

## Impact of Altitude-based Hemoglobin Modification on Pediatric Iron Deficiency Anemia Screening

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**Abstract:** The objective of this study was to determine if additional children attending primary care clinics in moderate-altitude areas would screen positive for anemia if the hemoglobin cutoff were modified for altitude.

The study design was cross-sectional and evaluated children aged 11-19 months of age who had a screening hemoglobin conducted between January 2011 and December 2017 at 4 moderate-altitude (1726-2212 m) and 8 low-altitude (1-20 m) US military clinics. The primary outcome was anemia prevalence (hemoglobin <11 g/dL) in moderate-altitude and low-altitude groups, before and after applying the current World Health Organization model for altitude-based hemoglobin modification. Groups were compared with prevalence ORs adjusted for age, sex, weight-for-length percentile, and parental military rank, and the false-negative proportion was calculated for children with anemia at moderate altitude.

Before altitude modification, anemia prevalence was 4.4% in the moderate-altitude group (n = 1488) and 16.8% in the low-altitude group (n = 7090) (prevalence OR, 0.23; 95% CI, 0.17-0.29). After applying the World Health Organization model, anemia prevalence in the moderate-altitude group increased to 14.7% (prevalence OR, 0.82; 95% CI, 0.70-0.97). Nonapplication of the model at moderate altitude resulted in a false-negative proportion of 0.70 (95% CI, 0.63-0.76).

In conclusion nonuse of the World Health Organization altitude-based modification model for hemoglobin may result in a large percentage of US children with anemia at moderate altitude screening falsely negative for anemia. Although ancestry disparities in altitude acclimatization may limit universal application of the current World Health Organization model, the existing standard of care may leave children at moderate altitude at risk for complications from iron deficiency anemia.

**Keywords:** Anemia, Altitude, Pediatrics, Screening



**Author Biography:** David Sayers attended medical school at the University of Mississippi School of Medicine. He has completed two medical residencies: general pediatrics at Wright State University/Wright Patterson Air Force Base in 2012 and preventive medicine at the Uniformed Services University of the Health Sciences (USUHS) in 2020. David earned a Master of Tropical Medicine & Hygiene degree in 2020 from USUHS as well. He currently serves as an adjunct assistant professor for the Department of Preventive Medicine and Biostatistics at USUHS. David is also a commissioned officer in the

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