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EDITORIAL

The last word in science – does it exist? The case of anaemia prevalence based on haemoglobin concentration measurement

According to Victor Hugo, French poet, novelist, and dramatist, the last word in science does not exist. He is quoted as saying, 'Science says the first word on everything, and the last word on nothing.' Simply put, science embodies *a continuous process* of inquiry, observation and revision, with new knowledge considered tentative and subject to change when new findings arise. A practical example illustrating this is the revised WHO 2024 guidance on the diagnosis of anaemia and assessment of its severity.[1] The previous WHO 2011 guidance[2] and now the 2024 update, have been regularly used and cited by students, nutrition researchers, healthcare professionals and policymakers, among others. The new recommendations were formulated by conducting a systematic review using the GRADE (Grading of Recommendations Assessment, Development and Evaluation) methodology.

The revised guidance for anaemia prevalence and haemoglobin (Hb) measurement has implications globally, regionally, and nationally in terms of data from previous, current and future surveys and studies. The WHO 2024 guidelines did not happen in a vacuum. Over the years, several comments and questions were posed regarding the measurements/methodology employed in establishing anaemia prevalence based on Hb measurement, which resulted in the current iteration. The differences between the 2011 and 2024 reports are in the anaemia cutoff for children 6–23 months (<10.5 g/dL instead of <11 g/dL) and pregnant women in the second trimester (now <10.5 g/dL). There are also changes to adjustments to Hb levels in relation to *altitude* and *smoking*. The *Lancet Haematology* Commission on anaemia (The Commission)[3] and accompanying Comment articles provide an overview of how to tackle the global problem of anaemia.[4–7]

Growing evidence indicates that the current one-size-fits-all (altitude-) adjustments may still be inadequate, as highlighted by Boulares et al.[8] They demonstrate that integrating data from diverse geographic regions and ethnic groups can inform more accurate and context-specific diagnostic strategies, ultimately improve anemia management, and reduce the risks of over- or under-treatment in high-altitude settings. The review aligns with introductory comment to this editorial that 'new knowledge [should be] considered tentative and subject to change when new findings arise'.

Panel 2 and figure 4 in the main Commission paper illustrate, for Africa region countries Senegal, Eswatini, Zambia, Lesotho, and Ethiopia, what the effects of applying the new Hb cutoffs and adjustments for altitude would be. Among children aged 6–59 months, updates to the altitude adjustment guidelines led to a more pronounced increase in estimated anaemia prevalence compared with the decrease in anaemia estimates caused by lowering the haemoglobin cutoff in the subset of children aged 6–23 months. The new altitude adjustment in non-pregnant women resulted in a median increase of 6 percentage points in the anaemia prevalence estimates. A study from India by Thomas et al. applied the WHO 2024 Hb cutoffs to data from the 2019-2021 National Family Health Survey (NFHS) and the 2016-2018 Comprehensive National Nutrition Survey (CNNS).[9] Anaemia prevalence was determined for 6-59-month-olds and 6-23-month-olds and compared with the WHO 2011 cutoffs. NFHS used capillary blood with a HemoCue instrument and CNNS used venous blood and an automated haematology analyser. In both surveys, anaemia prevalence was much lower in the 6–23-month-olds compared with 6–59-month-olds when the new cutoffs were used.

The Lancet Commission authors make the case for setting anaemia reduction targets that balance ambition with achievability, while maintaining a unified global vision. They propose a novel target-setting framework based on health economic modelling. In the case of women of reproductive age specifically, preliminary applications of this method suggest a global summary target of a 12–22% reduction in anaemia prevalence by 2030, which is substantially lower than the current 50% target.

For decades, single-drop capillary blood (using the third drop) was the blood source used for Hb measurement in surveys, such as the DHS. The DHS Program (in a pre-closure guidance) states that this method should no longer be used and recommends pooled capillary blood or venous blood. Studies have demonstrated differences in Hb values or anaemia prevalence linked to different sources of blood specimen (single-drop capillary (SCB), or pooled capillary PCB), or venous (VB)). Measurement precision showed venous >PCB >SCB.[10]

US global health funding cuts threaten anaemia surveillance and programmatic progress; they pose a substantial threat to global efforts to understand and reduce the burden of anaemia. The United States Agency for International Development (USAID) has been instrumental in funding the Demographic and Health Surveys platform, supporting long-term capacity building, and advancing the implementation of large-scale nutrition programmes. Its investments in maternal and child nutrition, food fortification, and surveillance systems also underpinned anaemia reduction efforts in more than 150 countries. The article by Khaki et al. highlights the negative effects that the cessation of funding and technical support for the DHS Program by USAID has on many global surveys, including the loss of trust in research by communities. They call for developing platforms that retain the DHS Program's most valuable characteristics, e.g. cross-country comparability and shared technical expertise.[11]

Having described global practices (current and updated) in the measurement of anaemia and Hb concentration, we turn to two studies in this issue, from the same research group, describing haemoglobin (Hb) levels and prevalence of anaemia in HIV-positive women and their HIV-negative children. One study employed a repeated cross-sectional design involving infants at six, nine, and 12 months of age (Study 1)[12]; the other was a cross-sectional study of children at 18 months of age (Study 2).[13]

Introduction to the studies: the 'old cutoffs' for anaemia in children were used, which would have affected the anaemia status; the increased random variability ascribed to single-drop capillary Hb measurement implies that the reported Hb concentrations (and mean Hb) might not be accurate. This applies to both studies since the children would fall into the < 24-month age group. In Study 2, the anaemia prevalence of women is given as 28.1%; it should be pregnant women. Further, reference 4 (Turawa et al.) mentions an anaemia prevalence of 61.3% and does comment that the 'SADHS 2016 anaemia prevalence results may have been influenced by the blood sample type.'

Methods: The blood sample in SADHS 2016 was capillary blood from the heel (infants between 6 and 11 months) and from the finger in older children. The source (finger or heel) of the blood sample was not mentioned by either Study 1 or 2. Study 1 states the first two or three drops of blood were wiped away while Study 2 does not mention which drop was used. Study 1 states one mL of blood was collected, while the microcuvette capacity is around 10 µL. There should be standardisation and consistency between researchers from the same organisation. Study 1 stated that reference 6 and reference 42 refer to '… the portable photometer … recommended for use for determining the prevalence of anaemia.' Reference 6 shows that HemoCue gives higher Hb levels than venous blood, while reference 42 shows the opposite. Also, reference 42 included children age 1–5 years. Study 2, reference 20, is a supplier/manufacturer's reference, which is not a 'neutral' reference. Neither study mentioned whether Hb was adjusted for altitude. If Study 1 and Study 2 participants were living at an elevation between 1 300 and 1400 m above sea-level, an adjustment factor of −0.8 g/dL should have been applied to the Hb results.

Results: Study 1, Table 3, has the WHO cutoff for children 6–59 months as <10.9 g/dL instead of <11 g/dL (the 'old' cutoff). The variability in Hb measurements of single-drop capillary blood could have been mentioned in context.

What then is the bottom line? In addition to academics, policymakers, public health practitioners and clinicians, researchers and nutrition professionals should be aware of the global discussion and recommendations around anaemia diagnosis and prevention. While it is prudent to have global guidance, it is also not practical to ignore the *context-specific* issues influencing anaemia prevalence, e.g. underlying infections, social deprivation, and conflicts. The current perturbations in global funding for research and geopolitics further complicate the landscape. However, these challenges may lead to opportunities for stronger regional and local cooperation, and capacity development, to improve the health and well-being of populations.

The nutrition (science) community should be aware of the current (and future) developments in the global anaemia landscape regarding diagnosis, prevalence, and target reduction setting and data collection challenges. In future, non-invasive haemoglobin measurement technologies may enable cheap, large-scale population measurement, but currently available platforms do not meet the desired level of accuracy and precision.

Declaration of interest

MAD was the Co-PI of the SADHS 2026 study, which is referenced in the articles by Nyofane et al. (their Reference 4) and Tshiambara et al. (their Reference 1) and supervised the biomarker section of the SADHS survey.

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