CENTRAL ASIAN JOURNAL OF INNOVATIONS ON TOURISM MANAGEMENT AND FINANCE

https://cajitmf.centralasianstudies.org/index.php/CAJITMF
Volume: 07 Issue: 02 | April 2026 ISSN: 2660-454X

Article

Early Detection of Pediatric Anemia in Low-Resource Settings: Evidence from Uzbekistan

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Abstract: Anaemia is a common but often overlooked condition among children in resource-limited settings, where diagnostic capabilities and screening practices are often limited. The researchers sought to assess early detection strategies for childhood anaemia in a number of health care settings in Uzbekistan, focusing on the use of simple diagnostic methods. We used an analytical cross-sectional approach, surveying 120 children between 6 months and 14 years who visited primary health care facilities for non-serious conditions or for routine check-ups. Children underwent medical and anthropometric examinations, parental interviews, and haemoglobin tests using portable analysers to detect anaemia and potential risk factors. Results showed 38.3% of the children studied had haemoglobin concentrations below age-specific cut-offs, suggesting a high prevalence of anaemia in the population. Early childhood (children below five years) was identified as a high-risk period with the highest prevalence. Lack of adequate dietary intake of iron-rich foods was found to be a key risk factor, with socioeconomic status and low dietary diversity also playing a role in disease occurrence. Notably, many cases of anaemia were only detected by portable haemoglobin measurement and not by clinical signs. These findings highlight that the detection of anaemia based on clinical signs alone is not sufficient to detect early anaemia, particularly in mild and asymptomatic patients. The use of low-cost point-of-care diagnostic technologies in child health services can greatly increase early detection rates in low-resource settings.

Keywords: Childhood anemia; early diagnosis; resource poor settings; hemoglobin measurement; child health; malnutrition; Uzbekistan; primary health care.

Citation: Abdullayevich N. I. Early Detection of Pediatric Anemia in Low-Resource Settings: Evidence from Uzbekistan. Central Asian Journal of Innovations on Tourism Management and Finance 2026, 7(2), 631-636.

Received: 10th Jan 2026
Revised: 11th Feb 2026
Accepted: 19th Mar 2026
Published: 30th Apr 2026

Introduction

Anaemia in children is a globally prevalent but often overlooked public health issue, especially in low-resource environments where health systems are not always optimally defined, and prevention programs may not always be well established. Recent global estimates suggest that almost 40% of children under five are affected by anaemia, with the prevalence disproportionately higher in developing countries where nutritional factors, infections and access to diagnostic services intersect [1]. Here, anaemia is not just a blood disorder but a complex condition that mirrors socioeconomic and environmental disparities, underscoring the need for early diagnosis, which is both medically imperative and a public health responsibility.

In Uzbekistan, following the introduction of major reforms in the health sector over the last decade, child health outcomes have improved, but anaemia remains a major issue among children, especially in rural and economically disadvantaged regions. Although there are national screening programs in place, the quality and reach of these programs

can differ based on location, access to laboratories and caregiver knowledge. This means many cases may go unnoticed until clinical symptoms become apparent, which not only makes treatment more difficult but also heightens the risk of long-term developmental impacts. Anaemia during early childhood has been shown to have a detrimental effect on cognitive function, physical growth and immune response, thereby impacting individual well-being and subsequent human capital development [2].

A key issue in resource-limited settings is the lack of access to cost-effective diagnostic tests. Routine laboratory tests like complete blood counts, although readily available in urban clinics, may not be accessible in peripheral clinics and primary health clinics. As a result, clinicians may fall back on symptoms that may only be present in the more severe stages of the disease, thus limiting early detection. This highlights the need for tailored approaches in different settings, with an emphasis on early detection through simple tests, community-based interventions and preventive interventions in the primary pediatric care setting [3].

Additionally, childhood anaemia is rarely due to a single cause. Iron deficiency is the most common cause, but it often occurs in conjunction with other factors, including parasitic infections, chronic disease, micronutrient deficiencies, and poor dietary habits. In low-resource settings, these issues tend to co-exist, compounding the effect, which calls for multifaceted solutions. So, local factors affecting pediatric anaemia need to be understood to develop interventions that would be effective yet sustainable within the health care system [4].

In this context, the current study seeks to consider the potential for early diagnosis of pediatric anaemia in resource-poor settings, including in Uzbekistan. Through an exploration of clinical signs, diagnostic issues and other contextual factors that affect disease recognition, this study will inform the development of feasible and scalable strategies to improve early diagnosis and, in turn, child health. In turn, it also underscores the need for integration of clinical and public health strategies, particularly in resource-limited settings where innovative approaches are required to meet changing demands.

Methods

This research was pursued as an analytical cross-sectional study to evaluate the viability and impact of early diagnosis approaches for children with anaemia in resource-poor healthcare settings in Uzbekistan. When designing the study, we took into account the challenges of providing early detection services in primary healthcare settings, where access to sophisticated laboratory technologies is often not available, and where early diagnosis of anaemia may rely on a combination of clinical skills and simple screening tests. As such, it was essential to design the study so that it could be both practical and scientifically rigorous, enabling the outcomes to be feasibly applied in clinical settings.

The study was undertaken from 2023-2025 at a number of primary health care centres and pediatric outpatient departments situated in both urban and rural areas. These locations have been chosen to encompass a variety of access to health care, including both reasonably well-resourced and limited diagnostic capacity locations. The study included 120 children between the ages of 6 months and 14 years. The children were recruited through purposive sampling, with children presenting for wellness visits, conditions not requiring immediate evaluation or intervention, or for growth monitoring included in the study. However, those children with known chronic blood disorders and those receiving iron supplements were excluded to prevent bias.

Data collection was undertaken in multiple interlinked steps, focusing on various aspects of anaemia screening. First, a systematic clinical examination was conducted where health professionals recorded general health status, pallor, fatigue, changes in appetite and other clinical signs that may be indicative of impending or established anaemia. Although these symptoms and signs may be non-specific, their careful assessment is important, especially when laboratory testing is not immediately available. Subsequently, weight,

height and body mass index were measured to determine nutritional status, as malnutrition is known to be a strong predictor of anaemia.

After the clinical examination, haemoglobin concentration was determined with the use of portable haemoglobin analysers, selected due to their low cost, simplicity of use, and adaptability to resource-poor settings. These enabled on-site testing, thus reducing the turnaround time for laboratory analysis and allowing for the timely identification of children with low haemoglobin levels. Anaemia cut-off values were set according to international guidelines for children, considering age-specific normal ranges for haemoglobin levels [5]. This ensured alignment with international norms while being pertinent in the local clinical setting.

While collecting biological data, parents or legal guardians were interviewed through a semi-structured questionnaire that aimed to assess dietary patterns, socioeconomic status, parents' level of education, and access to health care. Special attention was given to examining patterns of iron consumption, consumption of animal source foods, and exposure to risk factors, including parasitic infections and frequent illness. These factors were considered to gain a deeper insight into the factors contributing to anaemia and to identify potential opportunities for intervention beyond diagnosing anaemia [6].

The data gathered were systematically collated and analysed using simple statistical techniques commonly applied in practical clinical studies in resource-poor settings. Descriptive analysis was employed to profile the prevalence of anaemia and other related factors among the study population, and comparative analysis to explore the association between haemoglobin levels and variables such as age, nutrition and socioeconomic status. While complex modelling techniques were not the main aim of this study, it was ensured that the analysis process was rigorous and logically sound, ensuring a valid interpretation of the results.

The study adhered to ethical standards in research. Parents or legal guardians of all children were given informed consent, and the privacy of individual data was preserved. The research protocol was approved by the Institutional Ethics Committee and adhered to standard procedures for research with children [7].

The combination of clinical assessment, point-of-care testing and socioeconomic analysis allowed the methodological design of this study to be specifically targeted to address problems in early diagnosis of anaemia in resource-poor settings. This approach not only enabled the detection of affected children but also offered a better understanding of the systemic and environmental factors that impact disease identification and management, thus providing a platform for effective and sustainable disease control strategies.

Results

Following data collection, we found that anaemia continues to be a common childhood condition in resource-poor health care settings, despite often non-specific symptoms. Of the 120 children examined, 46 of them (38.3%) were found to have reduced haemoglobin levels, based on age-specific criteria. This result is consistent with the regional situation in Central Asia, where malnutritional problems and the lack of early detection still heavily contribute to the burden of childhood diseases [8].

When we further examined the prevalence by age, we found that the peak was among children aged 6 months to 5 years, a stage of life that is known for its high growth and nutritional requirements. In this group, almost half (47.8%) of the children had low levels of haemoglobin, suggesting that the early childhood years are a critical period. This was in contrast to older children, who had a lower prevalence, although they still exhibited a significant number of cases. This finding indicates that although the risk is reduced with age, it is not eliminated, particularly in a context where dietary diversity is low.

When divided by gender, there was no significant difference in the prevalence of anaemia between boys and girls, although there were some minor differences in the proportion of severity. The bulk of the cases (around 60%) were mild anaemia, followed by 30% moderate anaemia. Less than 10% of the children had severe anaemia, but these cases were often associated with multiple risk factors (e.g. undernutrition and infections).

About nutritional status, there was the expected correlation between anaemia and measures of undernutrition. Children who had lower body mass index (BMI) were more likely to have lower haemoglobin concentrations, a well-known association between poor dietary status and iron deficiency. Additionally, interviews with the parents of affected children confirmed that low intake of iron-rich foods, such as animal source foods, was a common feature of affected children. These insights suggest a need to focus on dietary behaviours as part of preventing anaemia [9].

The next aspect that was of significance was the efficacy of the point-of-care haemoglobin testing. In this study, many children who were diagnosed with anaemia via portable diagnostic tools hadn't been previously identified as having anaemia by the clinical exam alone. This finding highlights the need to rely on more than visual and symptomatic diagnosis, especially in the early stages of the disease, where symptoms may be mild or not easily detected. Thus, the use of simple, point-of-care testing seems to be important for increasing early diagnosis in resource-poor settings [10].

Table 1. Distribution of anaemia prevalence by age group.

Age Group	Total Children (n)	Anaemia Cases (n)	Prevalence (%)
6 months - 5 years	46	22	47.8%
6 - 10 years	38	13	34.2%
11 - 14 years	36	11	30.5%
Total	**120**	**46**	**38.3%**

The results in Table 1 demonstrate a clear age-related decrease in anaemia prevalence, but show that anaemia persists in all age groups. The prevalence in the early years (6 months to 5 years) can be attributed to a combination of physiological and ecological determinants, such as high iron needs during growth, late introduction of complementary foods and inadequate dietary diversity. As children age, progressive dietary improvements and physiological changes may play a role in decreasing the prevalence of anaemia; however, its persistence in the older age categories suggests that the underlying factors, such as socioeconomic factors and dietary habits, remain influential. These insights highlight that although screening and intervention should primarily target early childhood, it is important to reach older children as well, to achieve maximum coverage and impact. Additionally, the relatively high prevalence suggests anaemia is a systemic problem rather than a clinical disease and therefore requires comprehensive strategies that include early screening, nutrition education and access to health care [11].

Discussion

The results of this study demonstrate that children's anaemia continues to be a complex and endemic problem in low-and middle-income countries and that the early diagnosis remains both clinically and sociodemographically challenging. The 38.3% prevalence rate found in our study is in line with the global epidemiology of anaemia in developing countries, where anaemia is frequently associated with a complex interplay of nutritional deficiencies, socioeconomic factors, and lack of access to preventive health care. What is strikingly clear from this study is that, particularly in its early forms, anaemia is an asymptomatic disease, which poses challenges in its early detection when a reliance is placed only on clinical symptoms.

These findings are consistent with global trends. Similar prevalence rates have been reported from South Asia and Sub-Saharan Africa, noting that children under the age of five years are most affected due to heightened iron needs and are susceptible to dietary

deficiencies [12]. The alarmingly high prevalence in the youngest age group in our study also highlights this international trend and the need to focus on early childhood as a key period for intervention. But what sets low-resource settings, like some regions of Uzbekistan, apart from high-income countries is the inequitable distribution of medical services, which can hinder the implementation of systematic screening and early detection of affected children.

A further key finding of this study is the lack of sensitivity of clinical assessment in the early diagnosis of anaemia. Although pallor and fatigue are commonly used clinical signs, they typically appear only when haemoglobin concentrations are low. This is consistent with recent clinical studies, which demonstrate that visual examination is not sensitive for the detection of mild to moderate anaemia, especially in children [13]. Here, the application of handheld hemoglobinometers showed benefits, as it provided real-time and objective measurement, thus preventing underdiagnosis. This observation is relevant, as it supports the inclusion of point-of-care (POC) tests in primary health care where laboratory services are lacking.

The contribution of nutritional factors as identified in the current study also highlights the multifactorial nature of anaemia, where biological and social factors interplay. Deficiencies in the consumption of iron-rich foods, especially of animal origin, were commonly seen among children with anaemia. This finding is in agreement with other studies that suggest that dietary intakes of low-income people are often deficient in essential micronutrients needed for optimal blood development [14]. However, it is also crucial to consider that dietary interventions may not be the sole solution to the issue, particularly in situations where anaemia is complicated by infections, inflammation, or other diseases. Thus, a more holistic approach, which includes both nutritional education and supplementation, and disease prevention measures, is needed.

Public health implications of this study highlight that screening for early detection of pediatric anaemia should not be considered a clinical "stand-alone" activity, but rather a part of a health care approach. Screening programs, parent education programs and integration of simple tests into child health services could enhance early detection. Additionally, enhancing primary health services to provide systematic follow-up and treatment is also crucial to prevent transition to more severe anaemia. This is not uncommon in other low-resource settings where the use of task-shifting and community health workers has also been beneficial [15].

In Uzbekistan, where health care system reform is on the agenda, there is an opportunity to embed these approaches into the existing child care system. By focusing on early detection and the factors that contribute to anaemia, it is possible to not only lower the burden of the disease but also enhance long-term outcomes for kids. Ultimately, the key is not just to diagnose anaemia, but to do so promptly, to prevent its detrimental effects and ensure children can achieve their full potential.

Conclusion

Our findings confirm that childhood anaemia is still an important but under-recognised health problem in resource-poor settings, where diagnostic capacity and access to health services continue to pose challenges to early detection. While child health has improved over the years, many children continue to suffer from anaemia without being diagnosed early in life, especially during the critical years of early childhood. This not only makes it harder to treat but also increases the risk of long-term adverse effects, such as cognitive, growth, and immune deficiencies. What this study demonstrates, in particular, is the need to go beyond clinical signs when diagnosing early anaemia. The use of point-of-care haemoglobin measurement revealed that many children were not suspected of having anaemia, revealing an important gap in diagnosis. In this sense, the introduction of simple, inexpensive, and portable diagnostic equipment into pediatric practice represents a valuable and efficient approach, particularly in the absence of laboratory support.

REFERENCES

[1] World Health Organization, *Global anaemia estimates in children under 5 years of age*, Geneva, Switzerland, 2021.

[2] UNICEF, *The State of the World's Children 2019: Children, Food and Nutrition*, New York, USA, 2019.

[3] World Health Organization, *Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity*, Geneva, Switzerland, 2011.

[4] World Bank, *Repositioning Nutrition as Central to Development: A Strategy for Large-Scale Action*, Washington, DC, USA, 2006.

[5] World Health Organization, *WHO guideline on use of ferritin concentrations to assess iron status in individuals and populations*, Geneva, Switzerland, 2020.

[6] Food and Agriculture Organization, *Dietary assessment: A resource guide to method selection and application in low-resource settings*, Rome, Italy, 2018.

[7] World Medical Association, "Declaration of Helsinki: Ethical principles for medical research involving human subjects," *JAMA*, vol. 310, no. 20, pp. 2191–2194, 2013.

[8] G. A. Stevens *et al.*, "Global, regional, and national trends in haemoglobin concentration and prevalence of anaemia in children," *The Lancet Global Health*, vol. 1, no. 1, pp. e16–e25, 2013.

[9] Food and Agriculture Organization and World Health Organization, *Guidelines on food fortification with micronutrients*, Geneva, Switzerland, 2006.

[10] B. Nkrumah *et al.*, "Hemoglobin estimation by the HemoCue portable analyzer in resource-limited settings," *BMC Clinical Pathology*, vol. 11, p. 5, 2011.

[11] S. R. Pasricha, J. Tye-Din, M. U. Muckenthaler and D. W. Swinkels, "Iron deficiency," *The Lancet*, vol. 397, no. 10270, pp. 233–248, 2021.

[12] UNICEF, World Health Organization and World Bank, *Levels and trends in child malnutrition*, 2021.

[13] J. P. Chalco *et al.*, "Accuracy of clinical pallor in the diagnosis of anemia in children," *BMC Pediatrics*, vol. 5, p. 46, 2005.

[14] R. E. Black *et al.*, "Maternal and child undernutrition and overweight in low-income countries," *The Lancet*, vol. 382, no. 9890, pp. 427–451, 2013.

[15] H. B. Perry, R. Zulliger and M. M. Rogers, "Community health workers in low-, middle-, and high-income countries," *Annual Review of Public Health*, vol. 35, pp. 399–421, 2014.