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Evaluating Hospital-Based Anemia Screening Programs in Uganda: A Narrative Review of Diagnostic Performance, programme Quality and Health-System Value

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ABSTRACT

Anemia is a major clinical concern in Uganda, affecting children, pregnant and postpartum women, people living with HIV, surgical patients, and adults with infectious or chronic illnesses. Hospitals are ideal screening sites because they serve high-risk populations and provide access to laboratories, clinicians, transfusion services, and referral networks. This review argues that anemia screening should be evaluated as a complete clinical cascade, including patient reach, test accuracy, turnaround time, severity classification, investigation of causes, treatment initiation, transfusion decisions, referrals, follow-up, and outcomes. Point-of-care haemoglobin testing is feasible, although device and site performance vary, while visual pallor alone is unreliable for diagnosing severe anemia. Programme effectiveness depends on adequate supplies, quality assurance, staffing, medicines, blood availability, data systems, and follow-up. Universal testing is appropriate in antenatal care and selected high-risk admissions, while targeted screening may suit lower-risk groups. National standards, validated devices, integrated services, monitoring indicators, and cost-effectiveness studies are recommended.

Keywords: anaemia; anemia screening; haemoglobin; hospital programmes; Uganda; point-of-care testing; maternal health; paediatrics; quality improvement

INTRODUCTION

Anaemia is a reduction in haemoglobin concentration below an age-, sex- and physiological-status-specific threshold. It is a syndrome rather than a single disease [1]. Iron deficiency is important, but malaria, helminth infection, HIV, tuberculosis, bacterial infection, inflammation, haemoglobinopathies, renal disease, malignancy, nutritional deficiencies and acute or chronic blood loss all contribute in Uganda. A screening programme that detects low haemoglobin but assumes iron deficiency in every patient risks both ineffective care and delayed diagnosis of serious disease [2]. The burden justifies systematic attention. Recent Ugandan research describes a pooled anaemia prevalence of about 30% among pregnant women and approximately 50% among children younger than five, although estimates vary by population, region, method and period [3]. Hospital populations are not representative of communities: referral hospitals may see more severe and complex disease, while routine antenatal or HIV clinics capture ambulatory patients. Programme evaluation must therefore separate population burden from facility yield and avoid generalising single-hospital prevalence to the country [4]. This review examines screening in general, regional referral and national hospitals, while recognising that Uganda's care pathways extend through health centres and community referral. It synthesises national guidance, Ugandan diagnostic studies and programme-evaluation principles. The aim is to define what should be screened, how performance should be measured, what evidence presently supports implementation and where important gaps remain.

Why Hospitals Are Important Screening Platforms

Hospitals provide four advantages. First, they serve groups in whom anaemia is common and consequential: acutely ill children, pregnant and postpartum women, people living with HIV, patients with malaria or sepsis, surgical patients and those with suspected bleeding. Second, they can link testing to a clinical examination and more specific investigations such as a complete blood count, blood film, malaria test, reticulocyte count, ferritin or other tests when available [5]. Third, they can initiate treatment, monitor response and arrange transfusion or

referral. Fourth, aggregated results can inform blood planning, commodity forecasting and local disease surveillance. Hospitals also carry risks of inefficient screening. Testing all attendees irrespective of clinical pathway may overwhelm laboratories, increase waiting time and identify mild abnormalities without capacity to investigate them [6]. Screening at discharge, without a follow-up mechanism, may produce knowledge but no benefit. A strong programme therefore begins with an explicit target population, decision threshold and management pathway.

Table 1: Programme Models and Target Populations

Population	Preferred trigger	Immediate action	Key caution
Pregnant/postpartum	Routine Hb at defined ANC and peripartum contacts	Classify severity; treat; plan delivery/referral	Late ANC and stock-outs create missed opportunities
Children admitted	Routine or high-sensitivity triage protocol	Rapid Hb; malaria/sepsis assessment; transfusion decision	Clinical pallor alone misses and misclassifies cases
HIV clinics	Baseline and symptom/risk/drug-triggered Hb	Review ART, infection, nutrition and chronic disease	Avoid attributing all anaemia to HIV or medication
Surgical/bleeding	Pre-operative or clinical-risk testing	Optimise Hb, control bleeding, plan blood use	Testing without patient blood management wastes value
General outpatients	Symptoms, pallor or risk-factor trigger	POC Hb and tiered investigation/referral	Indiscriminate universal testing may be low yield

Uganda's clinical guidelines provide the national basis for diagnosis and management, while maternal and newborn guidance embeds haemoglobin assessment and iron–folate interventions within antenatal and obstetric care [7]. The appropriate model is therefore mixed: routine testing at high-value scheduled contacts and high-sensitivity risk-based testing elsewhere. Thresholds must follow current national or WHO guidance and account for pregnancy, age and sex. Screening protocols should state when a low point-of-care result requires confirmation, urgent review or additional tests.

Diagnostic Performance and Quality Assurance

Automated complete blood count analysers provide haemoglobin values and red-cell indices for morphological classification, but their use may be limited by equipment costs, reagent supply, electricity, maintenance, and trained staff. Point-of-care devices improve access and turnaround time in maternity, triage, and peripheral clinics, yet Ugandan evidence shows that devices differ in bias, sensitivity, and specificity, so selection should match the intended clinical purpose rather than cost alone [8]. Operational factors such as sample type, consumables, calibration, power needs, storage, connectivity, durability, infection control, and user-friendliness must also be considered. Because capillary and venous samples are not always interchangeable, procurement should be linked to standard operating procedures and quality assurance. Clinical pallor remains useful for rapid triage, especially in children, but it is subjective and cannot replace haemoglobin testing or override danger signs [9]. A minimum quality system should include internal controls, corrective actions, external proficiency testing, staff competency checks, lot verification, temperature and storage monitoring, maintenance and stock records, comparison with reference analysers near treatment thresholds, and routine tracking of invalid tests, repeats, downtime, and transcription errors to ensure reliable clinical decisions [10].

Evaluating the Screening Cascade

Programme evaluation should use a logic model linking inputs, processes, outputs, outcomes and unintended effects. The denominator must be explicit: all admissions, eligible ANC contacts, high-risk children, patients beginning a specified therapy, or another defined group. "Number screened" is otherwise uninterpretable.

Reach: Eligible patients tested; equity by age, sex, ward, residence, refugee status and ability to pay.

Timeliness: Arrival-to-sample, sample-to-result, result-to-clinician review and result-to-treatment times.

Diagnostic quality: Invalid/repeat rate; agreement with reference method; sensitivity near urgent thresholds; EQA performance.

Clinical response: Correct severity classification; causal work-up; iron/folate, malaria or infection treatment; transfusion or referral when indicated.

Continuity: Documented discharge plan, follow-up attendance, repeat Hb and treatment completion.

Patient outcomes: Recovery, mortality, length of stay, readmission, maternal and neonatal outcomes, adverse transfusion events.

Efficiency: Cost per person screened, case detected, appropriately treated case and adverse outcome averted.

Harms: Unnecessary iron, delayed diagnosis, avoidable transfusion, false reassurance, pain, waiting time and financial burden.

A cascade can reveal where impact is lost. For example, high testing coverage with low same-day review indicates a workflow problem; correct diagnosis without treatment indicates commodity or prescribing failure; treatment without repeat measurement leaves effectiveness unknown. A balanced dashboard should combine coverage, quality, equity, outcome and cost rather than reward test volume [11].

Implementation Barriers in Uganda

Implementing anaemia screening programmes in Uganda faces interconnected barriers involving laboratory systems, workforce capacity, treatment access, patient costs, and data quality. Even when testing devices are available, shortages of reagents, cuvettes, controls, paper, stable electricity, maintenance services, and trained personnel can interrupt services. Multiple device brands also complicate procurement, calibration, and staff training, highlighting the need for standardized equipment menus, lifecycle costing, and redistribution systems [12]. Staff shortages, heavy workloads, and unclear responsibility for reviewing results can delay care, while point-of-care testing requires time, infection control, documentation, quality assurance, and clear escalation procedures. Screening must be matched by reliable treatment and referral pathways, including iron and folate, malaria and deworming services, HIV, tuberculosis and sickle-cell care, nutritional support, safe blood access, and documented referral outcomes. Costs such as fees, transport, waiting time, repeat visits, and medicine purchases may exclude rural residents and refugees, so programmes should measure who is missed and whether costs are shifted to households [13]. Finally, fragmented records across laboratory books, cards, charts, and electronic systems weaken monitoring. A minimum dataset should link eligibility, testing, action, and outcome, use consistent thresholds, record methods and specimens, note suspected causes and treatment, and prevent double-counting repeat tests across all participating facilities [14].

Cost and Value for Money

Economic evaluation should compare realistic alternatives: clinical assessment alone, targeted POC testing, routine POC testing, or laboratory CBC. Costs include equipment, consumables, staff time, quality assurance, maintenance, waste disposal, confirmatory tests, treatment and patient expenses. Benefits include avoided severe disease, more appropriate transfusion, shorter stays and improved maternal, neonatal or child outcomes. Cost per test is insufficient because a cheap inaccurate test can produce expensive errors [15]. Uganda's national sickle-cell screening experience illustrates the importance of measuring turnaround time, cost per test and cost per positive case within the operational pathway, although haemoglobin screening has different objectives and downstream actions. Hospitals should initially use budget-impact analysis and time-driven workflow costing, then embed pragmatic cost-effectiveness studies during scale-up. Marginal value is likely highest where pre-test probability is substantial and an actionable treatment is immediately available [16].

Recommendations

The recommendations call for a national hospital screening standard that clearly defines eligible populations, screening timing, diagnostic thresholds, confirmation procedures, urgent actions, and referral pathways. Routine testing should be embedded in high-value services such as antenatal care, selected paediatric admissions, suspected bleeding cases, and other clinically defined high-risk groups, while targeted approaches for general outpatients are evaluated [17]. Hospitals should use a limited range of independently validated point-of-care devices selected according to diagnostic purpose, total lifecycle cost, connectivity, and quality-assurance requirements. Both laboratory and point-of-care testing should be supported by internal quality control, external quality assessment, staff competency certification, and regular method comparison. Monitoring should track the full pathway from eligibility to clinical outcome using a small national indicator set and facility-level improvement charts. Screening should also be integrated with malaria, maternal health, nutrition, HIV, tuberculosis, sickle-cell, surgery, and blood-transfusion services [18]. Reliable supply systems should include quantified forecasting, minimum stock levels, maintenance plans, and rapid redistribution. Critical-value alerts and named clinical responsibility should ensure same-day review of severe results. Programme evaluation should address equity, patient costs, experience, safety, and clinical yield. Before national scale-up, models should be piloted, compared, costed, independently evaluated, and publicly reported to guide transparent, evidence-based implementation nationwide [19].

Evidence Gaps and Limitations

Most Ugandan studies are cross-sectional, facility-specific and designed to estimate prevalence or diagnostic performance rather than programme impact. Evidence is limited on screening coverage, linkage to causal investigation, adherence, repeat haemoglobin, mortality, readmission, patient costs and incremental cost-effectiveness. Adult men, adolescents, surgical patients and people with chronic non-communicable disease are underrepresented [20]. Device evaluations may not generalise to children, profound anaemia or facilities without research-level supervision. Future studies should use prospective cascades, stepped implementation or controlled quality-improvement designs and should report false-positive and false-negative consequences.

CONCLUSION

Hospital-based anaemia screening in Uganda is clinically justified for well-defined high-risk populations and can be strengthened by validated POC technology. Its success, however, depends less on the presence of a haemoglobin device than on the reliability of the entire clinical system around it. The strongest programme will identify eligible patients, produce accurate and timely results, distinguish severity, investigate plausible causes, initiate appropriate treatment, use blood safely, ensure referral and follow-up, and learn from outcome data. Uganda should therefore move from counting tests to evaluating effective coverage: the proportion of patients who receive correct screening and complete, beneficial care. A tiered national framework, rigorous quality assurance and embedded economic evaluation would allow hospitals to expand access while protecting accuracy, equity and value for money.

REFERENCES

1. Braat, S., Fielding, K.L., Han, J., Jackson, V.E., Zaloumis, S., Xu, J.X.H., et al: Haemoglobin thresholds to define anaemia from age 6 months to 65 years: estimates from international data sources. Lancet Haematol. 11, e253–e264 (2024). https://doi.org/10.1016/S2352-3026(24)00030-9
2. Aja, P. M., Inya, J. E., Onyeije, P. E., Agu, E. and Awuchi, C. G. Restorative effects of ethanolic leaf extract of *Datura stramonium* against methotrexate-induced hematological impairments, Cogent Food & Agriculture, 2023; 9:1, DOI: 10.1080/23311932.2023.2258774
3. Bongomin, F., Olum, R., Kyazze, A.P., Ninsiima, S., Nattabi, G., Nakyagaba, L., et al: Anemia in Ugandan pregnant women: a cross-sectional, systematic review and meta-analysis study. Trop. Med. Health. 49, 19 (2021). https://doi.org/10.1186/s41182-021-00309-z
4. Igwe, M. C., Alum, E. U. Obeagu, E. I., Obeagu, G. U., Ugwu, O. P. C. Men's Essential roles in the Management of Sickle Cell Anemia. Newport International Journal of Scientific and Experimental Sciences. 2023; 4(2):20-29. https://doi.org/10.59298/NIJSES/2023/10.3.1111
5. Beletew, B., Mengesha, A., Ahmed, M., Fitwi, A., Wudu, M.: Determinants of Anemia among HIV-Positive Children on Highly Active Antiretroviral Therapy Attending Hospitals of North Wollo Zone, Amhara Region, Ethiopia, 2019: A Case-Control Study. Anemia. 2020, 3720572 (2020). https://doi.org/10.1155/2020/3720572
6. Ugwu, O. P. C., Obeagu, E. I., Obeagu, G. U., Alum, E. U., Persistent Immune Activation and Chronic Inflammation: Unraveling Their Impact on Anemia in HIV Infection. *INOSR Experimental Sciences*. 2023; 12(3):73-84. https://doi.org/10.59298/INOSRES/2023/7.3.21322
7. Essential Maternal & Neonatal Care Clinical Guidelines | MOH Knowledge Management Portal, https://library.health.go.ug/sexual-and-reproductive-health/essential-maternal-neonatal-care-clinical-guidelines/essential
8. Alum, E. U., Obeagu, G. U. Obeagu, E. I., Ugwu, O. P. C. Lifestyle, Genetics and Sickle Cell Anemia: Unveiling the Interplay of Risk Factors.International Journal of Innovative and Applied Research. 2023; 11(12):41-46. Article DOI: 10.58538/IJIAR/2060 DOI URL: http://dx.doi.org/10.58538/IJIAR/2060
9. Krleza, J.L., Dorotic, A., Grzunov, A., Maradin, M.: Capillary blood sampling: national recommendations on behalf of the Croatian Society of Medical Biochemistry and Laboratory Medicine. Biochem. Medica. 25, 335–358 (2015). https://doi.org/10.11613/BM.2015.034
10. Egba S. I., Obeagu E I, Obeagu G U, (2023) Coexisting Conditions: Addressing Diabetes in Sickle Cell Anemia Care Int. J. Curr. Res. Med. Sci. (2023). 9(11): 23-28
11. Dreischulte, T., Shahid, F., Muth, C., Schmiedl, S., Emil Haefeli, W.: Prescribing Cascades: How to Detect Them, Prevent Them, and Use Them Appropriately. Dtsch. Ärztebl. Int. 119, 745–752 (2022). https://doi.org/10.3238/arztebl.m2022.0306
12. Obeagu, E. I., Obeagu, G. U., Ugwu, O. P. C., Alum, E. U. Navigating Hemolysis in Expectant Mothers with Sickle Cell Anemia: Best Practices and Challenges. *IAA Journal of Applied Sciences*. 2024; 11(1):30-39. https://doi.org/10.59298/IAAJAS/2024/4.78.99.11
13. Shaw, J.L.V.: Practical challenges related to point of care testing. Pract. Lab. Med. 4, 22–29 (2015). https://doi.org/10.1016/j.plabm.2015.12.002
14. Nimo, O. M., Bunu, U. M. Anaemia in children under five years: African perspectives. *Int. J. Curr. Res. Biol. Med.*, 2023; (1): 1-7. DOI: http://dx.doi.org/10.22192/ijcrbm.2023.08.01.001.
15. Lingervelder, D., Koffijberg, H., Kusters, R., IJzerman, M.J.: Health Economic Evidence of Point-of-Care Testing: A Systematic Review. PharmacoEconomics Open. 5, 157–173 (2021). https://doi.org/10.1007/s41669-020-00248-1
16. Hernandez, A.G., Kiyaga, C., Howard, T.A., Ssewanyana, I., Ndeezi, G., Aceng, J.R., Ware, R.E.: Operational analysis of the national sickle cell screening programme in the Republic of Uganda. Afr. J. Lab. Med. 10, 1303 (2021). https://doi.org/10.4102/ajlm.v10i1.1303
17. Ali, M. M., Bunu, U. M. An Update of Aneamia in Adults with Heart Failure. *INOSR Experimental Sciences*, 2023; 11(2):1-16. https://doi.org/10.5281/zenodo.7791916

18. Fung, A.W.S.: Establishing sustainable quality improvement in the clinical laboratory: Redesign of the total testing process and digital transformation of routine quality assurance activities. Clin. Biochem. 137, 110915 (2025). https://doi.org/10.1016/j.clinbiochem.2025.110915
19. Udeozor P A, Precious A U, Ibiam U A, Umoru G U, Onwe E N, et al (2022).. Antioxidant and anti-anemic effects of ethanol leaf extracts of Mucuna poggei and Telfairia occidentalis in phenyl-hydrazine-induced anemia in Wistar albino rats. Ibnosina Journal of Medicine and Biomedical Sciences, 2022. 14(03): p. 116-126.
20. Tukamuhebwa, P.M., Gemmell, I.: A cross-sectional study evaluating the screening, diagnosis and management of advanced HIV disease at the AIDS support organization service centre in Mbarara City, Southwestern Uganda. BMC Infect. Dis. 25, 254 (2025). https://doi.org/10.1186/s12879-025-10682-3

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