



Interventions to reduce anaemia linked to infectious and chronic diseases: Insights from an evidence gap map on low- and middle-income countries

Infectious and chronic diseases, and related inflammation, are among the leading causes of anaemia, which is defined as low red blood cell count or haemoglobin levels. Together, infectious and chronic diseases account for approximately 12 percent of total anaemia cases globally, significantly reducing the quality of life and human potential.¹

Infectious diseases, such as malaria, schistosomiasis, soil-transmitted helminths (e.g., hookworm, *Trichuris trichiura*, and *Ascaris lumbricoides*), and **chronic infections, such as HIV and tuberculosis**, can destroy red blood cells, limit their production, cause blood loss, and impair nutrient absorption.^{2,3} While all these can lead to anaemia, people with anaemia are also at increased risk of being affected by these diseases.⁴

This policy brief explores the evidence on interventions specifically addressing anaemia linked to infectious and chronic diseases. It draws on the Anaemia Evidence Gap Map (EGM) developed by 3ie and Nutrition International (NI) with support from the Government of Canada. The EGM systematically collected and organized a total of 2,268 impact evaluations (IEs) and systematic reviews (SRs) of interventions addressing direct, intermediate, and underlying risk factors of anaemia. Developed in collaboration with the World Health Organization (WHO) and NI, this policy brief identifies patterns and gaps in the evidence and offers recommendations for future research and programs to help reduce the burden of anaemia caused by infectious and chronic diseases.

Highlights

- 369 studies evaluated interventions addressing anaemia caused by infectious diseases such as malaria, parasitic worms, and other parasites.
- 24 studies evaluated interventions addressing anaemia caused by inflammation due to chronic diseases such as HIV and tuberculosis.
- 44 percent of these studies reported direct measures of anaemia and haemoglobin.
- Evidence is clustered in regions with higher prevalence of infectious diseases, such as Africa and South-East Asia.
- Although more research is needed, systematic reviews included in the EGM indicate that anti-malaria interventions, such as intermittent preventive treatment, show promise for reducing parasite prevalence and anaemia for specific population groups and that deworming interventions may reduce parasitic infection and improve anaemia outcomes.

Main findings

About 44 percent of included IEs directly measured anaemia-related outcomes.

- A quarter (n = 106) reported the prevalence of anaemia on a categorical scale (e.g., high, medium, or low).
- A similar number of studies (n = 107) reported haemoglobin concentrations as an outcome.
- Nine studies reported on an indicator of iron or folate status.
- Table 1 shows the distribution of outcomes measured while evaluating various interventions for infectious and chronic diseases.

The majority of studies on infectious diseases evaluated anti-malarial interventions.

- **Of IEs evaluating interventions for infectious diseases, about two-thirds (n = 245) evaluated anti-malarial interventions.** These interventions included chemoprevention, intermittent preventive treatments, indoor residual spraying, and nets delivered at the individual, household, and population levels.
- **More than 40 percent (n = 105) of these IEs reported measures of anemia and/or haemoglobin.**
- **The majority of IEs evaluated anti-malarial interventions in**

Africa (n = 201) and most took place in Burkina Faso, Kenya, Mali, Tanzania, and Uganda. More than one-third (n = 90) of IEs took place in rural settings.

- **Most IEs (n = 234) focused on children under 5 years of age,** while almost one-third (n = 67) focused on women of reproductive age or pregnant women.
- **Less than 5 percent of IEs (n = 15) included a population with a genetic blood disorder,** including glucose-6 phosphate dehydrogenase (G6PD) deficiency (n = 11), sickle cell disorders (n = 3), and α -thalassemia (n = 1).

Table 1: Number of IEs on infectious and chronic diseases by intervention and outcome categories

Disease types	Intervention categories	Total no. of IEs	No. of IEs reporting Anaemia outcomes	No. of IEs reporting Haemoglobin outcomes	No. of IEs reporting both Anemia and Haemoglobin outcomes
Infectious diseases	Infectious diseases	245	77	62	105
	Deworming and helminth programs of which	88	20	30	33
	■ Deworming and helminth programs only	60	10	13	15
	■ Multi-component: Deworming + WASH and hygiene education	10	1	1	1
	■ Multi-component: Deworming + interventions for inadequate nutrition	18	9	16	17
	Other anti-parasite programs	15	1	2	3
Chronic diseases	HIV programs	21	7	11	14
	Tuberculosis programs	3	1	2	2
Grand total		372	106	107	157

Note: Counts of IEs for Anaemia and Haemoglobin outcomes may not be exclusive. An IE reporting both outcomes is accounted for in both columns.

Main findings

High- and medium-confidence SRs reported the potential for positive effects of anti-malarial interventions for preventing malaria. However, in some cases, results such as effects on haemoglobin levels were inconclusive or inconsistent. For example, effectiveness varied based on the population studied and the approach adopted. While more research is needed to explore the effects of anti-malarial interventions on different population groups or contexts, high- and medium-confidence SRs reported positive effects on health outcomes for the following interventions:

- Intermittent preventive treatment (IPT) against malaria to prevent malaria and reduce the risk of anaemia for infants or children living in malaria-endemic areas.
- Other anti-malarial interventions, including indoor residual spraying along with the use of insecticide-treated nets, mass drug administration (for infants in low malaria endemic areas), and house modifications to prevent the entry of mosquitoes to reduce the prevalence of malaria parasites.

- House modifications to reduce the prevalence of severe anaemia, and anti-malarial drug regimens to reduce the prevalence of severe maternal anaemia.

Almost one-quarter (n = 88) of the IEs focusing on infectious diseases evaluated deworming interventions.

- **In some cases, deworming interventions were delivered in combination with other interventions.** In 5% of these IEs (n = 18), deworming interventions were delivered in combination with interventions targeting inadequate nutrition. A total of 10 IEs evaluated deworming programs delivered with WASH programs and hygiene education interventions.
- **More than a third of the IEs (n = 33) reported effects on anaemia and/or haemoglobin.**
- About half of these IEs (n = 42) reported outcomes related to the frequency or severity of infections from soil-transmitted helminths. Other reported outcomes in these IEs included schistosomiasis, malaria, and concentration of various nutrients in the body.

- **The majority of IEs took place in Africa (n = 42) and South-East Asia (n = 28),** with the most studies occurring in China, India, Kenya, Indonesia, and Uganda. About 44% of IEs evaluating deworming programs took place in rural settings.

- **Infants, children, and adolescents were the most common population groups targeted for intervention.**

Interventions addressing other parasites, such as *Schistosoma*, various intestinal parasites, and Ebola, were evaluated in 4% of IEs (n = 15).

Three of these reported anaemia and/or haemoglobin outcomes.

Regardless of whether the intervention itself specifically targeted schistosomiasis, a total of 38 IEs reported outcome measures of the frequency or severity of such an infection. Two-thirds of these IEs (n = 25) evaluated various deworming, anti-malaria, and WASH programs, often bundled together, reflecting a multi-pronged approach.



Main findings

High- and medium-confidence SRs reported on the effectiveness of various deworming interventions, but they found highly variable effects, largely driven by characteristics of the population studied, such as age, gender and reproductive status, as well as frequency of helminths within the population. Although more research is needed to explore trends, high- and medium-confidence SRs reported positive effects for the following interventions:

- Deworming interventions to (1) increase haemoglobin in children living in soil-transmitted helminth-endemic areas, and (2) reduce HIV viral load within 6 to 12 weeks after treatment for people who also have soil-transmitted helminth, schistosomiasis, or lymphatic filariasis.

We found comparatively less evidence on interventions addressing chronic infections.

- **We identified 21 IEs evaluating HIV interventions.**
 - Most of the IEs were conducted in Africa (n = 20).
 - **Of these IEs, 14 reported outcome measures of anaemia and/or haemoglobin.** Other commonly reported outcomes included indicators assessing the status of iron; folate; vitamin A, B6, B12, D and E; and indicators of malaria, gastrointestinal disease, and kidney disease.

■ **Three IEs evaluated tuberculosis programs.**

- All studies reported outcomes for anaemia, haemoglobin concentration, and iron status.

■ **We found no high- or medium-confidence SRs synthesizing the effects of interventions targeting these chronic infections.**

Of all IEs mapped, regardless of whether they evaluated infectious or chronic disease interventions, 97 IEs reported outcomes related to gastrointestinal diseases, although our map did not include interventions addressing such diseases.

- These IEs mostly evaluated interventions to address direct causes of anaemia such as inadequate nutrient intake, absorption, and utilization programs (n = 38). Another 13 IEs on malaria, helminth, and other parasitic infections, HIV, and management of post-partum haemorrhage also reported this outcome.
- Another 16 IEs reporting these outcomes evaluated interventions that addressed intermediate risk factors and one IE addressed underlying risk factors of anaemia.
- In addition, a mix of multi-component interventions (n = 30) also reported gastro-intestinal outcomes.

About one-third of all IEs (n = 107), regardless of the disease targeted, reported outcomes related to kidney diseases.

- Of these IEs, 79 evaluated various inadequate nutrient intake, absorption, and utilization interventions; while 5 IEs reporting this outcome evaluated HIV interventions.

Promising areas for future research:

- Researchers, funders, and practitioners can use this EGM to explore the extensive evidence of interventions that address anaemia by tackling infectious and chronic diseases.
- Given the complexity of causes that need addressing and diverse outcome indicators associated with anaemia, this EGM identified gaps in IE evidence. Future research programming can address primary evidence gaps related to tuberculosis and routine immunization programs.
- Funders can prioritize multi-component intervention packages to address the multi-sectoral approach needed to tackle anaemia caused by infectious and chronic diseases.
- There are opportunities to carry out or update SRs in areas with substantial evidence, such as the effectiveness of HIV programs in addressing anaemia.
- Few IEs evaluating infectious and chronic disease interventions reported cost information (n = 33). Building cost analysis into evaluations or SRs could inform resourcing to realize the greatest impact and understand the extent to which cost-effectiveness varies by context.





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How to read an evidence gap map

3ie presents EGMs using an interactive online platform that allows users to explore the evidence base. Bubbles that appear at intersections of interventions and outcomes denote the existence of at least one study or review. The larger the bubble, the

greater the volume of evidence in that cell. The color of each bubble represents the type of evidence and, for an SR, a confidence rating (as indicated in the legend). In the online version, hovering over a bubble displays a list of the evidence for that

cell. The links for these studies lead to user-friendly summaries in 3ie's [Development Evidence Portal](#). Users can filter the evidence by type, confidence rating (for SRs), region, country, study design, and population.

What is a 3ie evidence gap map?

3ie EGMs are collections of evidence from IEs, SRs, and in some cases, qualitative studies for a given sector or policy issue, organized according to the types of programs evaluated and the outcomes measured. They include

an interactive online visualization of the evidence base, displayed in a framework of relevant interventions and outcomes. They highlight where there are sufficient IEs to support SRs and where more studies are needed. The maps help

decision-makers target their resources to fill these important evidence gaps and avoid duplication. They also make existing research more accessible to facilitate evidence-informed decision-making.



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About this brief

This brief is based on *Interventions to reduce anaemia in low- and middle-income countries: An evidence gap map*, a 3ie evidence gap map report by Ashiqun Nabi, Diana Belén Córdova-Aráuz, Ingunn Storhaug, Maria Daniela Anda Leon, Lina Khan, Charlotte Lane, Daniel López de Romaña, Alison Mildon,

Mandana Arabi, and Shannon Shisler. The authors identify, map, and describe the evidence base regarding interventions that address anaemia's direct causes, intermediate and underlying risk factors, and impacts on health outcomes. The full report describes 2,022 completed IEs, 174 ongoing

IEs, 57 SRs rated as high- or medium-confidence, and 15 SR protocols mapped on a framework of 46 intervention categories and 21 outcomes, spanning 105 low- and middle-income countries (L&MICs). This brief was designed and produced by Akarsh Gupta, Mallika Rao, and Tanvi Lal.

Endnotes

¹ Hess, Sonja Y., Aatekah Owais, Maria Elena D. Jefferds, Melissa F. Young, Andrew Cahill, and Lisa M. Rogers. 2023. "Accelerating Action to Reduce Anemia: Review of Causes and Risk Factors and Related Data Needs." *Annals of the New York Academy of Sciences* 1523 (1): 11–23. <https://doi.org/10.1111/nyas.14985>.

² Chaparro, Camila M., and Parminder S. Suchdev. 2019. "Anemia Epidemiology, Pathophysiology, and Etiology in Low- and Middle-Income Countries." *Annals of the New York Academy of Sciences* 1450 (1): 15–31. <https://doi.org/10.1111/nyas.14092>.

³ Madu, Anazoeze Jude, and Maduka Donatus Ughasoro. 2016. "Anaemia of Chronic Disease: An In-Depth Review." *Medical Principles and Practice* 26 (1): 1–9. <https://doi.org/10.1159/000452104>.

⁴ USAID. 2022. *Brief: Anemia and Coexisting Infection and Inflammation*. Arlington, VA: U.S. Agency for International Development (USAID). Accessible at: <https://www.advancingnutrition.org/sites/default/files/2022-10/usaaid-an-anemia-coexisting-brief-2022.pdf>



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For more information on 3ie's evidence gap maps, contact info@3ieimpact.org or visit our website.

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December 2024

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