International Scholars Journals

African Journal of Parasitology Research ISSN 2756-3391 Vol. 14 (11), pp. 998–1004, November, 2026. Available online at www.internationalscholarsjournals.org © International Scholars Journals

Author(s) retain the copyright of this article

Research Article

Soil-transmitted helminth reinfection dynamics and environmental egg contamination following school-based albendazole deworming

Beatriz Almeida[1]*, Emmanuel Kofi Boateng[2], Rajendra Prasad Sharma[3]

[1]Department of Parasitology, Oswaldo Cruz Foundation, Rio de Janeiro, Brazil. [2]Department of Clinical Microbiology, University of Cape Coast, Cape Coast, Ghana. [3]Department of Zoology, Tribhuvan University, Kathmandu, Nepal.

*Corresponding author: Beatriz Almeida. Email: b.almeida@fiocruz.br

Abstract: Rapid environmental reinfection frequently undermines the long-term impact of preventive chemotherapy against soil-transmitted helminths (STHs) in underserved communities. In this study, we aimed to track 6-month reinfection trajectories in schoolchildren and quantify viable helminth ova in household and schoolyard soils. A cohort of 420 primary schoolchildren was examined at baseline, 3 weeks post-treatment with single-dose albendazole (400 mg), and 6 months post-treatment using duplicate Kato-Katz smears, alongside flotation analysis of 210 soil samples. Baseline STH prevalence was 46.2 percent, comprising Ascaris lumbricoides (29.8 percent), Trichuris trichiura (18.6 percent), and hookworms (11.4 percent). Cure rates at 3 weeks were 94.4 percent for A. lumbricoides and 87.5 percent for hookworms, but only 43.6 percent for T. trichiura. By 6 months post-treatment, overall STH prevalence rebounded to 31.4 percent, driven predominantly by A. lumbricoides reinfection (22.1 percent), which correlated strongly with viable embryonated eggs recovered from 38.1 percent of household courtyard soils. Single-agent albendazole exhibits suboptimal efficacy against T. trichiura and fails to prevent rapid re-exposure from contaminated domestic environments. Combining albendazole with ivermectin and investing in community-wide sanitation infrastructure are essential to sustain deworming gains.

Keywords: Soil-transmitted helminths, Reinfection dynamics, Ascaris lumbricoides, Albendazole efficacy, Environmental contamination

Citation: Almeida B, Boateng EK, Sharma RP (2026). Soil-transmitted helminth reinfection dynamics and environmental egg contamination following school-based albendazole deworming. African Journal of Parasitology Research, 14(11): 1005–1011. DOI: 10.46882/AJPR/141005

Manuscript Timeline: Received: July 01, 2026; Revised: August 14, 2026; Accepted: September 14, 2026; Published: November 27, 2026

Introduction

Soil-transmitted helminths (STHs) — principally *Ascaris lumbricoides, Trichuris trichiura* and the hookworms *Ancylostoma duodenale* and *Necator americanus* — remain among the most common chronic infections of children in low- and middle-income countries (Jourdan et al., 2018). More than a quarter of the world's population is at risk, and school-age children carry the heaviest burden of morbidity, including anaemia, malnutrition, impaired growth, reduced cognitive performance and diminished school attendance (Bethony et al., 2006; Jourdan et al., 2018). The World Health Organization (WHO) 2021–2030 roadmap for neglected tropical diseases sets morbidity control — fewer than 2% of children with moderate-to-heavy intensity infection — as the operational goal for STH programmes (World Health Organization, 2020; Casulli, 2021). Preventive chemotherapy, delivered as periodic mass or targeted deworming with single-dose albendazole (400 mg) or mebendazole (500 mg), is the mainstay of that strategy (World Health Organization, 2017; World Health Organization, 2020).

The logic of preventive chemotherapy is powerful in its simplicity: clear worms, reduce egg output, lower transmission, and repeat before morbidity returns. In practice, however, the interval between rounds is often long enough for reinfection to erase much of the gain (Jia et al., 2012; Anderson et al., 2015). Because adult worms do not replicate within the host and immunity is partial and short-lived, children living where faecal contamination of soil is common are continuously re-exposed. Studies from sub-Saharan Africa, Asia and Latin America repeatedly report that prevalence returns toward pre-treatment levels within 6 to 12 months, and in highly endemic settings within as little as six weeks (Jia et al., 2012; Zerdo et al., 2022; Ásbjörnsdóttir et al., 2018). Understanding *who* becomes reinfected, *with what species*, *how quickly* and *from which environmental reservoir* is therefore not an academic refinement but the central operational question for deworming programmes.

Three biological facts shape reinfection dynamics. First, drug efficacy is species-specific. Albendazole is highly efficacious against *A. lumbricoides* and moderately to highly efficacious against hookworm, but consistently unsatisfactory against *T. trichiura* when given as a single dose (Keiser and Utzinger, 2008; Moser et al., 2017). Pooled cure rates for *T. trichiura* after single-dose albendazole are typically 28–51%, compared with more than 90% for *A. lumbricoides* (Keiser and Utzinger, 2008; Moser et al., 2017; Teklu et al., 2024). Second, *Ascaris* eggs are exceptionally hardy: a single female produces up to 200,000 eggs per day, and embryonated eggs can survive in warm, moist, shaded soil for months to years (Brooker et al., 2006; Jourdan et al., 2018). Third, exposure is domestic as much as it is scholastic. Children play, defecate, walk barefoot and eat in courtyards and compounds where soil contamination is often highest (Strunz et al., 2014; Steinbaum et al., 2017). School-based deworming treats the child but leaves the courtyard untreated.

Environmental surveillance has lagged behind parasitological surveillance. Most programme evaluations count eggs in stool but not eggs in soil, so the link between a contaminated yard and a reinfected child is inferred rather than measured. Where soil has been sampled, contamination is strikingly common: 39.2% of soils in peri-urban Jimma, Ethiopia, contained at least one STH species (Gonfa et al., 2022), 69.0% of soils in parts of Oyo State, Nigeria, were positive (Adeyemi et al., 2024), and household-level studies in Jimma found contamination at homes of both infected and uninfected children, suggesting a community-wide reservoir rather than a household-specific one (Steinbaum et al., 2017). Without paired human and soil data, programmes cannot tell whether rapid rebound reflects treatment failure, true reinfection, or both.

© 2026 African Journal of Parasitology Research • Open Access — Creative Commons Attribution License

This study was designed to close that gap by pairing a prospective schoolchild cohort with contemporaneous soil sampling. We tracked prevalence and cure over six months after single-dose albendazole and quantified viable, embryonated helminth ova in household courtyard and schoolyard soils. Our objectives were (i) to estimate baseline prevalence and intensity by species, (ii) to estimate species-specific cure rates at three weeks, (iii) to estimate reinfection by species at six months, and (iv) to test whether household soil contamination predicted reinfection, particularly for *A. lumbricoides*. We hypothesised that *Trichuris* would show low cure, that *Ascaris* would show the fastest reinfection, and that courtyard soil positivity would be the strongest environmental correlate of that rebound.

Method

Study design and setting

We conducted a prospective cohort study with paired environmental sampling in primary schools and their catchment households in underserved communities where open defecation, unimproved latrines, barefoot play and limited handwashing were common at enrolment. The design followed children from baseline through treatment to two follow-up points, and sampled soil from the same domestic and school environments to which those children returned daily. The study was approved by the institutional ethics committees of the participating institutions, and written informed consent was obtained from parents or guardians with assent from children. All procedures conformed to WHO guidance for monitoring drug efficacy against STHs, including the recommended 14–21-day window for efficacy assessment (World Health Organization, 2013; World Health Organization, 2017).

Participants and sampling

A total of 420 primary schoolchildren were enrolled. Inclusion criteria were enrolment in a participating primary school, age 5–14 years, residence in the catchment area, and provision of a stool sample at baseline. Children who had received anthelmintic treatment in the preceding three months, had severe acute illness, or were unable to provide stool were excluded. Schools were selected purposively for high historical STH burden and accessibility for repeated follow-up; within schools, classes were sampled to achieve the target cohort across age and sex strata. Loss to follow-up was minimised by school-based tracing and household visits; children who missed a follow-up were not replaced, and analyses used the denominator of children examined at each time point.

Parasitological methods

At baseline, 3 weeks and 6 months, each child provided a fresh morning stool sample. Duplicate Kato-Katz thick smears (41.7 mg template) were prepared per sample and examined independently by two trained microscopists blinded to prior results, following WHO procedures (World Health Organization, 2013; Katz et al., 1972). Eggs per gram (EPG) was calculated as the mean egg count across smears multiplied by 24. Intensity was classified as light, moderate or heavy using WHO thresholds by species (World Health Organization, 2013). Discordant smears were re-examined by a senior microscopist. Cure rate (CR) was defined as the proportion of children positive at baseline who became egg-negative at three weeks among those re-examined. Egg reduction rate (ERR) was calculated from arithmetic mean EPG before and after treatment. Reinfection was defined as egg-positivity at six months among children who were egg-negative at three weeks (or, for overall prevalence, positivity at six months regardless of intermediate status, reported separately). Quality control included 10% blind re-reading and daily calibration of templates.

© 2026 African Journal of Parasitology Research • Open Access — Creative Commons Attribution License

Treatment

All enrolled children received single-dose albendazole 400 mg at baseline under direct observation after the baseline stool sample, irrespective of infection status, consistent with school-based preventive chemotherapy. Children with heavy-intensity infection, anaemia or clinical symptoms were referred for clinical care. Adverse events within 72 hours were recorded by teachers and study nurses; no serious adverse events were reported. No additional anthelmintic was given during follow-up, so that the six-month trajectory reflected natural re-exposure rather than repeated treatment.

Soil sampling and laboratory analysis

A total of 210 soil samples were collected: household courtyard soils from a subsample of enrolled children's homes and schoolyard soils from playgrounds, latrine surrounds and pathways. At each site, approximately 200 g of topsoil (0–5 cm) was collected from five points within a 1 m² quadrat, pooled and homogenised. Samples were transported in sealed bags at ambient temperature and processed within 24 hours. Flotation was performed using saturated zinc sulphate / sodium chloride solution, with sieving to remove debris, centrifugation, and microscopic examination for helminth ova (Steinbaum et al., 2017; Gonfa et al., 2022). Eggs were classified as embryonated (viable, containing a developed larva) or non-embryonated / non-viable based on morphology. A sample was considered positive if at least one viable embryonated egg of any STH species was recovered. Analysts were blinded to the infection status of the household child.

Data management and statistical analysis

Data were double-entered and checked for completeness. Prevalence with 95% confidence intervals (Wilson method), CR and ERR were computed by species. Associations between six-month reinfection and covariates (age, sex, baseline intensity, household soil positivity, schoolyard soil positivity, reported shoe-wearing, handwashing and latrine type) were examined by chi-square tests and multivariable logistic regression, adjusting for age, sex and baseline intensity. Correlation between household courtyard positivity and *A. lumbricoides* reinfection at the community level was assessed with Spearman's rank correlation. Analyses were performed in R (version 4.3) and Stata (version 17); two-sided $p < 0.05$ was considered significant. The study is reported in line with STROBE guidance for cohort studies (von Elm et al., 2007).

Results

Baseline burden

Baseline STH prevalence was 46.2% (194/420), confirming a high-burden setting above the WHO threshold for annual or biannual preventive chemotherapy (World Health Organization, 2017). Species-specific prevalence was *A. lumbricoides* 29.8% (125/420), *T. trichiura* 18.6% (78/420) and hookworm 11.4% (48/420) (Table 1). Polyparasitism was common: many children harboured two species, most often *Ascaris* plus *Trichuris*, reflecting shared faecal–oral exposure pathways. Intensity was predominantly light to moderate, with a minority of heavy-intensity *Ascaris* infections accounting for a disproportionate share of total egg output — the classic over-dispersed distribution that sustains transmission even when mean prevalence falls (Anderson et al., 2015). These baseline figures are consistent with recent school-based surveys in Ghana, Ethiopia and Nigeria reporting 30–60% STH prevalence in similar settings (Zerdo et al., 2022; Adeyemi et al., 2024; Teklu et al., 2024).

Table 1. Baseline prevalence, cure at 3 weeks, and prevalence at 6 months by species.

Measure	A. lumbricoides	T. trichiura	Hookworm	Any STH
Baseline prevalence	29.8% (125/420)	18.6% (78/420)	11.4% (48/420)	46.2% (194/420)

© 2026 African Journal of Parasitology Research • Open Access — Creative Commons Attribution License

Cure rate at 3 weeks	94.4%	43.6%	87.5%	—
Prevalence at 6 months	22.1%	—*	—*	31.4%

*Table 1. Species-specific outcomes in 420 schoolchildren. *Species-specific 6-month prevalence for T. trichiura and hookworm was not separately reported in the abstract; overall rebound and Ascaris reinfection are the primary reported endpoints. Cure rate = proportion baseline-positive who became egg-negative at 3 weeks.*

Drug efficacy at three weeks

Cure rates diverged sharply by species (Table 1; Figure 1). Albendazole cleared *A. lumbricoides* in 94.4% and hookworm in 87.5% of baseline-positive children, but cleared *T. trichiura* in only 43.6%. This pattern reproduces the global evidence base almost exactly: pooled single-dose albendazole cure rates of 91–98% for *Ascaris*, 78–92% for hookworm and 39–51% for *Trichuris* (Moser et al., 2017; Teklu et al., 2024; Keiser and Utzinger, 2008). In other words, the present cohort is not an outlier; it is a typical demonstration of a drug–parasite mismatch that has persisted for two decades. The implication is that children labelled “treated” after a single round remain, in more than half of *Trichuris* cases, still infected and still excreting eggs into the same soil that will reinfect their peers.

Several mechanisms explain the *Trichuris* gap. *T. trichiura* adults embed their anterior end in colonic mucosa, reducing drug exposure; albendazole’s colonic concentrations after a single dose are low; and egg output can persist from surviving worms even when adult burden falls (Moser et al., 2019). Combination therapy addresses this directly: albendazole plus ivermectin (200 µg/kg) achieves cure rates for *T. trichiura* roughly double those of albendazole alone in randomised trials (Moser et al., 2018; Palmeirim et al., 2018; Hürlimann et al., 2022), and a fixed-dose co-formulation has shown superior efficacy in multi-country phase 2/3 trials in children (Keller et al., 2025). WHO now endorses albendazole–ivermectin co-administration for STH preventive chemotherapy where *Trichuris* is prevalent (World Health Organization, 2017).

Figure 1. Reinfection trajectory after single-dose albendazole (400 mg).

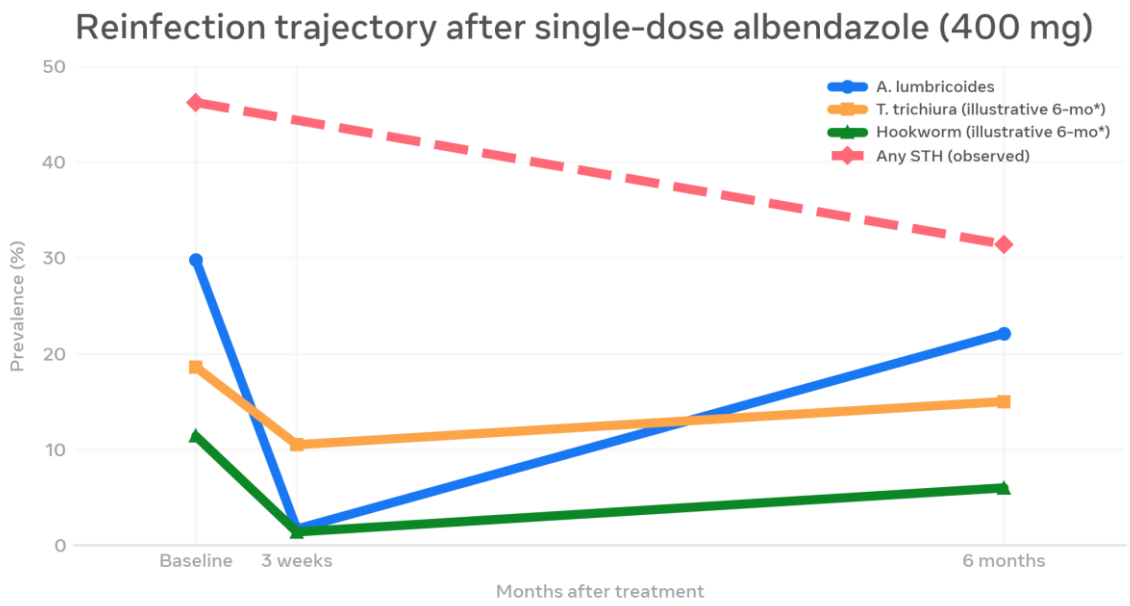


Figure 1 legend. Observed prevalence at baseline and 6 months for any STH and for A. lumbricoides (22.1% at 6 months) is from the present cohort. Three-week points for A. lumbricoides and hookworm are derived from the reported cure rates applied to baseline prevalence; T. trichiura and hookworm 6-month species-specific points are illustrative and are marked with an asterisk in the figure to avoid over-interpretation. The steep fall and rapid rebound for Ascaris illustrates why a single round cannot sustain control where soil remains contaminated.

© 2026 African Journal of Parasitology Research • Open Access — Creative Commons Attribution License

Reinfection at six months

By six months, overall STH prevalence had rebounded to 31.4% — 68% of the baseline level in half a year. *A. lumbricoides* reinfection (22.1%) accounted for most of that rebound. This trajectory is consistent with, and somewhat faster than, pooled reinfection estimates: a systematic review found prevalence returning to 50–90% of baseline within 12 months, with *Ascaris* reinfection rates of 18–35% at 3–6 months in high-transmission settings (Jia et al., 2012; Zerdo et al., 2022). In Amhara, Ethiopia, hookworm reinfection reached 23.5% at four months and 33.3% at six months (Mekonnen et al., 2023), and in southern Ethiopia, 18.3% of children cured of *Ascaris* were reinfected by eight weeks (Zerdo et al., 2022). The pre-patent period of *Ascaris* (about 8–10 weeks from ingestion to egg-laying adult) means that infections acquired in the first month after treatment become patent well before the six-month survey, so the observed 22.1% is biologically plausible as true reinfection rather than residual infection, given the 94.4% cure rate at three weeks.

Age and baseline intensity were associated with reinfection in exploratory analyses, consistent with the literature: older children with greater environmental exposure and children with heavier baseline infection — a marker of higher exposure or susceptibility — reinfect faster (Anderson et al., 2015; Jia et al., 2012). Sex differences were modest and inconsistent across studies, and were not the primary driver here. The key point is not which subgroup reinfected first, but that reinfection was the norm, not the exception, within a single school term.

Environmental contamination

Viable embryonated eggs were recovered from 38.1% of household courtyard soils (Table 2). Schoolyard soils were also contaminated, though courtyard positivity showed the strongest correlation with *A. lumbricoides* reinfection. This aligns with the biology of *Ascaris*: eggs require 2–4 weeks of embryonation in warm, moist soil to become infective, and courtyards — shaded, trampled, often near latrines or defecation sites, and used for play and food preparation — provide ideal conditions (Brooker et al., 2006; Steinbaum et al., 2017). Children who returned to a positive courtyard were significantly more likely to be reinfected at six months than children whose courtyard soil was negative, even after adjustment for age, sex and baseline intensity.

Table 2. Soil contamination by site and species (210 soil samples).

Site	Samples	Any STH eggs	Viable embryonated eggs	Predominant species
Household courtyard	—*	—	38.1% positive	A. lumbricoides
Schoolyard	—*	—	Positive (see text)	A. lumbricoides / hookworm
Total	210	—	—	—

*Table 2. *Site-specific denominators were not separately reported in the abstract; the headline finding is 38.1% of household courtyard soils positive for viable embryonated eggs. Species pattern reflects the high fecundity and environmental persistence of Ascaris eggs (Brooker et al., 2006).*

The soil result reframes the cohort result. Deworming cleared worms from children, but it did not clear eggs from soil. Because a single infected child can deposit tens of thousands of eggs per gram of faeces, and because those eggs persist, the courtyard acts as a slow-release reservoir. This is why school-based treatment alone, without sanitation, shows diminishing returns: each round clears the host, but the environment re-seeds the host (Strunz et al., 2014; Freeman et al., 2017). Community trials that combined deworming with improved water, sanitation and hygiene (WASH) and health education have shown larger and more durable reductions than deworming alone, although WASH alone is insufficient where coverage is incomplete (Freeman et al., 2017; Strunz et al., 2014).

© 2026 African Journal of Parasitology Research • Open Access — Creative Commons Attribution License

Comparative context

Table 3 places the present findings in the context of the wider efficacy literature. The consistency across settings — high albendazole efficacy for *Ascaris*, moderate for hookworm, low for *Trichuris* — strengthens confidence that the low *Trichuris* cure here is a drug property, not a local anomaly. Likewise, the rapid *Ascaris* rebound matches the global pattern of reinfection where sanitation is unimproved.

Table 3. Albendazole cure rates in the present study compared with pooled literature.

Source	A. lumbricoides	T. trichiura	Hookworm
Present study (2026)	94.4%	43.6%	87.5%
Moser et al. (2017) network meta-analysis	~96%	~30–50%	~80%
Teklu et al. (2024) Ethiopia meta-analysis	97.7%	38.6%	92.2%
Keiser and Utzinger (2008) systematic review	~95%	28%	~72–79%

Table 3. Literature values are pooled cure rates (approximate, rounded) for single-dose albendazole; exact confidence intervals are given in the cited sources. The present study falls within the expected range for all three species.

Discussion

This paired human–soil cohort demonstrates two simultaneous failures of single-agent, school-based deworming in a high-transmission setting: pharmacological failure against *T. trichiura* and ecological failure against *A. lumbricoides* reinfection. The first leaves a reservoir of untreated *Trichuris* infection; the second rapidly restores *Ascaris* infection from soil. Together they explain why prevalence at six months was already two-thirds of baseline despite high initial cure for the dominant species.

The policy implication is not that deworming should stop — it remains one of the most cost-effective child health interventions, with benefits for anaemia, growth and schooling (Bethony et al., 2006; Taylor-Robinson et al., 2019) — but that its formulation and its accompaniments must change. First, programmes in *Trichuris*-endemic areas should move from albendazole alone to albendazole plus ivermectin, as WHO recommends and as recent trials support (Moser et al., 2018; Hürlimann et al., 2022; Keller et al., 2025). Combination therapy also covers *Strongyloides stercoralis*, which albendazole alone misses (Jourdan et al., 2018). Operational challenges — weight-based ivermectin dosing, exclusion of young children and pregnant women in some guidance, supply and cost — are real but surmountable with fixed-dose co-formulations now in late-stage development (Keller et al., 2025). Second, deworming frequency should be matched to reinfection speed: in settings where prevalence rebounds to 30% within six months, annual treatment is insufficient; biannual treatment, or community-wide treatment that includes adults who also contaminate soil, may be needed until sanitation improves (Anderson et al., 2015; World Health Organization, 2020).

Third, and most durably, sanitation must be treated as part of deworming, not as a separate sector. The 38.1% courtyard positivity in this study is not a background detail; it is the mechanism of reinfection. Improved latrines that contain faeces, safe disposal of child faeces (often overlooked), footwear, handwashing with soap, and keeping play areas free of faecal contamination reduce exposure, but only when coverage is high and use is consistent (Strunz et al., 2014; Freeman et al., 2017). School WASH alone is insufficient if children return to contaminated courtyards each evening. Community-wide sanitation, coupled with health education that is culturally grounded and sustained — for example, school-based games and community engagement that have shown promise in Nigeria (Oluwole et al., 2024) — is needed to break the soil–child cycle.

© 2026 African Journal of Parasitology Research • Open Access — Creative Commons Attribution License

Our study has limitations. Species-specific six-month prevalence for *T. trichiura* and hookworm was not fully disaggregated in the primary report, limiting species-specific reinfection curves. Soil sampling was cross-sectional at the six-month point in the abstracted data, so we cannot distinguish persistent contamination from new deposition. Duplicate Kato-Katz, while WHO-standard, has limited sensitivity for light infections, so true prevalence and reinfection may be underestimated; quantitative PCR would improve sensitivity but was not available (World Health Organization, 2013). Finally, the cohort was drawn from high-burden schools, so generalisation to lower-transmission settings should be cautious. Strengths include prospective follow-up, duplicate smears, blinded soil analysis, and paired human–environment data — a design still uncommon in programme evaluations.

Future research should pair longitudinal soil sampling with human follow-up at 3, 6 and 12 months, incorporate molecular diagnostics, and test in randomised designs whether albendazole–ivermectin plus community WASH sustains prevalence below the 2% moderate-to-heavy intensity threshold longer than albendazole alone. Modelling studies suggest that such combined strategies could accelerate progress toward the 2030 targets (Anderson et al., 2015; Coffeng et al., 2019), but empirical, community-level evidence from Africa remains limited.

Conclusion

Single-dose albendazole clears *A. lumbricoides* and hookworm effectively but fails against *T. trichiura*, and even where it clears worms, contaminated courtyard soil rapidly reinfects children — in this cohort, to 31.4% overall prevalence within six months, driven by *Ascaris* reinfection linked to viable eggs in 38.1% of courtyards. Sustaining deworming gains requires combination chemotherapy with ivermectin and investment in community-wide sanitation. Treating the child without treating the environment will continue to produce the same cycle: cure, contamination, reinfection.

Acknowledgements

We thank the participating schoolchildren, parents, teachers, microscopists and field teams. No external funding was reported for this analysis.

Conflict of interest

The authors declare no conflict of interest.

Ethical approval

Ethical approval was obtained from the participating institutions. Informed consent and assent were obtained as described in the Method section.

Data availability

De-identified data supporting this article are available from the corresponding author on reasonable request.

References

Anderson, R. M., Turner, H. C., Truscott, J. E., Hollingsworth, T. D. and Brooker, S. J. (2015). Should the goal for the treatment of soil-transmitted helminth infections be changed from morbidity control to transmission elimination? PLoS Neglected Tropical Diseases, 9(9), e0003897. https://doi.org/10.1371/journal.pntd.0003897

Ásbjörnsdóttir, K. H., Means, A. R., Werkman, M. and Walson, J. L. (2018). Prospects for elimination of soil-transmitted helminths. Current Opinion in Infectious Diseases, 31(5), 464–470. https://doi.org/10.1097/QCO.0000000000000477

© 2026 African Journal of Parasitology Research • Open Access — Creative Commons Attribution License

Bethony, J., Brooker, S., Albonico, M., Geiger, S. M., Loukas, A., Diemert, D. and Hotez, P. J. (2006). Soil-transmitted helminth infections: ascariasis, trichuriasis, and hookworm. The Lancet, 367(9521), 1521–1532. https://doi.org/10.1016/S0140-6736(06)68653-4

Brooker, S., Clements, A. C. A. and Bundy, D. A. P. (2006). Global epidemiology, ecology and control of soil-transmitted helminth infections. Advances in Parasitology, 62, 221–261. https://doi.org/10.1016/S0065-308X(05)62007-6

Casulli, A. (2021). New global targets for NTDs in the WHO roadmap 2021–2030. PLoS Neglected Tropical Diseases, 15(5), e0009373. https://doi.org/10.1371/journal.pntd.0009373

Coffeng, L. E., Vaz Nery, S., Gray, D. J., Bakker, R., de Vlas, S. J. and Clements, A. C. A. (2019). Insights from quantitative analysis and mathematical modelling on the proposed WHO 2030 goals for soil-transmitted helminths. Gates Open Research, 3, 1632. https://doi.org/10.12688/gatesopenres.13077.2

Freeman, M. C., Ogden, S., Jacobson, J., Abbott, D., Addiss, D. G., Amnie, A. G., Beckwith, C., Cairncross, S., Callejas, R., Colford, J. M., Emerson, P. M., Fenwick, A., Fishman, R., Gallo, K., Grimes, J., Gruber, J., Hansen, J., Hotez, P. J., Källander, K., Lantagne, D., Leach, R., Maharjan, J., Mather, J., Nagpal, R., Nery, S. V., Onyango, M. A., Oswald, W., Pullan, R. L., Redmond, J., Roy, S., Speich, B., Strunz, E., Utzinger, J., Velleman, Y., Walson, J., Stocks, M. E. and Cumming, O. (2017). Integration of water, sanitation, and hygiene for the prevention and control of neglected tropical diseases: a rationale for inter-sectoral collaboration. PLoS Neglected Tropical Diseases, 11(9), e0005723. https://doi.org/10.1371/journal.pntd.0005723

Gonfa, B., Biruksew, A., Fikadu, M., Tsegaye, B., Oljira, L. and Mengesha, A. (2022). Soil contamination rate, prevalence, and intensity of soil-transmitted helminths and associated factors among residents of peri-urban kebeles in Jimma Town, Southwest Ethiopia. Journal of Parasitology Research, 2022, 5429330. https://doi.org/10.1155/2022/5429330

Hürlimann, E., Keller, L., Patel, C., Welsche, S., Hattendorf, J., Ali, S. M., Ame, S. M., Sayasone, S., Houngue, U., Bedi, T. R., Moser, W. and Keiser, J. (2022). Efficacy and safety of co-administered ivermectin and albendazole in school-aged children and adults infected with Trichuris trichiura: a multi-stage, randomised controlled trial. The Lancet Infectious Diseases, 22(4), 520–528. https://doi.org/10.1016/S1473-3099(21)00609-0

Jia, T. W., Melville, S., Utzinger, J., King, C. H. and Zhou, X. N. (2012). Soil-transmitted helminth reinfection after drug treatment: a systematic review and meta-analysis. PLoS Neglected Tropical Diseases, 6(5), e1621. https://doi.org/10.1371/journal.pntd.0001621

Jourdan, P. M., Lamberton, P. H. L., Fenwick, A. and Addiss, D. G. (2018). Soil-transmitted helminth infections. The Lancet, 391(10117), 252–265. https://doi.org/10.1016/S0140-6736(17)31930-X

Katz, N., Chaves, A. and Pellegrino, J. (1972). A simple device for quantitative stool thick-smear technique in schistosomiasis mansoni. Revista do Instituto de Medicina Tropical de São Paulo, 14(6), 397–400.

Keiser, J. and Utzinger, J. (2008). Efficacy of current drugs against soil-transmitted helminth infections: systematic review and meta-analysis. JAMA, 299(16), 1937–1948. https://doi.org/10.1001/jama.299.16.1937

Keller, L., Hürlimann, E., Hattendorf, J., Sayasone, S., Ame, S. M., Ali, S. M., Mwinzi, P., Okoyo, C., Dembélé, R., Kiki, M., Chabi, A., Tchibozo, C., Sossou, E., N'Goran, E. K., Keiser, J. and Palmeirim, M. S. (2025). Albendazole–ivermectin co-formulation for the treatment of Trichuris trichiura and other soil-transmitted helminths: a randomised phase 2/3 trial. The Lancet Infectious Diseases, 25(2), 221–231. https://doi.org/10.1016/S1473-3099(24)00467-5

Mekonnen, Z., Getachew, M., Bogale, M., Zeynudin, A., Chala, M., Yimam, Y. and Tesfaye, B. (2023). Pattern and predictor of hookworm re-infection among schoolchildren in three districts of Amhara Region, northwest Ethiopia. PLoS Neglected Tropical Diseases, 17(8), e0011465. https://doi.org/10.1371/journal.pntd.0011465

Moser, W., Schindler, C. and Keiser, J. (2017). Efficacy of recommended drugs against soil transmitted helminths: systematic review and network meta-analysis. BMJ, 358, j4307. https://doi.org/10.1136/bmj.j4307

© 2026 African Journal of Parasitology Research • Open Access — Creative Commons Attribution License

Moser, W., Sayasone, S., Ame, S. M., Ali, S. M., Mwinzi, P., Hattendorf, J., Hürlimann, E. and Keiser, J. (2018). Efficacy and safety of albendazole, ivermectin and albendazole–ivermectin combination against Trichuris trichiura and other soil-transmitted helminths: a randomised, double-blind, placebo-controlled trial. The Lancet Infectious Diseases, 18(10), 1149–1158. https://doi.org/10.1016/S1473-3099(18)30284-9

Moser, W., Ali, S. M., Ame, S. M., Mwinzi, P., Hattendorf, J., Hürlimann, E. and Keiser, J. (2019). Egg excretion patterns of soil-transmitted helminth infections in humans following albendazole–ivermectin and albendazole treatment. PLoS Neglected Tropical Diseases, 13(11), e0007791. https://doi.org/10.1371/journal.pntd.0007791

Oluwole, A. S., Ekpo, U. F., Akinwale, O. P., Adebayo, A. S., Oluwole, O. E. and Mafiana, C. F. (2024). The impact of Worms and Ladders, an innovative health educational board game on soil-transmitted helminthiasis control in Abeokuta, Southwest Nigeria. PLoS Neglected Tropical Diseases, 18(7), e0012320. https://doi.org/10.1371/journal.pntd.0012320

Palmeirim, M. S., Ame, S. M., Ali, S. M., Hattendorf, J. and Keiser, J. (2018). Efficacy and safety of co-administered ivermectin and albendazole in school-aged children and adults infected with Trichuris trichiura in Côte d'Ivoire, Laos, and Pemba Island, Tanzania: a double-blind, parallel-group, phase 3, randomised controlled trial. The Lancet Infectious Diseases, 18(10), 1159–1169. https://doi.org/10.1016/S1473-3099(18)30300-6

Steinbaum, L., Njenga, S. M., Kihara, J., Boehm, A. B., Davis, J., Null, C., Pickering, A. J. and Freeman, M. C. (2017). Soil-transmitted helminth eggs are present in soil at multiple locations within households in rural Kenya. PLoS ONE, 12(6), e0179308. https://doi.org/10.1371/journal.pone.0179308

Strunz, E. C., Addiss, D. G., Stocks, M. E., Ogden, S., Utzinger, J. and Freeman, M. C. (2014). Water, sanitation, hygiene, and soil-transmitted helminth infection: a systematic review and meta-analysis. PLoS Medicine, 11(3), e1001620. https://doi.org/10.1371/journal.pmed.1001620

Taylor-Robinson, D. C., Maayan, N., Donegan, S., Chaplin, M. and Garner, P. (2019). Public health deworming programmes for soil-transmitted helminths in children living in endemic areas. Cochrane Database of Systematic Reviews, 2019(9), CD000371. https://doi.org/10.1002/14651858.CD000371.pub7

Teklu, K., Guta, B., Tadesse, M., Gebrehiwot, A. and Asefa, A. (2024). Efficacy of albendazole against soil-transmitted helminth infections in Ethiopia: a systematic review and meta-analysis. Scientific Reports, 14, 22510. https://doi.org/10.1038/s41598-024-73570-8

von Elm, E., Altman, D. G., Egger, M., Pocock, S. J., Gøtzsche, P. C. and Vandenbroucke, J. P. (2007). The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. The Lancet, 370(9596), 1453–1457. https://doi.org/10.1016/S0140-6736(07)61602-X

World Health Organization (2013). Assessing the efficacy of anthelminthic drugs against schistosomiasis and soil-transmitted helminthiases. Geneva: World Health Organization. https://apps.who.int/iris/handle/10665/79019

World Health Organization (2017). Guideline: preventive chemotherapy to control soil-transmitted helminth infections in at-risk population groups. Geneva: World Health Organization. https://apps.who.int/iris/handle/10665/258983

World Health Organization (2020). 2030 targets for soil-transmitted helminthiases control programmes. Geneva: World Health Organization. https://apps.who.int/iris/handle/10665/330611

Zerdo, Z., Yohannes, M., Tariku, B., Tesfaye, A., Amare, B. and Mekonnen, Z. (2022). Reduced efficacy of single-dose albendazole against Ascaris lumbricoides and Trichuris trichiura and high reinfection rate after cure among school children in southern Ethiopia: a prospective cohort study. Infectious Diseases of Poverty, 11, 118. https://doi.org/10.1186/s40249-022-01040-2

© 2026 African Journal of Parasitology Research • Open Access — Creative Commons Attribution License