

## THE ROTARY 5000 SCREENING PROJECT IN SAMOA. 1. SCREENING STUDY FOR ANEMIA IN CHILDREN AND ADOLESCENTS

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Anemia has been a public health problem in Samoa as is documented in the WHO Global Database on Anemia, with the occurrence in postpartum women reaching 62% in 1978 and 61.2% in randomly selected villages in 1999<sup>1</sup>. The latter figure corresponds well with the data from Samoa National Nutrition Survey of 1999<sup>2</sup>. It has been over 10 years since these findings and no wide-scale screening for blood hemoglobin has been performed in Samoa until the launching of the "Rotary 5000" project in 2009.

The "Rotary 5000" is a community health-screening project sponsored by the Apia Rotary Club. The Rotary Club is working in partnership with the Oceania University of Medicine, the Tupua Tamasese Meaole (TTM) National Hospital, and has also invited other key stakeholders to participate, including the Ministry of Health, the Kidney Foundation of Samoa, and the Samoa Cancer Society. The goal of Rotary Project 5000 is to systematically take/provide health screening to the outlying and remote villages of Samoa, until a target of 5,000 people screened is reached, hence the name of the project. Special forms were prepared for medical documentation of persons screened. All relevant medical information was gathered and records were subjected to the same treatment and security of confidentiality as normal hospital medical records.

For last two decades, the use of point-of-care testing (POCT) has been expanding in most countries<sup>3</sup>. It is now a well-established adjunct to hospital central laboratories (where rapid results are especially important), external primary care clinics, and also in general practice where tests may be carried out by a practice nurse or by the doctor<sup>4</sup>. The total blood count is the most common screening test for almost every patient and, obviously, it plays an important role in POCT. However, this test usually requires venous blood samples, which

confines testing to clinics and health centers. Alternatively, various instruments are available for measuring hemoglobin alone. Some of them are simple to use, cheaper than total blood count analyzers and often require only one drop of capillary blood.

It has been difficult to launch screening for anemia in Samoa because of the obvious technical issues in obtaining, handling and transporting venous blood samples to the TTM National Hospital laboratory where a hemoglobin test could then be performed. On the other hand, no portable POCT instrument has been previously available for doing blood hemoglobin tests directly in the villages.

Since January 2009, the Rotary 5000 project has employed a novel technology for performing hemoglobin assays on capillary blood with a portable POCT instrument. The HemoCue® blood hemoglobin testing system (Ängelholm, Sweden) includes a hemoglobin analyzer and disposable plastic microcuvettes which contain all the required reagents pre-loaded. The cuvette serves as a sampling device (a drop of capillary blood is drained into the cuvette by capillary action), a test vial (where chemical reaction occurs and specific color develops), and a measurement cuvette (in which the color intensity is then measured by the analyzer) at the same time.

*Table 1. Haemoglobin upper reference limits (URL) used to define anaemia*

Age and/or gender group	Haemoglobin URL (g/l)
children (0.50–4.99 yrs)	110
children (5.00–11.99 yrs)	115
children (12.00–14.99 yrs)	120
non-pregnant women (≥15.00 yrs)	120
pregnant women	110
men (≥15.00 yrs)	130

The instrument calculates the hemoglobin concentration in mmol/l or g/dl and displays the results in less than one minute. The unit is powered either by mains electrical supply or an AA (1.5 V) battery pack. It is factory-calibrated against the International Committee for Standardisation in Haematology (ICSH) method according to Kwant et al.<sup>5</sup> No further calibration by the end-user is required. According to a recent multi-centre evaluation study<sup>6</sup>, all hospital bench-top blood cell counters and HemoCue® hemoglobin system demonstrate excellent correlation and no bias from the ICSH reference method. Analytical reliability of the system has been found to be high<sup>6-8</sup>.

It is noteworthy that it was a previous generation of HemoCue® hemoglobin analyzers that was employed in the Samoan National Nutritional Survey of 1999<sup>2</sup>. The HemoCue® Hb 301 system utilized in the Rotary 5000 project has been optimized for the use in primary care with results displayed in 10-15 seconds and designed for high ambient temperatures and humidity, which is crucial for performing laboratory tests in Samoa.

### Patients and methods

165 randomly selected children and adolescents (male: 74, age: 2-18 years; female: 91, age: 5-20 years) from the villages of Lalomanu, Lotofaga, Sa'anapu, Sataoa, Nu'usuatia, Ulutogia, Vaie'e, Fusi, Utogia, Safatoa, and Salamumu were randomly screened for blood hemoglobin testing from February till September 2010. None of the female participants were known to be pregnant during the study period. The relatively low number of children and adolescents screened was accounted for by their low availability at the time of the examination that occurred during school hours. A drop of capillary blood was obtained by puncturing a finger using HemoCue® Safety Lancets and directly collected into a HemoCue® 301 microcuvette by capillary action. Care was taken to avoid pressure on the finger (which could result in the dilution of capillary blood by interstitial fluid). Color intensity of the reagents in the cuvette was measured at two wavelengths at a time to provide correction for non-specific turbidity (due to leukocytes and possible lipemia). Each hemoglobin concentration was recorded in the participant data card. The upper reference cut-off hemoglobin values for children and adolescents (Table 1) were accepted according to WHO Global Database on Anemia (adapted from<sup>9</sup>, in our modification).

Quality control tests were performed using EuroTrol (The Netherlands) reference materials. Quality control samples (aliquots of sterile hemolysed blood) were treated at the OUM laboratory the same way as participants' blood. Additionally, 10 cuvettes were used to assess within-run reproducibility of the assay by a person previously not familiar with the HemoCue® hemoglobin system.

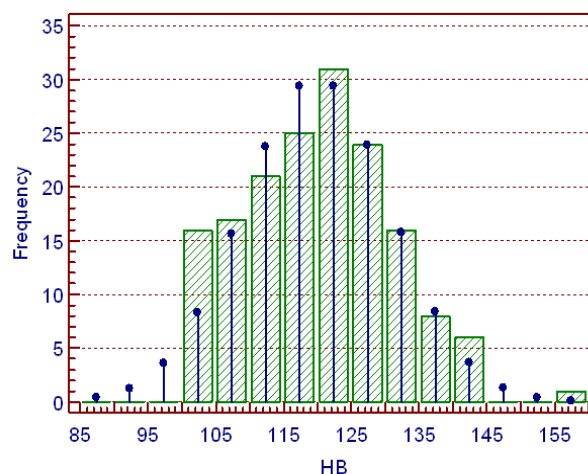
Statistical data processing was performed using Medcalc® software (Leuven, Belgium). Wilcoxon test was used for estimating the differences between variables.

### Results

Overall, the blood hemoglobin levels in the screened cohort have found to be close to the lower reference limit provided by Heil et al.<sup>10</sup> and the manufacturer of the hemoglobin system<sup>11</sup> (mean ± SD: 120.0 ± 10,8 g/l, 95% CI: 118,4 to

121,7 g/l). The distribution pattern of the values is shown in Figure 1.

Figure 1. Histogram of blood hemoglobin values in the screened children and adolescents.



Note: Lines with the dots on top indicate normal distribution.

The proportion of anemia in the screened children and adolescents appeared to be high. In total, 68 cases of anemia (41,2%) have been detected (males: 28, i.e. 37,8% of all males, females: 40, i.e. 44% of all females). Elder adolescent group (over 12 years) have demonstrated a slightly higher percentage of anemia cases (44%) than younger children (38,4%,  $p > 0,05$ ).

Anemia has been detected at quite a high rate in each age subgroup except children under 5 years of age, in which only one child with normal hemoglobin occurred (Table 2).

Gender	Occurrence of anemia (number and percentage) in age groups:			
	under 5 yr (n = 1)	5-11 yr (n = 73)	12-14 yr (n = 58)	15 yr and over (n = 33)
Male	0	14 (36,8%)	6 (30%)	8 (53,3%)
Female	0	14 (40%)	19 (50%)	7 (38,9%)

Table 2. Anemia in different age groups of the screened children

Quality control study has demonstrated that the HemoCue® Hb 301 system exhibited an excellent within-run reproducibility (CV: 0,9%) even when used by an inexperienced person, and all the data of within-run and between-run measurements of the EuroTrol Hb quality control material have been within the assigned reference range.