Anaemia Estimates using Venous and Capillary Blood Samples in the 2022 Tanzania DHS-MIS

Anaemia occurs when there are not enough healthy red blood cells to carry oxygen to tissues in the body. In the 2022 Tanzania Demographic and Health Survey and Malaria Indicator Survey (2022 TDHS-MIS), anaemia was tested in two subsamples using different blood sources: capillary blood and venous blood.

This brief provides information on the anaemia testing procedures and prevalence of anaemia from these two blood sources, along with information to aid in interpreting the results. It is intended for policymakers, programme managers, and other decision makers using Tanzania's anaemia data.

Anaemia data are important for policy and programme decision making. Anaemia data can be used to assess the health situation and track trends over time in Tanzania, and estimates can be compared with other countries. Anaemia data are important for tracking Sustainable Development Goal 2: to end hunger, achieve food security and improved nutrition, and promote sustainable agriculture. The second National Multisectoral Nutrition Action Plan 2021–2025/26 (NMNAP II) in Tanzania calls for a nearly 6% reduction of anaemia among nonpregnant women age 15–49 by 2025/26.

Many factors can cause anaemia, including iron and other micronutrient deficiencies, malaria, other infections, and haemoglobinopathies (Chaparro and Suchdev 2019). Characterising the magnitude and causes of anaemia is important for designing and evaluating strategies and programmes to reduce anaemia. Data on several factors that can cause anaemia were collected in the micronutrient component of the 2022 TDHS-MIS.

Current evidence on anaemia testing in venous and capillary blood. The World Health Organization recommends haemoglobin, a protein responsible for transporting oxygen in the blood, as the biomarker to assess population-based prevalence estimates of anaemia (WHO 2017). Haemoglobin is assessed in a whole blood sample using either venous or capillary blood. Venous blood samples are collected from a vein, usually from the inside of the elbow or the back of the hand. Capillary blood samples are collected by pricking the skin of the finger or heel. Venous blood is the gold standard source of blood; however, until recently, capillary blood haemoglobin had been considered an accurate and reliable measure in field settings.

Capillary blood is collected by finger or heel prick

Venous blood is collected from a vein

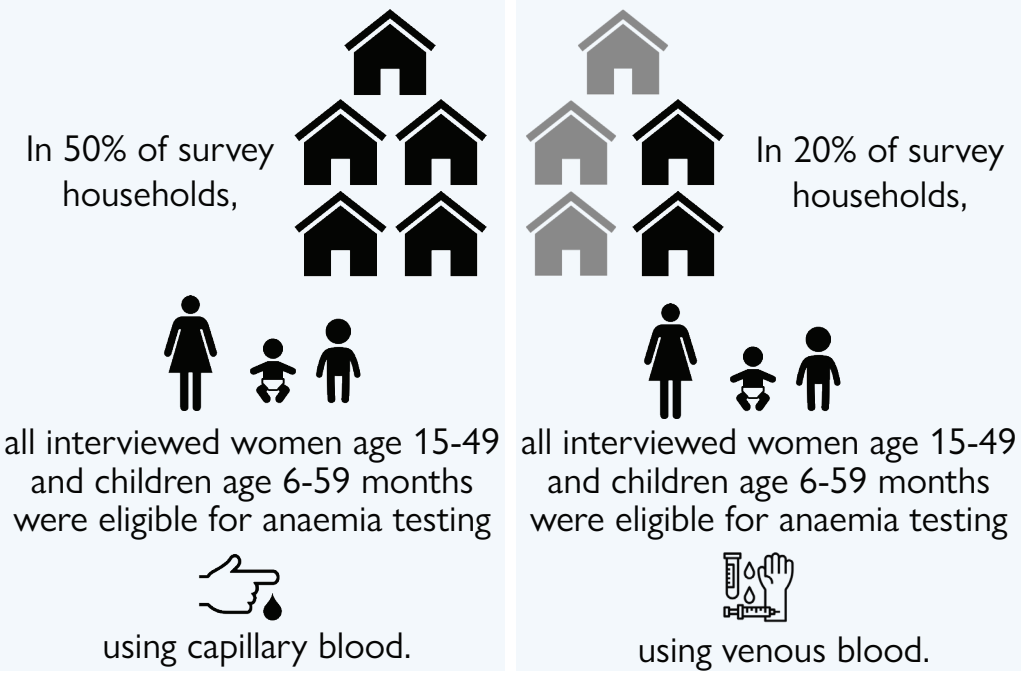
New studies comparing venous and capillary haemoglobin results have revealed differences in anaemia estimates using the two blood sources; these differences have been more pronounced in children and may be less of an issue for women (Hruschka et al. 2020; Stevens et al. 2022). Experiments comparing haemoglobin measured in capillary and venous blood collected at the same time in the same individual show that the differences in haemoglobin levels between the two blood types are variable, with capillary blood sometimes having higher haemoglobin levels and sometimes having lower haemoglobin levels than venous blood (Neufeld et al. 2019). This variability can lead to different estimates of anaemia prevalence in capillary blood and in venous blood, in some cases resulting in a change in the public health significance classification of anaemia in a country. These issues are discussed in more detail in a webinar focusing on USAID Advancing Nutrition's HEmoglobin MEasurement Project.

Future studies are needed to determine whether improvements in capillary blood collection protocols can improve the precision of capillary blood haemoglobin tests for better anaemia prevalence estimates in household surveys.

Measurement of anaemia in Tanzania in The DHS Program. In Tanzania, anaemia testing has been included in surveys collected through The DHS Program since 2004–05. Tanzania DHS surveys that have included anaemia testing used capillary blood following the standard protocol of The DHS Program. However, in the 2022 Tanzania DHS-MIS survey, anaemia was measured using both capillary and venous blood tested on-site using a battery-operated portable HemoCue® 201+ device.

In a subsample of half of all households selected for the survey, all interviewed women age 15–49 and children age 6–59 months were eligible for anaemia testing using capillary blood. Each field team included two technicians who carried out the capillary blood collection and anaemia testing. A single drop of capillary blood was used to fill a microcuvette directly from a finger prick (or a heel prick in the case of children age 6–11 months).

Anaemia Testing Protocol for 2022 TDHS-MIS



In the remaining half of all households not selected for capillary testing, approximately 20% was selected for venous blood collection for a micronutrient component of the 2022 TDHS-MIS. Within those households, all interviewed women age 15–49 and children age 6–59 months were eligible for anaemia testing. A different team of two technicians collected venipuncture blood into a tube containing an anticoagulant. They performed anaemia testing by placing a few drops of whole blood from the tube onto a small piece of wax film and then collecting the blood in a microcuvette.

Analysis of haemoglobin values involves first adjusting for altitude (and cigarette smoking among women, if known) and then applying standard cutoffs of less than 11 g/dl for children and pregnant women and less than 12 g/dl for nonpregnant women to define any anaemia (CDC 1998; WHO 2017). These adjustments are standard practice for The DHS Program and were applied the same way to both capillary and venous anaemia results.

Response rates for anaemia testing were low for both capillary and venous blood. Anaemia testing was successfully completed for 93% of eligible children using venous blood and was successfully completed for 97% of eligible children using capillary blood. Anaemia testing was successfully completed for 97% of eligible women using venous blood and was successfully completed for 99% of eligible women using capillary blood. There was no difference by urban/rural residence in anaemia testing response rates for children and women using capillary blood. Response rates were slightly lower in urban than rural areas among children (88% and 94%, respectively) but not women using venous blood. Response rates were similar by age in the capillary blood subsample for children and increased with age among children in the venous subsample (85%

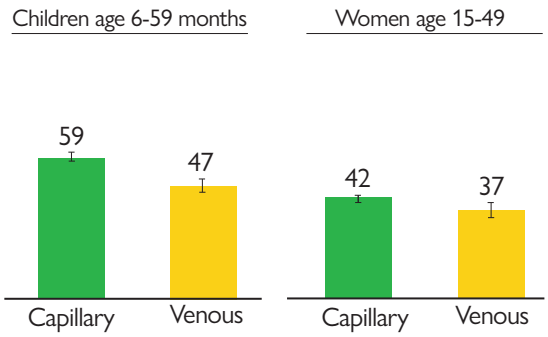
and 94% among children age 6–11 months and 48–59 months, respectively). Overall, percentage differences in response rates were small, and thus these nonresponse patterns are unlikely to impact anaemia estimates or the differences observed between estimates from the capillary and venous subsamples.

Mean haemoglobin estimates are similar between blood sources, but anaemia prevalence estimates are lower for children when using venous as compared with capillary blood. Individuals in the separate anaemia measurement subsamples were selected using random sampling within the same communities. There may be small random differences in haemoglobin between the individuals in the subsample tested using capillary blood and those in the subsample tested using venous blood.

Among children age 6–59 months, the prevalence estimate for any anaemia is 12 percentage points lower in the venous blood sample (47%) than in the capillary blood sample (59%). This difference is statistically significant. The differences in prevalence estimates by blood source are smaller for women than for children. Among women age 15–49, the prevalence of anaemia in the venous blood sample (37%) is 5 percentage points lower than in the capillary blood sample (42%). This difference is also statistically significant.

Anaemia Prevalence by Capillary and Venous Blood Collection

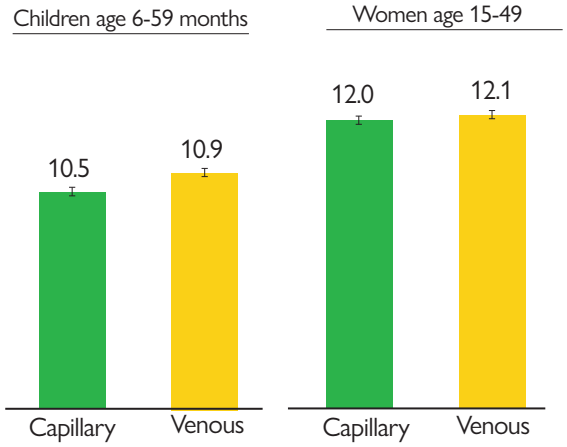
Percent of children age 6-59 months and women age 15-49 classified as anaemic by capillary and venous blood sources



Any anaemia < 11 g/dl for children and pregnant women
Any anaemia < 12 g/dl for nonpregnant women

Mean Haemoglobin Concentration (g/dl) by Capillary and Venous Blood Collection

Mean haemoglobin concentrations of children age 6-59 months and women age 15-49 by capillary and venous blood sources



Any anaemia < 11 g/dl for children and pregnant women
Any anaemia < 12 g/dl for nonpregnant women

Although estimates of anaemia prevalence are different between the venous and capillary blood samples, the distributions of haemoglobin concentrations in the two samples are similar. The differences in average haemoglobin concentrations between the venous and capillary blood samples are 0.4 g/dl for children and 0.1 g/dl for women. However, the differences are statistically significant.

The differences in mean haemoglobin and anaemia estimates between the venous and capillary data in the 2022 TDHS-MIS are similar to those observed in other studies that compared estimates from near-in-time surveys using venous versus capillary blood samples (Hruschka et al. 2020; Stevens et al. 2022). The magnitude of the differences has varied depending on the survey in these studies, but the general pattern is more pronounced differences in children than in women.

Look for full anaemia results in the 2022 Tanzania DHS-MIS final report and the forthcoming micronutrient report. The anaemia results from both samples are available in the 2022 Tanzania DHS-MIS Final Report. The results for anaemia and other tests conducted in the micronutrient component will be published in a separate report. In addition to anaemia, the 2022 TDHS-MIS micronutrient report will provide data on standard anthropometry measures for women age 15–49 and children age 0–59 months; data on inflammation, iron, vitamin A, vitamin B12, folate status, and malaria among children age 6–59 months and women age 15–49; and information on food fortification coverage.

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