

## Cost and Value of Community Health Worker-Led Interventions for Neglected Tropical Diseases in Middle-Income and Low Countries: Evidence from a Scoping Review

Mateusz Piotr Kowalski<sup>1\*</sup>, Jakub Tomasz Zielinski<sup>1</sup>, Kamil Adrian Nowicki<sup>2</sup>, Pawel Rafal Majewski<sup>2</sup>, Lukasz Michal Dabrowski<sup>3</sup>, Tomasz Krystian Urbanski<sup>3</sup>

<sup>1</sup>Department of Management, Warsaw School of Economics, Warsaw, Poland.

<sup>2</sup>Faculty of Management, University of Lodz, Lodz, Poland.

<sup>3</sup>Faculty of Economics, University of Gdansk, Gdansk, Poland.

\*E-mail ✉ [m.kowalski.sgh@yahoo.com](mailto:m.kowalski.sgh@yahoo.com)

### Abstract

Neglected tropical diseases (NTDs) are a collection of more than twenty infections caused by parasites, bacteria, and viruses, collectively affecting over a billion people worldwide. Community Health Workers (CHWs) are increasingly recognized as vital for expanding access to NTD prevention and treatment in low- and middle-income countries (LMICs), yet the economic evidence supporting their deployment remains scarce. To map existing knowledge, a scoping review was performed, examining studies published between August 2015 and July 2024 across ten academic databases and grey literature sources. Searches focused on CHWs and economic evaluation metrics, with study selection guided by predefined inclusion and exclusion criteria. Data on methodology, costs, and outcomes were systematically extracted and analyzed using Microsoft Excel. From 10 studies, 29 implementation scenarios were identified. Seven scenarios involved mass drug administration at the community level, while the remaining 22 explored other interventions, including disease-specific preventive and treatment programs such as dengue control. Economic outcomes most frequently reported included cost per capita (ranging from \$10.24 to \$21.09) and cost per service delivered (ranging from \$0.13 to \$5.33). Cost-effectiveness was assessed in five scenarios, yielding mixed results, with roughly 40–50% of interventions considered cost-effective. Notably, one study found that programs integrating multiple services were more likely to be cost-effective than those following vertical, single-disease approaches. Despite these findings, the evidence base remains limited, and no definitive conclusions can be drawn regarding the affordability or overall cost-effectiveness of CHW-led NTD interventions in LMICs. Additional rigorous economic evaluations are needed to better understand how CHWs can contribute to both preventive and treatment-focused NTD strategies.

**Keywords:** Tropical diseases, Community health workers, LMICs, Economic evaluation metrics

### Introduction

Neglected tropical diseases (NTDs) refer to a set of more than twenty health conditions with diverse etiologies, including parasitic, bacterial, viral, and fungal infections, as well as select non-communicable diseases. Together, they affect over one billion people worldwide, with more

than two-thirds of the global burden occurring in low- and middle-income countries (LMICs) [1, 2]. These conditions are primarily found in tropical and subtropical settings [2] and are most common in rural and marginalized communities where poverty, poor sanitation, limited healthcare access, and under-resourced health systems intersect [3]. The relationship between NTDs and poverty is cyclical: infection often leads to high out-of-pocket healthcare costs and reduced earning capacity, which in turn deepens household financial vulnerability [4].

From a global health perspective, NTDs account for an estimated 17 million Disability-Adjusted Life Years (DALYs) lost each year [5]. Despite representing the

Access this article online

<https://smerpub.com/>

Received: 01 June 2022; Accepted: 02 October 2022

Copyright CC BY-NC-SA 4.0

**How to cite this article:** Kowalski MP, Zielinski JT, Nowicki KA, Majewski PR, Dabrowski LM, Urbanski TK. Cost and Value of Community Health Worker-Led Interventions for Neglected Tropical Diseases in Middle-Income and Low Countries: Evidence from a Scoping Review. *J Med Sci Interdiscip Res.* 2022;2(2):111-27. <https://doi.org/10.51847/b6DLByDhFy>

second-largest infectious disease burden in terms of DALYs—surpassed only by HIV/AIDS—NTDs have historically been under-prioritized in global funding and policy agendas [1, 2]. Evidence from 29 LMICs illustrates this imbalance, with government and partner expenditure on NTDs averaging just 1.3% of total infectious disease spending, compared with 14% allocated to HIV programs [2, 6].

Efforts to correct this neglect have included major international initiatives. The WHO NTD Roadmap and the London Declaration, both launched in 2012, marked a turning point by elevating NTDs within the global health agenda and drawing attention to their wide-ranging health, social, and economic consequences [7, 8]. The original Roadmap established measurable targets for disease control, elimination, and eradication by 2020. These commitments were subsequently revised and expanded in the WHO Roadmap for 2021–2030, which introduced new targets, broader disease coverage, and a stronger emphasis on health system integration [2].

Although financial commitments to NTD control have increased—illustrated by the \$777 million pledged at the 2023 Reaching the Last Mile Forum [9]—resource allocation remains uneven. Funding continues to favor mass drug administration (MDA) as a preventive strategy, while comparatively less investment is directed toward case management for individuals already living with NTDs (CM-NTDs), despite clear recognition of the need for both [2]. Case management approaches are more resource-intensive, requiring diagnostic capacity, trained personnel, and ongoing follow-up care. As a result, many LMICs continue to rely on vertical, disease-specific MDA programs that inadequately address morbidity and long-term disability. The 2021–2030 WHO Roadmap seeks to address this imbalance by promoting integrated NTD services that strengthen access to treatment and continuity of care. Since 2016, global political commitment has been further reinforced through the inclusion of NTD elimination within the Sustainable Development Goals (SDGs), alongside HIV/AIDS, tuberculosis, and malaria [1, 10].

Anticipated reductions in global health financing in 2025 pose a significant threat to progress toward these targets and are expected to disproportionately affect community health worker (CHW) programs [11]. CHWs are central to NTD service delivery, particularly in settings where geographic, financial, and infrastructural barriers limit access to formal healthcare [11]. Their roles commonly include implementing MDA campaigns, conducting

active case detection, delivering health education, and facilitating referrals to higher-level facilities. The WHO Roadmap for 2021–2030 explicitly identifies CHWs as key actors in NTD control strategies [2]. Although CHW roles and training vary across contexts [12], they are generally described as lay or semi-skilled workers who receive focused training to provide preventive, promotive, and basic curative services within their communities [13]. Through these functions, CHWs strengthen links between communities and health systems by supporting surveillance, treatment adherence, health education, and, in some contexts, direct medicine delivery [14].

Despite their recognized importance, there remains a notable lack of economic evidence examining the costs, cost-effectiveness, and affordability of CHW involvement in NTD programs. This gap presents a challenge for policymakers, particularly within Ministries of Health and Finance, who require robust economic data to guide resource allocation decisions. The most recent scoping review examining CHW costs and cost-effectiveness in LMICs, published by Vaughan *et al.* in 2015, did not include NTD-related interventions and did not assess affordability [15].

To address this gap, the present scoping review synthesizes evidence published between 2015 and 2024 on the economic performance of CHW-led NTD programs in LMICs. Specifically, it examines reported costs, cost-effectiveness, and affordability, alongside the methodological approaches used in these evaluations. By consolidating this evidence, the review aims to clarify the economic role of CHWs in NTD prevention and treatment and to inform strategies for achieving the goals outlined in the WHO Roadmap for the prevention, control, elimination, and eradication of NTDs [2].

## Materials and Methods

A comprehensive scoping review was carried out to systematically identify and characterise the evidence base on economic evaluations of community health worker (CHW) programmes—both vertically organised and horizontally integrated—in low- and middle-income countries (LMICs). Searches were conducted across ten bibliographic databases and relevant grey literature sources, covering publications from August 2015 to July 2024. The review adhered to PRISMA-ScR reporting standards, and the completed checklist is available in S1 Checklist.

Titles and abstracts were screened, followed by full-text review, using Covidence software and predefined eligibility criteria. Studies were included if they primarily evaluated CHW-led interventions (excluding those focused on other cadres of health workers), addressed vertically structured CHW programmes targeting neglected tropical diseases (NTDs), and reported either partial or full economic evaluations. Eligible interventions were required to be implemented in LMICs, according to World Bank income group classifications for the relevant costing year. Publications such as editorials, protocols, commentaries, conference abstracts, and systematic reviews were excluded, although reference lists of reviews were examined to identify additional primary studies. Studies evaluating digital or technological enhancements to CHW programmes were also excluded. No limits were applied based on study quality, language of publication, or analytical time horizon.

In line with the objectives of a scoping review, formal appraisal of methodological quality was not undertaken, and no studies were excluded on this basis. Two reviewers independently extracted data on study characteristics, cost inputs, and outcome measures, which were collated in Microsoft Excel and adjusted to 2024 US dollars where possible. Costs and outcomes were subsequently classified into predefined domains to facilitate cross-study comparison. Due to wide variation in intervention design, geographical context, and evaluation methods, results were synthesised using narrative and descriptive approaches. Additional methodological details have been published elsewhere in this article series [16, 17].

Given the substantial number of included studies and the diversity of programme models and disease areas, findings have been disseminated across multiple publications, grouped by disease category or CHW programme type to improve interpretability. The present paper concentrates on vertical CHW interventions targeting neglected tropical diseases, including yaws; trachoma; taeniasis/cysticercosis; snakebite envenoming; soil-transmitted helminthiasis; schistosomiasis; scabies

and other ectoparasitoses; rabies; onchocerciasis; noma; mycetoma, chromoblastomycosis and other deep mycoses; lymphatic filariasis; leprosy; leishmaniasis; human African trypanosomiasis; foodborne trematodiasis; echinococcosis; dracunculiasis; dengue and chikungunya; Chagas disease; and Buruli ulcer [18].

#### *Patient and public involvement*

The public and patients are not involved in the conduct of this scoping review.

#### *Ethics approval*

An internal review by the University of Washington's Human Subjects IRB established that the project does not qualify as human subjects research and is thus exempt from IRB approval. The reflexivity statement appears in the S2 Checklist.

## Results and Discussion

#### *Search results*

A wide-ranging preliminary literature search was carried out, covering neglected tropical diseases (NTDs) as well as several other fields, namely non-communicable diseases (NCDs), mental health, HIV, malaria, tuberculosis (TB) [16], reproductive, maternal, newborn, and child health (RMNCH), plus integrated and horizontal community health worker (CHW) initiatives [17]. (Recent publications address HIV, TB, malaria, and horizontal approaches, while manuscripts on the other topics are presently in peer review.) This search retrieved 9,790 records, which dropped to 5,663 once duplicates were eliminated. Screening of abstracts eliminated 5,345 records, and full-text evaluation excluded another 170. After classifying the remaining records according to health domain, 10 studies specifically addressing NTDs were selected for inclusion in the review. Across these studies, 29 unique scenarios were identified and are described in greater detail in **Table 1**. More comprehensive information is presented in the PRISMA flowchart (**Figure 1**) [19].

**Table 1.** Details of CHW roles and scenarios in NTD management.

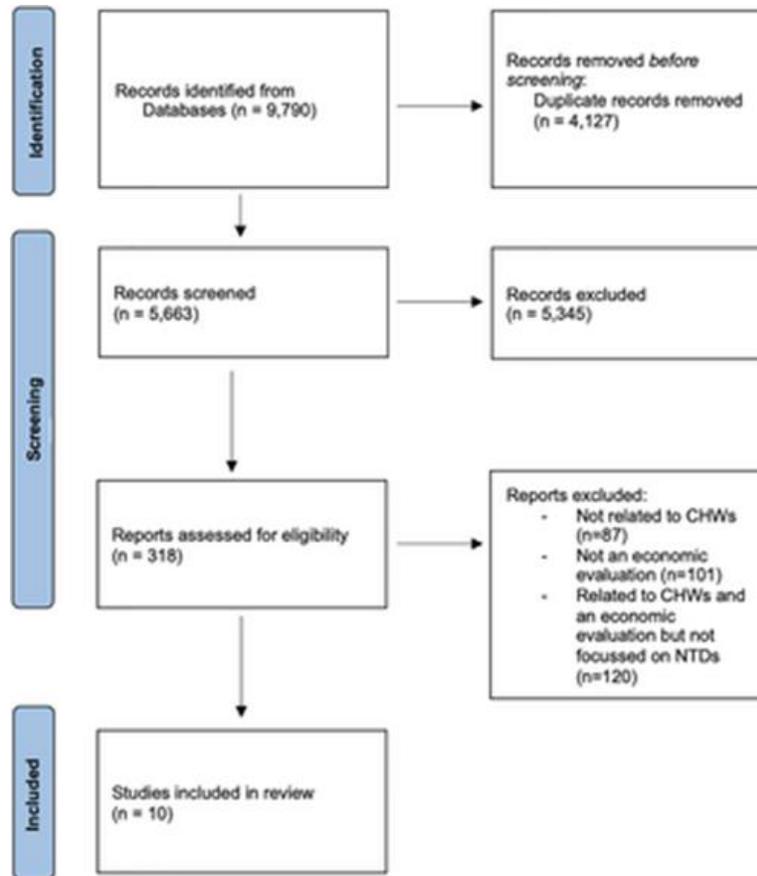
Population and type of CHW	Intervention type	NTDs studied	Nature of intervention (Prevention, curative, both)	Scenarios descriptions	Role of CHW	Comparator
----------------------------	-------------------	--------------	---	------------------------	-------------	------------

<p>Expenditure analysis of mass drug administration across communities and schools for soil-transmitted helminths: results from a randomized trial conducted in Benin, India, and Malawi [22]</p>	<p>Rural Ugandan villages with high NTD prevalence</p> <p>Volunteer CDDs managing an integrated NTD program</p> <p>cMDA</p> <p>Lymphatic filariasis, schistosomiasis, trachoma, onchocerciasis</p> <p>Single scenario (n = 1)</p> <p>Volunteers delivering preventive chemotherapy, maintaining registers, and reporting activities</p> <p>N/A</p>	<p>Using a mixed-methods design to assess the performance of community drug distributors in NTD control [21]</p>	<p>Rural communities in Liberia where NTDs are endemic</p> <p>Salaried community health distributors carrying out MDA</p> <p>cMDA</p> <p>Not specified</p> <p>Single scenario (n = 1)</p> <p>CHWs implementing drug administration for lymphatic filariasis, schistosomiasis, and onchocerciasis</p> <p>N/A</p>	<p>Determinants of compliance with mass drug administration and the opportunity costs of community drug distributors in Liberia: a mixed-methods study [20]</p>
---	--	--	---	---

Inhabited and resort islands in the Maldives	A cost-benefit evaluation of dengue control strategies and treatment protocols in the Maldives [24]	Rural districts in Southern Malawi	Mass drug administration strategies for schistosomiasis and soil-transmitted helminth prevention: a comparison of two approaches in selected districts of Southern Malawi [23]	Mixed rural and semi-urban areas in Benin, India, and Malawi at risk for soil-transmitted helminths
Home-based dengue monitoring and treatment		Drug distribution for schistosomiasis prevention		Community-wide and school-based deworming campaigns
Other (home visits)		cMDA		cMDA
Dengue fever		Soil-transmitted helminthiases and schistosomiasis		Soil-transmitted helminthiases
Single scenario (n = 1)		Two scenarios (n = 2) comparing community-directed vs standard care		Three scenarios (n = 3) reflecting country-specific findings
CHWs visiting households for dengue screening and management		CHWs providing preventive drugs to households		CHWs distributing albendazole via schools and door-to-door visits
N/A		Standard care with Health Surveillance Assistants vs community-directed delivery		Community-wide vs school-based programmes

<p>Monetary and broader economic implications of eliminating and eradicating onchocerciasis (river blindness) across Africa [27]</p>	<p>Remote areas of Cameroon and Uganda with onchocerciasis</p>	<p>Community-led approaches prove feasible and successful in resource-limited settings: Lessons from ivermectin distribution for onchocerciasis control in Cameroon and Uganda, 2004–2010 [26]</p>	<p>Population and type of CHW</p>	<p>Evaluation of cost-effectiveness and societal impacts from a community-led lymphatic management program for podoconiosis in Ethiopia's East Gojjam Zone [25]</p>
<p>Community-led ivermectin distribution</p>	<p>Community-based ivermectin distribution</p>	<p>Intervention type</p>	<p>Adults in rural East Gojjam Zone, Ethiopia with podoconiosis</p>	<p>Community-based monthly care sessions</p>
<p>Other (ivermectin)</p>	<p>Other (ivermectin)</p>	<p>NTDs studied</p>	<p>Other (monthly care)</p>	<p>Other (monthly care)</p>
<p>Onchocerciasis</p>	<p>Onchocerciasis</p>	<p>Nature of intervention (Prevention, curative, both)</p>	<p>Podoconiosis lymphoedema</p>	<p>Podoconiosis lymphoedema</p>
<p>Four scenarios (n = 4) from 2007 and 2010</p>	<p>Four scenarios (n = 4) from 2007 and 2010</p>	<p>Scenarios descriptions</p>	<p>Single scenario (n = 1)</p>	<p>Single scenario (n = 1)</p>
<p>CHW's distributing ivermectin using community-directed approach</p>	<p>CHW's distributing ivermectin using community-directed approach</p>	<p>Role of CHW</p>	<p>CHW's conducting monthly prevention and care sessions</p>	<p>CHW's conducting monthly prevention and care sessions</p>
<p>Cameroon vs Uganda</p>	<p>Cameroon vs Uganda</p>	<p>Comparator</p>	<p>CHW-led programme vs no intervention</p>	<p>CHW-led programme vs no intervention</p>

<p>Liberian communities affected by Buruli ulcer, leprosy, lymphatic filariasis, and yaws</p> <p>Integrated NTD case management</p> <p>Other (integrated management)</p> <p>Buruli ulcer, leprosy, lymphatic filariasis, yaws</p> <p>Two scenarios (n = 2): a) CHWs and health workers conducting screening during MDA campaigns; b) CHWs performing daily home visits for education and case detection</p> <p>CHWs conducting household-level screening and education</p> <p>Standard fragmented screening vs coordinated integrated management</p>	<p>Analysis of the cost-effectiveness of a combined case management approach for multiple Neglected Tropical Diseases in Liberia [29]</p> <p>Urban and semi-urban areas in Nicaragua and Mexico with dengue</p> <p>Community mobilization interventions</p> <p>Other (community-based)</p> <p>Dengue fever</p> <p>Two scenarios (n = 2) reporting country-specific outcomes</p> <p>CHWs facilitating local dengue prevention activities</p> <p>Community mobilization vs government vector control programmes</p>	<p>Economic evaluation of the Camino Verde community engagement strategy for dengue vector control in Nicaragua and Mexico: Evidence from a cluster randomized trial [28]</p>	<p>Populations across 28 sub-Saharan African countries</p> <p>Ivermectin delivery for control and elimination</p> <p>Other (ivermectin)</p> <p>Onchocerciasis</p> <p>Twelve scenarios (n = 12) assessing financial and economic costs for control, elimination, and eradication</p> <p>CHWs mobilizing communities, distributing ivermectin, and collecting census data</p> <p>Control vs elimination vs eradication</p>
--	---	---	--



**Figure 1.** PRISMA flow diagram

The initial search across databases yielded 9,790 records. After removing 4,127 duplicates, 5,663 records were screened for eligibility. Full-text review was conducted for 318 articles, of which 10 studies satisfied the inclusion criteria. Studies were excluded mainly due to not focusing on CHWs, lacking an economic evaluation, or not addressing neglected tropical diseases (NTDs).

#### *Reporting of results*

For each section, we summarize the CHW programs and alternative approaches examined, along with reported findings on costs, cost-effectiveness, and affordability. Costs were converted to 2024 US dollars to enable direct comparison across studies [30, 31]. Regarding cost-effectiveness, we describe whether the CHW interventions were compared to other service delivery models, such as facility-based care, and whether a threshold (e.g., willingness-to-pay or GDP per capita) was applied. For affordability, we note whether studies evaluated the impact of the intervention on overall health system budgets and whether it could be delivered within

current budget constraints. Cost-effectiveness and affordability are presented based on the original authors' conclusions, regardless of whether formal thresholds were applied. Each scenario represents a unique combination of CHW characteristics (e.g., paid versus volunteer), setting, and methodological parameters. For example, a study reporting separate costs for volunteer CHWs versus paid CHWs is treated as two distinct scenarios, while studies reporting country-specific outcomes are presented as separate scenarios per country. The review identified ten studies examining NTD-related preventive or treatment programs across a range of countries. Five low-income countries were represented: Ethiopia, Liberia, Malawi, Nicaragua, and Uganda [20–26, 28, 29]; three lower-middle-income countries: Benin, Cameroon, and India [22, 26]; and two upper-middle-income countries: Maldives and Mexico [24, 28]. One study covered 27 African nations [27]. Targeted NTDs included lymphatic filariasis, schistosomiasis, trachoma, onchocerciasis, soil-transmitted helminthiasis, dengue

fever, podocniosis-associated lymphoedema, Buruli ulcer, leprosy, and yaws.

Intervention sizes were reported in six scenarios, ranging from 15 to 556 CHWs [21, 23, 25, 26], and the number of beneficiaries ranged from 659 to 6,285,000 [21, 23–25, 27, 28]. Five scenarios involved salaried CHWs [20, 22, 25, 29], with two specifying salary amounts (\$56 and \$90 per month) [20, 25]. Fourteen scenarios (from two studies) involved volunteer CHWs [23, 27]; two scenarios included CHWs receiving stipends [21, 28];

one scenario valued CHW time equivalent to other health workers [28]; and seven scenarios did not report remuneration [22, 24, 26].

Comparators differed across studies. Three scenarios used standard care [23, 28, 29]; seven compared alternative approaches [22, 25]; four examined differences between countries [26]; twelve scenarios compared varying stages of onchocerciasis control, elimination, and eradication [27]; and three scenarios had no comparator [20, 21, 24].

**Table 2.** Summary of included studies examining CHW-led NTD programs.

Country	Type of Economic Analysis	Population served	CHWs (#)	Compensation method (2024 US\$)	Cost/service (2024 US\$)	Additional cost outcomes (2024 US\$)	Cost-effectiveness conclusion* (threshold used)	Affordability conclusion (criteria used)
Determinants of participation in mass drug administration programs and the indirect costs incurred by community drug distributors in Liberia: A mixed-methods investigation [20]								
Liberia	Partial - Cost analysis	Not reported	Not reported	Salaried (\$56/month)	n/a	n/a	Not assessed	Not assessed
Mixed-methods assessment of community drug distributor effectiveness in neglected tropical disease control efforts [21]								
Uganda	Partial - Cost analysis	34,615	64	\$1.80/day stipend (paid only on training days)	n/a	n/a	Not assessed	Not assessed
Expenditure analysis for large-scale mass drug administration and school-targeted deworming initiatives against soil-transmitted helminths: Data from a randomized trial across Benin, India, and Malawi [22]								
Benin	Partial - Cost analysis	Not reported	Not reported	Not reported	\$2.66	Cost per treatment via cMDA (\$2.56)	Not assessed	Not assessed

India	Partial - Cost analysis	Not reported	Not reported	Not reported	\$1.31	Cost per treatment via cMDA (\$1.44)	Not assessed	Not assessed
Malawi	Partial - Cost analysis	Not reported	Not reported	Salaried (amount not specified)	\$5.38	Cost per treatment via cMDA (\$6.20)	Not assessed	Not assessed
Evaluating two distinct mass drug administration methods for schistosomiasis and soil-transmitted helminth control in chosen districts of Southern Malawi [23]								
Malawi	Partial - Cost analysis	25,893 - 28,764	25 and 140 across the two methods respectively	None (unpaid volunteers)	n/a	n/a	Not assessed	Not assessed
Financial assessment of dengue control initiatives and clinical care approaches in the Maldives [24]								
Maldives	Partial CEA - cost description	1.8 million	Not reported	Not reported	Not reported	Annual cost per person (\$10.56)	Not assessed	Not assessed
Examination of economic viability and community-wide advantages from a locally managed therapy for podoconiosis-associated lymphoedema in Ethiopia's East Gojjam Zone [25]								
Ethiopia	Full CEA	659	15	Salaried (\$90.47/month)	Not reported	n/a	Varied results, depending on criteria applied (compared to alternative option)	Not assessed
Locally directed treatment strategies show viability and impact in constrained environments: Insights from ivermectin programs for onchocerciasis management in Cameroon and Uganda between 2004 and 2010 [26]								



Liberia - integrated care intervention	Full CEA	Not documented	Not documented	Salaried (amount not specified)	n/a	Cost per diagnosed patient (\$714) Cost per treated patient (\$1,151)	Yes (compared to alternative approach)	Not assessed
Liberia - vertical intervention (control)	Full CEA	Not documented	Not documented	Salaried (amount not specified)	n/a	Cost per diagnosed patient (\$3,942) Cost per treated patient (\$13,800)	No (compared to alternative approach)	Not assessed

Traditional thresholds such as GDP per capita have been criticized because they often fail to reflect local resource limitations, including the opportunity costs within health systems. Additionally, their use in decision-making is limited, as they tend to classify the majority of interventions as cost-effective.

“N/A” indicates data that were not applicable.

#### *Intervention approaches*

Community-wide mass drug administration (cMDA) was evaluated in four studies encompassing 13 scenarios [20–23]. These interventions, serving preventive or therapeutic purposes, were delivered through various channels, including door-to-door campaigns, school-based programs, and community-directed initiatives. In contrast, six studies covering 16 scenarios assessed non-cMDA interventions delivered by community health workers (CHWs) for NTD management [24–29]. These approaches included home visits, community education sessions, and integrated case management strategies. **Table 1** provides a detailed description of the CHW-led interventions.

#### *Functions of CHWs*

Across the included scenarios, CHWs were engaged in multiple roles. Screening for NTDs occurred in 23 scenarios [20–22, 26, 27, 29], while medication distribution was reported in 23 scenarios [20–23, 26, 27].

Administrative responsibilities were documented in 18 scenarios [20, 21, 26, 27], outreach and training in nine [20, 23–25, 28, 29], and ongoing program management in three [20, 24, 29].

#### *Costs associated with interventions*

Full economic evaluations were reported in five scenarios [25, 28, 29], whereas the remaining 24 used partial evaluations [20–24, 26, 27]. The most frequently reported cost outcomes were cost per service (15 scenarios), ranging from \$0.13 to \$5.38 [22, 27], and cost per capita (3 scenarios), ranging from \$10.24 to \$21.09 [21, 28]. Additional metrics included cost per CHW (2 scenarios) [26], \$0.72–\$4.20; cost per cMDA dose (3 scenarios) [22], \$1.44–\$6.20; cost per patient diagnosed (2 scenarios) [29], \$714–\$3,942; and cost per patient treated (2 scenarios) [29], \$1,151–\$13,800. The latter two metrics, derived from a study in Liberia, demonstrated that integrated CHW-led case management reduced diagnostic costs fivefold and treatment costs tenfold compared to vertical programs [29].

#### *Cost-effectiveness evidence*

Of the five scenarios reporting cost-effectiveness, two were classified as cost-effective (40%), rising to 50% when scenarios with ambiguous results were excluded [25, 28, 29]. One study found CHWs to be cost-effective compared with no intervention when using ADLA

episodes and DLQI as outcomes, but less effective when assessed with WHODAS 2.0 [25, 32]. In the context of dengue prevention, a Mexican community mobilization scenario was cost-effective, whereas the Nicaraguan counterpart was not, largely due to low per capita GDP and high personnel costs [28]. In Liberia, integrated door-to-door NTD care was more cost-effective than sporadic screening conducted twice yearly [29].

#### *Affordability considerations*

Only a single study assessed affordability (two scenarios) [28]. The study concluded that the dengue prevention intervention, as implemented, was not affordable. However, the authors suggested that efficiency improvements, multivalent approaches, and factoring in benefits for other arboviral diseases could improve affordability, though no explicit criteria were applied [28]. This gap underscores the lack of evidence on the financial feasibility of these interventions.

#### *Methodological features of economic evaluations*

Among the ten studies (29 scenarios), cost per service (15 scenarios) and cost per capita (3 scenarios) were the most commonly reported metrics. Cost per CHW was reported in four scenarios, and cost per cMDA dose in three. No studies reported cost per DALY averted.

Only ten scenarios specified the analytical perspective: four used a health system perspective, three a provider perspective, and three a mixed perspective. Time horizons exceeded one year in 17 scenarios, with 11 using a one-year horizon. Most scenarios included detailed resource reporting, such as training costs (25 scenarios), non-training capital items (21 scenarios), recurrent costs (23 scenarios), and indirect or overhead costs (19 scenarios).

Overall, cost-effectiveness data were limited, with only two studies (five scenarios) comparing CHWs to no intervention or GDP-based thresholds, producing mixed findings. Affordability was assessed in only one study (two scenarios), also yielding inconclusive results. None of the studies followed the CHEERS checklist, despite its role in ensuring economic evaluations are transparent, interpretable, and useful for policy and decision-making. Between 2015 and 2024, research on the economic impact of community health workers (CHWs) in managing neglected tropical diseases (NTDs) has grown, with ten studies covering 29 scenarios included in this review. Prior to 2015, no economic evaluations specifically examining CHWs' roles in NTD control

were reported [15], highlighting a relatively recent interest in understanding the financial implications of these interventions. Among the limited studies reporting cost-effectiveness, only a minority of scenarios were deemed cost-effective (40%), increasing slightly to 50% when excluding ambiguous results.

A key finding from this review is the persistent lack of robust evidence on both cost-effectiveness and affordability of CHW-led interventions. Only two studies (five scenarios) assessed cost-effectiveness, and a single study (two scenarios) explored affordability. Importantly, no studies focusing on community-wide mass drug administration (cMDA) examined these outcomes. This gap is particularly concerning given the burden of NTDs in low- and middle-income countries (LMICs) and the reliance on CHWs for service delivery. Although MDA programs delivered outside of CHW frameworks have been shown to be cost-effective for diseases such as soil-transmitted helminths [33], the economic role of CHWs within these programs remains poorly characterized. Filling this gap is essential for policymakers aiming to design sustainable frameworks that leverage CHWs effectively.

Among the scenarios that did explore cost-effectiveness, results were highly context-specific. For example, CHWs conducting monthly education sessions for podoconiosis-related lymphoedema were cost-effective when outcomes were measured using disease-specific tools, but findings varied depending on the assessment metric used, such as DLQI versus WHODAS 2.0 [32]. Similarly, dengue prevention programs were borderline cost-effective in Mexico but not in Nicaragua, likely reflecting differences in economic context, program costs, effectiveness, and funding structures. The frequent use of GDP per capita thresholds in these evaluations is also problematic, as such thresholds fail to account for local resource constraints, do not reflect opportunity costs, and offer limited guidance for budget allocation [34, 35]. Notably, no study reported outcomes in cost per DALY averted, a widely accepted metric for comparing health interventions, which limits the ability to prioritize CHW-led NTD programs relative to other health investments.

Affordability data were even more scarce. Only one study (two scenarios) attempted an affordability assessment, concluding that dengue prevention interventions were unlikely to be affordable in their current form, though they might become feasible under more efficient implementation strategies [28]. Future

research should incorporate standardized economic tools, including budget impact analyses that consider both short- and long-term costs to health systems and communities. Evidence from other NTD control strategies, including MDA and vector control, suggests that ending NTDs is affordable for most endemic countries, often requiring less than 0.1% of domestic health spending when pharmaceutical donations are included [36]. Nevertheless, historical underinvestment in NTD programs, combined with recent reductions in international aid, poses a threat to program sustainability and underscores the need for innovative financing mechanisms, such as increased domestic funding.

The reliance on volunteer CHWs in nearly half of the scenarios (14 of 29) further complicates economic assessments. Volunteer labor omits key cost and productivity factors, potentially undervaluing program costs and CHWs' contributions [37–39]. Guidelines emphasize fair remuneration as a core element of sustainable CHW programs [40], and future evaluations should account for appropriate valuation of volunteer or underpaid labor to reflect true program costs.

Most interventions in this review were delivered through vertical programs, which target specific NTDs efficiently but often operate in isolation from broader health systems. Integrated approaches, combining multiple disease interventions within general healthcare systems, appear to offer better efficiency and sustainability [41]. This was exemplified in Liberia, where integrated case management increased patient coverage while dramatically reducing per-patient costs—diagnosis costs were five times lower and treatment costs ten times lower compared with fragmented vertical programs [29].

Finally, preventive measures such as cMDA remain highly cost-effective for diseases like lymphatic filariasis and onchocerciasis [42], typically outperforming resource-intensive treatment strategies [43]. CHWs are pivotal in bridging prevention and treatment, as evidenced by their prominent roles in screening (26 scenarios) and medication delivery (26 scenarios), while also supporting administrative tasks, outreach, and ongoing management to a lesser extent. Strengthening CHW-led community health systems can alleviate pressure on higher-level facilities and enhance overall health outcomes. However, more rigorous economic evidence is needed to assess the relative cost-effectiveness and affordability of these integrated, multi-role approaches.

#### *Limitations and strengths*

This review represents, to our knowledge, the first attempt to compile and examine evidence on the financial aspects of CHW involvement in NTD programs in low- and middle-income countries, including costs, cost-effectiveness, and affordability. By highlighting what is currently known, it addresses a major gap in global understanding of the economic implications of these interventions. However, the limited number of studies and scenarios available restricts the ability to draw strong conclusions about whether CHW-led programs are consistently cost-effective or financially sustainable. Consistent with scoping review methodology, the methodological quality of the included studies was not formally evaluated [44].

#### *Future research directions*

Several key areas merit attention in future studies. Methodologically, economic evaluations should adopt broader and more standardized outcome measures, such as cost per DALY averted, and consider a range of geographic and epidemiologic contexts. Explicitly stating the analytic perspective and time horizon is also crucial. In this review, just over half of the scenarios ( $n = 17$ ) used time horizons longer than one year. While shorter timeframes may be appropriate for specific study aims, interventions like cMDA often produce long-term effects, and limited horizons could fail to capture their full economic impact.

The choice of perspective is similarly important. Most current studies take a health system perspective, which informs governmental planning but overlooks costs and benefits at the household level. Incorporating broader societal or household perspectives could provide a more comprehensive understanding of CHW contributions and strengthen the case for investment in these programs. Additionally, CHW-delivered interventions may produce downstream benefits, such as early diagnosis reducing the need for costly advanced care, which are not typically captured in current cost-effectiveness analyses. Future research should examine these indirect effects to provide a fuller picture of economic impact.

Adherence to established reporting standards, such as the CHEERS checklist, could improve study quality and enhance the utility of findings for decision-makers. Researchers should also prioritize methods that explicitly evaluate affordability, including budget impact analyses, rather than focusing solely on cost or cost-effectiveness outcomes.

## Conclusion

Since the review by Vaughan *et al.* (2015), the evidence base on the economics of CHW involvement in NTD programs has grown but remains limited, encompassing only ten studies with no definitive conclusions regarding cost-effectiveness or affordability in LMICs. Existing evidence suggests that integrated interventions may offer greater cost-effectiveness than vertical approaches.

To support policy and funding decisions, there is a pressing need for rigorous analyses that assess both the cost-effectiveness and affordability of CHW-led NTD programs. Without such evidence, it is difficult to optimize CHW contributions to both preventive and treatment-oriented strategies, potentially limiting the effectiveness and sustainability of NTD control efforts.

**Acknowledgments:** None

**Conflict of Interest:** None

**Financial Support:** None

**Ethics Statement:** None

## References

- Lin Y, Fang K, Zheng Y, Wang H-L, Wu J. Global burden and trends of neglected tropical diseases from 1990 to 2019. *J Travel Med.* 2022;29(3):taac031. pmid:35238925
- Ending the neglect to attain the Sustainable Development Goals: a road map for neglected tropical diseases 2021–2030. Geneva: World Health Organization; 2020. <https://creativecommons.org/licenses/by-nc-sa/3.0/igo/>
- World Health Organization. Neglected tropical diseases. World Health Organization. <https://www.who.int/news-room/questions-and-answers/item/neglected-tropical-diseases>
- Patikorn C, Cho J-Y, Higashi J, Huang XX, Chaiyakunapruk N. Financial hardship among patients suffering from neglected tropical diseases: a systematic review and meta-analysis of global literature. *PLoS Negl Trop Dis.* 2024;18(5):e0012086. pmid:38739636
- Institute for Health Metrics and Evaluation. GBD results. Accessed 2023 October 1. <https://www.healthdata.org/data-tools-practices/interactive-visuals/gbd-results>
- Global report on neglected tropical diseases 2023. Geneva: World Health Organization; 2023.
- Accelerating work to overcome the global impact of neglected tropical diseases – a roadmap for implementation. Geneva: World Health Organization; 2012.
- London declaration on neglected tropical diseases. 2012. <https://unitingtocombatntds.org/en/neglected-tropical-diseases/resources/london-declaration-on-neglected-tropical-diseases/>
- Venkatesan P. Millions of dollars pledged at COP28 to fight NTDs. *Lancet Infect Dis.* 2024;24(2):e88. pmid:38280400
- SDG Target 3.3 communicable diseases. Accessed 2023 October 1. [https://www.who.int/data/gho/data/themes/topics/sdg-target-3\\_3-communicable-diseases](https://www.who.int/data/gho/data/themes/topics/sdg-target-3_3-communicable-diseases)
- Lay K. Some of these diseases are in the Bible: despair as cuts halt progress on age-old tropical illnesses. *The Guardian.* 2025.
- Olaniran A, Smith H, Unkels R, Bar-Zeev S, van den Broek N. Who is a community health worker? - a systematic review of definitions. *Glob Health Action.* 2017;10(1):1272223. pmid:28222653
- Hodgins S, Lehmann U, Perry H, Leydon N, Scott K, Agarwal S, et al. Comparing apples with apples: a proposed taxonomy for “Community Health Workers” and other front-line health workers for international comparisons. *PLOS Glob Public Health.* 2025;5(2):e0004156. pmid:39913354
- LeBan K, Kok M, Perry HB. Community health workers at the dawn of a new era: 9. CHWs’ relationships with the health system and communities. *Health Res Policy Syst.* 2021;19(Suppl 3):116. pmid:34641902
- Vaughan K, Kok MC, Witter S, Dieleman M. Costs and cost-effectiveness of community health workers: evidence from a literature review. *Hum Resour Health.* 2015;13:71. pmid:26329455
- O’Donovan J, Baskin C, Stansert Katzen L, Ballard M, Kok M, Jimenez A, et al. Costs and cost-effectiveness of community health worker programs focussed on HIV, TB and malaria infectious diseases in low- and middle-income countries (2015-2024): a scoping literature review. *PLOS Glob Public Health.* 2025;5(5):e0004596. pmid:40343952

17. O' Donovan J, Kumar MB, Ballard M, Mchenga M, Martin L, Dennis M, et al. Costs and cost-effectiveness of integrated horizontal community health worker programmes in low- and middle-income countries (2015-2024): a scoping literature review. *BMJ Glob Health*. 2025;10(7):e017852. pmid:40701612
18. World Health Organization. Neglected tropical diseases. World Health Organization. 2023. <https://www.who.int/health-topics/neglected-tropical-diseases>
19. Agboraw E, Sosu F, Dean L, Siakeh A, Thomson R, Kollie K, et al. Factors influencing mass drug administration adherence and community drug distributor opportunity costs in Liberia: a mixed-methods approach. *Parasit Vectors*. 2021;14(1):557. pmid:34711278
20. Fleming FM, Matovu F, Hansen KS, Webster JP. A mixed methods approach to evaluating community drug distributor performance in the control of neglected tropical diseases. *Parasit Vectors*. 2016;9(1):345. pmid:27305942
21. Morozoff C, Avokpaho E, Puthupalayam Kaliappan S, Simwanza J, Gideon SP, Lungu W, et al. Costs of community-wide mass drug administration and school-based deworming for soil-transmitted helminths: evidence from a randomised controlled trial in Benin, India and Malawi. *BMJ Open*. 2022;12(7):e059565. pmid:35803632
22. Makaula P, Kayuni SA, Mamba KC, Bongololo G, Funsanani M, Juziwelo LT, et al. Mass drug administration campaigns: comparing two approaches for schistosomiasis and soil-transmitted helminths prevention and control in selected Southern Malawi districts. *BMC Health Serv Res*. 2024;24(1):11. pmid:38172854
23. Bangert M, Latheef AT, Dev Pant S, Nishan Ahmed I, Saleem S, Nazla Rafeeq F, et al. Economic analysis of dengue prevention and case management in the Maldives. *PLoS Negl Trop Dis*. 2018;12(9):e0006796. pmid:30260952
24. Hounsoume N, Kassahun MM, Ngari M, Berkley JA, Kivaya E, Njuguna P, et al. Cost-effectiveness and social outcomes of a community-based treatment for podoconiosis lymphoedema in the East Gojjam zone, Ethiopia. *PLoS Negl Trop Dis*. 2019;13(10):e0007780. pmid:31644556
25. Katarawa MN, Habomugisha P, Eyamba A, Byamukama E, Nwane P, Arinaitwe A, et al. Community-directed interventions are practical and effective in low-resource communities: experience of ivermectin treatment for onchocerciasis control in Cameroon and Uganda, 2004–2010. *Int Health*. 2016;8(2):116–23.
26. Kim YE, Sicuri E, Tediosi F. Financial and Economic Costs of the Elimination and Eradication of Onchocerciasis (River Blindness) in Africa. *PLoS Negl Trop Dis*. 2015;9(9):e0004056. pmid:26360917
27. Tschampl CA, Undurraga EA, Ledogar RJ, Coloma J, Legorreta-Soberanis J, Paredes-Solis S, et al. Cost-effectiveness of community mobilization (Camino Verde) for dengue prevention in Nicaragua and Mexico: a cluster randomized controlled trial. *Int J Infect Dis*. 2020;94:59–67. pmid:32179138
28. Godwin-Akpan TG, Diaconu K, Edmiston M, Smith JS Jr, Sosu F, Weiland S, et al. Assessing the cost-effectiveness of integrated case management of neglected tropical diseases in Liberia. *BMC Health Serv Res*. 2023;23(1):705. pmid:37386431
29. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ*. 2021;372:n71. pmid:33782057
30. Vaughan K, Ozaltin A, Mallow M, Moi F, Wilkason C, Stone J, et al. The costs of delivering vaccines in low- and middle-income countries: findings from a systematic review. *Vaccine X*. 2019;2:100034. pmid:31428741
31. Croke K, Hamory J, Hsu E, Kremer M, Maertens R, Miguel E, et al. Meta-analysis and public policy: reconciling the evidence on deworming. *Proc Natl Acad Sci U S A*. 2024;121(25):e2308733121. pmid:38857387
32. Üstün TB, Kostanjsek N, Chatterji S, Rehm J. Measuring health and disability: Manual for WHO disability assessment schedule (WHODAS 2.0). World Health Organization.
33. Lo NC, Bogoch II, Blackburn BG, Raso G, N'Goran EK, Coulibaly JT, et al. Comparison of community-wide, integrated mass drug administration strategies for schistosomiasis and soil-transmitted helminthiasis: a cost-effectiveness modelling study. *Lancet Glob Health*. 2015;3(10):e629-38. pmid:26385302
34. Chi Y-L, Blecher M, Chalkidou K, Culyer A, Claxton K, Edoaka I, et al. What next after GDP-

- based cost-effectiveness thresholds?. *Gates Open Res.* 2020;4:176. pmid:33575544
35. Bertram MY, Lauer JA, De Joncheere K, Edejer T, Hutubessy R, Kieny M-P, et al. Cost-effectiveness thresholds: pros and cons. *Bull World Health Organ.* 2016;94(12):925–30. pmid:27994285
  36. Fitzpatrick C, Nwankwo U, Lenk E, de Vlas SJ, Bundy DAP. An investment case for ending neglected tropical diseases. In: Holmes KK, Bertozzi S, Bloom BR, Jha P, eds. *Major Infectious Diseases.* Washington (DC): The International Bank for Reconstruction and Development / The World Bank.
  37. Community Health Workers (ROI). Exemplars in Global Health. 2022. [https://www.exemplars.health/-/media/files/egh/resources/community-health-workers/partner-content/chw-roi\\_2-pager\\_may2022](https://www.exemplars.health/-/media/files/egh/resources/community-health-workers/partner-content/chw-roi_2-pager_may2022)
  38. Ballard M, Olaniran A, Iberico MM, Rogers A, Thapa A, Cook J, et al. Labour conditions in dual-cadre community health worker programmes: a systematic review. *Lancet Glob Health.* 2023;11(10):e1598–608. pmid:37734803
  39. Colvin CJ, Hodgins S, Perry HB. Community health workers at the dawn of a new era: 8. Incentives and remuneration. *Health Res Policy Syst.* 2021;19(Suppl 3):106. pmid:34641900
  40. World Health Organization. WHO guideline on health policy and system support to optimize community health worker programs. 2018.
  41. Donovan L, Habte T, Batisso E, Getachew D, Stratil A-S, Tekalegne A, et al. Improving neglected tropical disease services and integration into primary healthcare in Southern Nations, Nationalities and People's Region, Ethiopia: results from a mixed methods evaluation of feasibility, acceptability and cost effectiveness. *PLoS Negl Trop Dis.* 2025;19(2):e0011718. pmid:39977439
  42. Hassan SM, Okoli EC, Azike CA, Okoye NA, Adindu NK. Assessing the impact of community health workforce on the efficiency and accessibility of healthcare delivery. *Arch Curr Res Int.* 2024;24(10):167–73.
  43. Turner HC, Stolk WA, Solomon AW, King JD, Montresor A, Molyneux DH, et al. Are current preventive chemotherapy strategies for controlling and eliminating neglected tropical diseases cost-effective?. *BMJ Glob Health.* 2021;6(8):e005456. pmid:34385158
  44. Gough D, Thomas J, Oliver S. Clarifying differences between review designs and methods. *Syst Rev.* 2012;1:28. pmid:22681772