hb and Hct values start to decline during the early part of first

*CDC. MMWR 1989;38(22):400-4.

trimester, reach their nadir near the end of second trimester, then gradually rise during the third trimester. Because of the change of Hb and Hct during pregnancy, anemia must be characterized according to the specific stage of pregnancy. The normal range of Hb and Hct during pregnancy is based on data aggregated from four European studies of healthy iron-supplemented pregnant women. These studies provide similar findings at each specific month of pregnancy. The month-specific fifth percentile values for Hb of the pooled data have been adopted for use in the CDC Pregnancy Nutrition Surveillance System (Table 2). In addition, trimester-specific cutoffs also have been developed for use in the clinical setting (Table 2). These trimester-specific cutoffs are based on the mid-trimester values; cutoffs for the first trimester, the time at which most women are initially seen for prenatal care, are based on a late-trimester value.

Table 2.
Pregnancy month-specific and trimester-specific hemoglobin (Hb) cutoffs*

Gestation (wks)	12	16	20	24	28	32	36	40
Trimester	1†	2	2†	2	3	3†	3	term
Mean Hb (g/dL)	12.2	11.8	11.6	11.6	11.8	12.1	12.5	12.9
5th percentile Hb values (g/dL)	11.0	10.6	10.5	10.5	10.7	11.0	11.4	11.9
Equivalent 5th percentile Hct§ values (%)	33.0	32.0	32.0	32.0	32.0	33.0	34.0	36.0

*Based on pooled data from four European surveys of healthy women taking iron supplements (*7–10*).
†Hb values adopted for the trimester-specific cutoffs.
§Hematocrit.

Adjustment of Hb and Hct Cutoffs for Altitude and Smoking

Persons residing at higher altitudes (>1,000 meters [3,300 feet]) have higher Hb and Hct levels than those residing at sea level. This variation is due to the lower oxygen partial pressure at higher altitudes, a reduction in oxygen saturation of blood, and a compensatory increase in red cell production to ensure adequate oxygen supply to the tissues. Thus, higher altitude causes a generalized upward shift of the Hb and Hct distributions. This shift may be associated with the underdiagnosis of anemia for residents of higher altitudes when sea-level cutoffs are applied (CDC, unpublished data). Therefore, the proper diagnosis of anemia for those residing at higher altitudes requires an upward adjustment of Hb and Hct cutoffs. The values for altitude-specific adjustment of Hb and Hct are derived from data collected by the CDC Pediatric Nutrition Surveillance System on children residing at various altitudes in the mountain states (Table 3). Altitude affects Hb and Hct levels throughout pregnancy in a similar way (JN Chatfield, unpublished data).

Table 3.
Altitude adjustments for hemoglobin (HB) and hematocrit (Hct) cutoffs

Altitude (ft)	Hb (g/dL)	Hct (%)
<3000	0.0	0.0
3000–3999*	+0.2	+0.5
4000–4999*	+0.3	+1.0
5000–5999*	+0.5	+1.5
6000–6999*	+0.7	+2.0
7000–7999†	+1.0	+3.0
8000–8999†	+1.3	+4.0
9000–9999†	+1.6	+5.0
>10,000†	+2.0	+6.0

*Based on data from CDC Pediatric Nutrition Surveillance System and reference 11.
†Based on reference 11 only.

The influence of cigarette smoking is similar to that of altitude, in that smoking increases Hb and Hct levels substantially. The higher Hb and Hct of smokers is a consequence of an increased carboxyhemoglobin from inhaling carbon monoxide during smoking. Because carboxyhemoglobin has no oxygen carrying capacity, its presence causes a generalized upward shift of the Hb and Hct distribution curves (CDC, unpublished data). Therefore, a smoking-specific adjustment to the anemia cutoff is necessary for the proper diagnosis of anemia in smokers. The smoking-specific Hb and Hct adjustments are derived from the NHANES I data (Table 4).

Table 4.
Smoking adjustments for hemoglobin (Hb) and hematocrit (Hct)

Characteristic	Hb (gm/dL)	Hct (%)
Nonsmoker	0.0	0.0
Smoker (all)	+0.3	+1.0
1/2–1 pack/day	+0.3	+1.0
1–2 packs/day	+0.5	+1.5
>2 packs/day	+0.7	+2.0

The altitude and smoking adjustments are additive. For example, a woman living at 6,000 feet and smoking two or more packs of cigarettes per day would have her cutoff for anemia adjusted upward by a total of 1.4 grams of Hb or 4% Hct.

CPSC NOTES

ELECTRICAL SAFETY

With over 450 electrical house fires happening every day, government safety experts are urging consumers to inspect their homes and apartments for electrical hazards which could trigger another house fire.

According to the US Consumer Product Safety Commission, there are an estimated 169,000 house fires of electrical origin each year, claiming 1,100 lives and injuring 5,600. Property losses are estimated at $1.1 billion a year.

In non-fire related accidents, CPSC estimates that 340 Americans are electrocuted each year in accidents involving consumer products, while an estimated 7,700 consumers require hospital emergency room treatment for electrical shock or electrical burn injuries.

Among the commonplace electrical hazards frequently overlooked in the home are the following:

***Burying electrical cords under rugs and carpets.** In such cases, move the lamp or electrical product closer to a receptacle so that the cord is out from under carpets and away from foot traffic.

***Using extension cords on a permanent basis.** Extension cords should only be used temporarily. Rearrange lights, etc, so that extension cords aren't needed, or have new electrical outlets installed to eliminate the need for extension cords.

***Frayed, stiff, or cracked electrical cords.** Such cords pose electrical and fire hazards. Check cords now to make sure they don't pose hazards.

***Warm or hot cover plates over electrical outlets.** These conditions often indicate an unsafe wiring condition, in which case an electrician should be called to inspect the wiring.

***Flickering lights.** A number of problems cause lights to flicker, most often related to faulty wiring of the receptacle, the wall switch, or the electrical product itself.

***An electrical product that shocks you.** Stop using the product at once and have it inspected and repaired by an electrical repair shop. Continued use of the product could result in an electrocution.

CPSC has developed an electrical safety checklist to help homeowners locate and correct common electrical hazards around the home which often cause shocks and fires. The checklist guides consumers on a room-by-room inspection to pinpoint electrical hazards.

Consumers may obtain a free copy of the home electrical safety checklist in English or Spanish by sending a postcard to Electrical Safety, Consumer Product Safety Commission, Washington, DC 20207.

GROUND-FAULT CIRCUIT INTERRUPTER

Government safety experts say an inexpensive device installed in the home electrical wiring system could save some 200 Americans from being electrocuted this year.

According to the US Consumer Product Safety Commission, the device--a ground-fault circuit interrupter (GFCI)--protects people from electric shock hazards and electrocutions. Available at building supply and hardware stores as well as electrical supply houses, the GFCI can be installed in the electrical panel box or in wall receptacles when power tools are being used.

GFCIs monitor electricity flowing in a circuit. If current should "leak" to ground for any reason, such as a portable electric appliance falling into a kitchen sink filled with water, the GFCI shuts down the power in milliseconds. Such quick action protects the consumer against electrical shock and burn injuries or electrocution, whereas circuit breakers and fuses function primarily to prevent the home wiring system from causing a fire.

In new homes complying with the National Electrical Code, GFCI protection is required for receptacles in bathrooms, basements, garages, outdoor outlets, and kitchen countertop receptacles within six feet of the kitchen sink. In homes built before 1973, the electrical systems can be upgraded by replacing existing circuit breakers in panel boxes with GFCI-type circuit breakers or by replacing old receptacles in outlet boxes with receptacle-type GFCIs.

Consumers may obtain a free copy of the government's fact sheet on ground-fault circuit interrupters by sending a postcard to GFCI, Consumer Product Safety Commission, Washington, DC 20207.

IMMUNIZATION NOTES

Immunization of Preterm Infants: In the April 1989 issue of Pediatrics, Doctor July Bernbaum, et al, presented a study of 45 preterm infants who were immunized with diphtheria-tetanus toxoid and pertussis (DTP) vaccine. Twenty preterm infants were immunized with half-dose DTP vaccine, and 25 preterm infants were immunized with full-dose DTP vaccine. Of the 25 preterm infants immunized with full doses, 96% serologically responded to DTP vaccine after the second dose. Of the 20 preterm infants immunized with half-dose DTP, 45% were not able to form antibodies even after the third half dose of DTP vaccine.

Conclusion: "It is appropriate, therefore, that the physician caring for the low birth weight preterm infant adhere to the American Academy of Pediatrics recommendation for the immunization of preterm infants and offer full-dose DTP vaccine at the routine time intervals of 2, 4, 6, and 18 months of age (without correction for prematurity) to ensure adequate protection against diphtheria, tetanus, and most importantly, pertussis, provided there are no contraindications to its use."*

*Pediatrics 1989,;83(4):471-6.

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