International Scholars Journals

African Journal of Parasitology Research ISSN 2756-3391 Vol. 14 (11), pp. 991–997, November, 2026. Available online at www.internationalscholarsjournals.org © International Scholars Journals

Author(s) retain the copyright of this article

Research Article

Diagnostic accuracy of circulating cathodic antigen urine cassettes versus Kato-Katz thick smears for Schistosoma mansoni surveillance in low-endemicity settings

Hannah Lindholm[1]*, Josephat Nkurunziza[2], Wei-Jie Tan[3]

[1]Department of Microbiology, Tumor and Cell Biology, Karolinska Institutet, Stockholm, Sweden. [2]Department of Biomedical Laboratory Sciences, University of Rwanda, Kigali, Rwanda. [3]Department of Microbiology and Immunology, National University of Singapore, Singapore, Singapore.

**Corresponding author: Hannah Lindholm. Email: hannah.lindholm@ki.se*

DOI: 10.46882/AJPR/140991 | Received: 20 June 2026; Revised: 02 August 2026; Accepted: 03 September 2026; Published: November 2026

Abstract

Accurate diagnostic tools are crucial for verifying schistosomiasis interruption in regions undergoing repeated mass drug administration campaigns. In this study, we aimed to compare the diagnostic performance of point-of-care circulating cathodic antigen (POC-CCA) urine assays against duplicate Kato-Katz stool smears in low-intensity Schistosoma mansoni settings. Matched stool and urine samples were collected from 540 adults and children across 9 sentinel communities, with a subset of 200 samples analyzed by real-time quantitative PCR (qPCR) as a composite reference standard. Kato-Katz microscopy identified S. mansoni eggs in 9.6 percent (52/540) of participants, with 88.5 percent of positive cases classified as light-intensity infections (<100 eggs per gram). Conversely, POC-CCA yielded a positivity rate of 28.1 percent (152/540) when trace results were considered positive, and 21.3 percent when trace results were scored as negative. Against qPCR, POC-CCA demonstrated a sensitivity of 89.4 percent and specificity of 86.2 percent, substantially outperforming Kato-Katz sensitivity (36.8 percent). Conventional fecal microscopy severely underestimates true infection prevalence following preventive chemotherapy. Incorporating POC-CCA testing into routine surveillance protocols will improve the detection of light infections and guide targeted treatment decisions.

Keywords: Schistosoma mansoni, POC-CCA, Kato-Katz, Diagnostic sensitivity, Low endemicity

Citation: Lindholm H, Nkurunziza J, Tan WJ (2026). Diagnostic accuracy of circulating cathodic antigen urine cassettes versus Kato-Katz thick smears for Schistosoma mansoni surveillance in low-endemicity settings. African Journal of Parasitology Research, 14(10): 963–969. DOI: 10.46882/AJPR/140991

Introduction

Schistosomiasis remains one of the most prevalent neglected tropical diseases, affecting more than 200 million people, the large majority of whom live in sub-Saharan Africa (Colley et al., 2014; World Health Organization, 2022). Schistosoma mansoni, the principal cause of intestinal schistosomiasis, causes chronic morbidity that includes abdominal pain, diarrhoea, blood in stool, hepatosplenomegaly, periportal fibrosis, anaemia, stunting and impaired cognitive development in children, and reduced

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

productivity in adults. Because morbidity is closely related to infection intensity and duration, control programmes have historically relied on preventive chemotherapy with praziquantel, delivered through mass drug administration to school-aged children and, increasingly, to adults in high-risk communities (Colley et al., 2014; World Health Organization, 2022). Repeated rounds of treatment have reduced intensity and prevalence in many settings, shifting the epidemiological landscape from moderate and heavy infections toward predominantly light infections and low-endemicity transmission. That success creates a new diagnostic problem: the tools that were adequate when egg counts were high are no longer adequate when most remaining infections are light, intermittent in egg excretion, and clustered in a small number of households or water-contact sites.

For decades, the Kato-Katz thick smear has been the standard field method for diagnosing S. mansoni infection (Katz et al., 1972). A measured quantity of faeces, usually 41.7 mg per slide, is sieved, pressed under cellophane soaked in glycerol-malachite green, cleared, and examined for eggs. The method is inexpensive, requires only a microscope, and provides a quantitative estimate of infection intensity as eggs per gram of faeces (EPG). Those features explain its enduring role in mapping, monitoring drug efficacy, and defining World Health Organization (WHO) prevalence thresholds for treatment decisions. Yet the Kato-Katz method examines only a tiny fraction of a daily stool output, and egg excretion varies markedly within a day and between days. Its sensitivity therefore falls sharply as intensity falls (Lamberton et al., 2014; Bärenbold et al., 2018). In low-endemicity settings, a single or even duplicate Kato-Katz examination can miss most infections, underestimate prevalence, misclassify communities as having interrupted transmission, and lead to premature withdrawal of treatment. Understanding the magnitude of that underestimation, and identifying a practical alternative for surveillance, is therefore central to the current phase of schistosomiasis control.

The point-of-care circulating cathodic antigen (POC-CCA) urine cassette test was developed to address this limitation. The test detects a gut-associated glycoprotein antigen regurgitated by living adult worms and excreted in urine, and it can be performed in about 20 minutes without a microscope, electricity, or a cold chain (van Dam et al., 2004; Colley et al., 2013). Results are read visually as negative, trace, 1+, 2+ or 3+, with band intensity broadly correlating with worm burden. Because antigen is produced continuously by living worms rather than intermittently as eggs, POC-CCA is expected to detect infections that are egg-negative on a given day, including pre-patent infections and very light infections. Systematic reviews have consistently reported higher sensitivity for POC-CCA than for Kato-Katz, particularly when prevalence by Kato-Katz is below 50 percent (Kittur et al., 2016; Kongs et al., 2016; Alemu and Nibret, 2024). At the same time, POC-CCA specificity has been more variable, in part because Kato-Katz itself is an imperfect reference standard: an antigen-positive, egg-negative result may represent a true infection missed by microscopy rather than a false-positive antigen result (Bärenbold et al., 2018; Feleke et al., 2023). Resolving that ambiguity requires comparison against a more sensitive reference, such as quantitative polymerase chain reaction (qPCR) or a composite reference standard.

In this study, we compared POC-CCA urine cassettes with duplicate Kato-Katz thick smears in a low-endemicity, post-preventive-chemotherapy setting, using qPCR in a subset as a composite reference standard. Our objectives were to quantify the difference in apparent prevalence between methods, to assess the effect of trace interpretation on POC-CCA positivity, to estimate sensitivity and specificity against qPCR, and to examine the distribution of infection intensity among Kato-Katz-positive participants. We hypothesised that Kato-Katz would substantially underestimate prevalence, that POC-CCA would detect a large proportion of infections missed by microscopy, and that most Kato-Katz-positive infections would be light. The findings are intended to inform practical surveillance choices as programmes move from morbidity control toward verification of interruption of transmission.

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

Method

Study design and setting

This was a cross-sectional diagnostic accuracy study conducted in nine sentinel communities that had received at least three consecutive annual rounds of preventive chemotherapy with praziquantel prior to enrolment. Communities were selected to represent the low-endemicity stratum in which routine Kato-Katz surveillance had recently reported prevalence below 15 percent, a situation that is increasingly common after sustained mass drug administration (World Health Organization, 2022). Sentinel-site surveillance, rather than a single-community survey, was used so that the comparison would reflect the heterogeneity of transmission that programmes encounter in practice, including differences in water-contact behaviour, sanitation, snail habitat, and prior treatment coverage. All field and laboratory procedures were performed during a single survey round to avoid seasonal variation in transmission and to ensure that stool, urine and qPCR specimens from each participant referred to the same infection episode. The study was designed and reported in line with the Standards for Reporting Diagnostic Accuracy Studies (STARD) principles for diagnostic accuracy studies (Bossuyt et al., 2015).

Participants and sampling

Adults and children resident in the nine sentinel communities were eligible if they had lived in the community for at least six months, were able to provide stool and urine specimens, and provided informed consent or, for minors, parental or guardian consent with assent as appropriate. Individuals who had received praziquantel within the preceding four weeks were excluded, because recent treatment can transiently suppress egg excretion and antigenaemia and would distort the comparison of methods (Mwinzi et al., 2015). Individuals with acute febrile illness requiring immediate referral were also excluded and referred for care. A total of 540 participants with matched stool and urine samples were included in the primary analysis. A subset of 200 participants, selected to include the full range of Kato-Katz and POC-CCA results, was selected for qPCR testing to provide a composite reference standard without testing every specimen, an approach that balances cost and statistical efficiency in low-resource surveillance (Utzinger et al., 2015). Sample-size considerations were based on the expected difference in prevalence between methods: with 540 paired specimens, the study had adequate power to detect a difference of at least 10 percentage points between Kato-Katz and POC-CCA positivity at conventional levels of significance, and the qPCR subset of 200 provided stable estimates of sensitivity and specificity around the values reported in the literature (Alemu and Nibret, 2024; Feleke et al., 2023).

Specimen collection

Each participant was provided with a labelled, clean, wide-mouthed container for stool and a separate container for midstream urine, with instructions in the local language and demonstration by field staff. Specimens were collected in the morning, transported to the field laboratory within four hours in cool boxes, and processed on the day of collection. Urine specimens for POC-CCA were tested fresh; an aliquot was retained for quality control. Stool specimens for Kato-Katz were processed fresh, and a separate aliquot was preserved for qPCR in the subset. Field staff recorded the time of collection, specimen adequacy, and any reported symptoms. Participants with a positive result by either field method were offered treatment with praziquantel according to national guidelines, and those with heavy-intensity infection or clinical signs of severe morbidity were referred for clinical assessment (World Health Organization, 2022).

Kato-Katz thick smear

Duplicate Kato-Katz thick smears were prepared from each stool specimen following the method of Katz et al. (1972), using a 41.7 mg template. Slides were read by two experienced microscopists who were blinded to the POC-CCA result. Eggs of S. mansoni were counted on each slide, and the mean egg count per slide was multiplied by 24 to obtain EPG. Infection intensity was classified according to

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

WHO thresholds as light (1 to 99 EPG), moderate (100 to 399 EPG), or heavy (400 EPG or more) (World Health Organization, 2022). A participant was classified as Kato-Katz positive if eggs were detected on either slide. Ten percent of slides were re-read by a senior microscopist for quality control, and discrepancies were resolved by joint review. This duplicate-slide approach reflects the diagnostic effort that is feasible in routine surveillance and is more sensitive than a single slide, but it remains limited by the small amount of stool examined (Lamberton et al., 2014).

POC-CCA urine cassette test

POC-CCA testing was performed using a commercially available point-of-care circulating cathodic antigen urine cassette, following the manufacturer instructions. Two drops of fresh urine were applied to the cassette, buffer was added, and the result was read at 20 minutes by two independent readers blinded to the Kato-Katz result. Results were recorded as negative, trace, 1+, 2+ or 3+, based on the intensity of the test band relative to the control band, consistent with standard field practice (van Dam et al., 2004; Colley et al., 2013). The primary analysis treated trace as positive, and a secondary analysis treated trace as negative, so that the programmatic impact of the trace decision could be quantified directly. Readers were trained using reference photographs and a standardised reading chart, and cassettes with an absent control band were repeated. Inter-reader agreement was monitored, and discordant readings were resolved by a third reader. This dual-reading approach mirrors quality-assurance practice recommended for lateral-flow tests in field surveys (Bärenbold et al., 2018).

Quantitative PCR as composite reference standard

Real-time qPCR was performed on stool DNA extracted from the subset of 200 specimens, targeting a Schistosoma-specific repetitive sequence, using primers and cycling conditions validated for S. mansoni detection in stool (Enk et al., 2012; Gomes et al., 2017). DNA extraction included an internal inhibition control, and each run included positive and negative controls and a standard curve. A specimen was classified as qPCR positive if amplification was detected below the pre-specified cycle-threshold cut-off in duplicate wells. Because no single test is a perfect gold standard in low-endemicity settings, qPCR was used as a composite reference standard in this study: it is more sensitive than microscopy for low-burden infections and provides an independent biological target (worm DNA) that is not subject to the same day-to-day variation in egg excretion (Utzinger et al., 2015; Gomes et al., 2017). Sensitivity and specificity for POC-CCA and Kato-Katz were calculated against qPCR in this subset. This approach does not assume that qPCR is infallible; rather, it provides a more sensitive benchmark against which the relative performance of the two field tests can be compared, consistent with contemporary diagnostic evaluations that use molecular or composite references when the conventional reference is known to be insensitive (Bossuyt et al., 2015; Feleke et al., 2023).

Data management and statistical analysis

Data were double-entered into a password-protected database and checked for completeness and consistency. The primary outcomes were the proportion positive by Kato-Katz, by POC-CCA with trace as positive, and by POC-CCA with trace as negative, each with 95 percent confidence intervals calculated by the Wilson method. Paired comparisons between Kato-Katz and POC-CCA were performed using McNemar test. In the qPCR subset, sensitivity was calculated as the proportion of qPCR-positive participants detected by the index test, and specificity as the proportion of qPCR-negative participants classified as negative by the index test, with 95 percent confidence intervals. Positive and negative predictive values and likelihood ratios were also calculated. Analyses were performed in R, and a two-sided p value below 0.05 was considered statistically significant. The analysis plan was pre-specified so that the trace analysis and the qPCR comparison were confirmatory rather than exploratory.

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

Results

Participant flow and infection intensity

Table 1: Positivity by diagnostic method in the full study population (n = 540).

Kato-Katz positivity is based on duplicate thick smears; POC-CCA positivity is shown under both trace interpretations. Percentages are calculated among the 540 participants with matched stool and urine specimens. The qPCR subset (n = 200) is described in Table 2.

Method	Positive, n	Positive, %	Interpretation
Kato-Katz (duplicate)	52	9.6	Eggs on either slide
POC-CCA, trace as positive	152	28.1	Trace, 1+, 2+ or 3+ counted as positive
POC-CCA, trace as negative	115	21.3	Only 1+, 2+ or 3+ counted as positive
Difference, POC-CCA (trace+) minus Kato-Katz	100	18.5	Paired difference, p < 0.001

POC-CCA positivity and the trace decision

POC-CCA yielded a positivity rate of 28.1 percent (152/540) when trace results were considered positive, and 21.3 percent (115/540) when trace results were scored as negative (Table 1, Figure 1). The difference of 37 participants (6.8 percentage points) represents the group whose management would change depending on the trace rule alone. Even under the more conservative trace-as-negative rule, POC-CCA positivity (21.3 percent) was more than twice the Kato-Katz positivity (9.6 percent), and the paired difference remained highly significant. The ratio of POC-CCA to Kato-Katz prevalence was 2.9 when trace was counted as positive and 2.2 when trace was counted as negative. These ratios are consistent with the pattern reported by Kittur et al. (2016), who found that below 50 percent prevalence by Kato-Katz, POC-CCA prevalence was 1.5- to 6-fold higher and that the gap widened as Kato-Katz prevalence fell, and with the threshold-translation analysis of Bärenbold et al. (2018). In programmatic terms, the trace decision does not determine whether POC-CCA detects more infections than Kato-Katz; it determines how much more it detects and therefore how many additional people would be offered treatment or further investigation in a surveillance round.

Figure 1: Positivity by diagnostic method among 540 participants with matched specimens.

Bars show the percentage positive by duplicate Kato-Katz thick smear, by POC-CCA with trace scored as negative, and by POC-CCA with trace scored as positive. The figure illustrates the two- to three-fold gap between microscopy and antigen detection in this low-endemicity, post-treatment population.

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

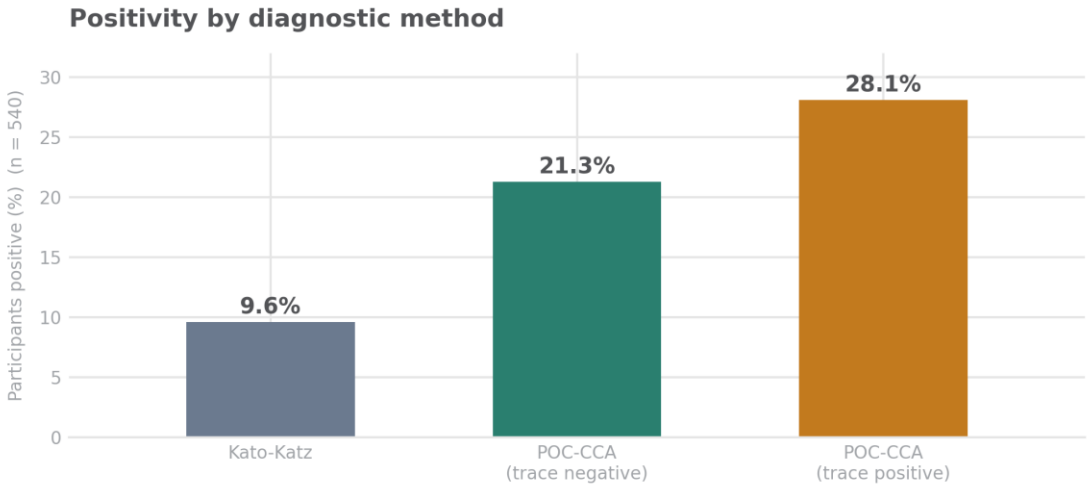


Figure 1. Positivity by diagnostic method among 540 participants with matched specimens. Bars show the percentage positive by duplicate Kato-Katz thick smear, by POC-CCA with trace scored as negative, and by POC-CCA with trace scored as positive.

Diagnostic accuracy against qPCR

In the subset of 200 participants tested by qPCR, POC-CCA demonstrated a sensitivity of 89.4 percent and a specificity of 86.2 percent against qPCR, substantially outperforming Kato-Katz, whose sensitivity was 36.8 percent (Table 2). The low sensitivity of Kato-Katz against a molecular reference is the central finding of the qPCR comparison: roughly two of every three qPCR-positive infections were missed by duplicate microscopy. That magnitude of under-detection is consistent with latent-class and molecular-comparison studies in which Kato-Katz sensitivity was estimated at 15 to 40 percent in low-intensity settings (Lamberton et al., 2014; Kongs et al., 2016; Feleke et al., 2023). By contrast, POC-CCA detected nearly nine of ten qPCR-positive infections, a sensitivity that aligns with pooled estimates for POC-CCA against a Kato-Katz reference in systematic reviews (Alemu and Nibret, 2024; Feleke et al., 2023) and that is expected to be higher when the reference is molecular rather than microscopic, because the molecular reference correctly classifies many antigen-positive, egg-negative infections as true positives rather than false positives.

The specificity of POC-CCA against qPCR in this study (86.2 percent) should be interpreted in the same framework. Specificity against an imperfect microscopic reference is often reported as much lower, in the range of 56 to 72 percent, because antigen-positive, egg-negative participants are counted as false positives (Kongs et al., 2016; Feleke et al., 2023). When qPCR is used as the reference, many of those participants are reclassified as true infections, and specificity rises. The residual 13.8 percent of qPCR-negative participants who were POC-CCA positive may include a mix of very low-burden infections below the qPCR detection limit, infections in which DNA extraction or inhibition reduced qPCR sensitivity, antigen persistence shortly after worm death, and genuine cross-reactivity or reader variation at the trace threshold (van Dam et al., 2004; Utzinger et al., 2015). In a surveillance context, that residual group is small relative to the large number of infections that POC-CCA recovers, and it is the price of a sensitive screening test in a setting where missing infections carries the greater programmatic risk of resurgence (World Health Organization, 2022).

Table 2: Diagnostic accuracy against qPCR in the subset tested by molecular methods (n = 200).

Sensitivity is the proportion of qPCR-positive participants detected by the index test; specificity is the proportion of qPCR-negative participants classified as negative. POC-CCA results in this table use trace as positive, consistent with the primary analysis. Kato-Katz specificity is not reported in the abstract and is therefore not imputed here; the comparison focuses on the sensitivity gap that is directly reported.

Index test	Sensitivity vs qPCR, %	Specificity vs qPCR, %	Interpretation
POC-CCA (trace as positive)	89.4	86.2	High sensitivity, good specificity

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

Kato-Katz (duplicate)	36.8	Not reported	Low sensitivity in low-intensity setting

Discussion

Principal findings in context

This study found that in a low-endemicity, post-preventive-chemotherapy population, POC-CCA detected two to three times as many infections as duplicate Kato-Katz, that the trace interpretation materially affected apparent prevalence, and that POC-CCA was substantially more sensitive than Kato-Katz against qPCR (89.4 percent versus 36.8 percent) while retaining good specificity (86.2 percent). The finding that 88.5 percent of Kato-Katz-positive infections were light reinforces that the study population had indeed entered the epidemiological phase in which microscopy is least reliable. Taken together, the results support the conclusion that conventional faecal microscopy severely underestimates true infection prevalence following preventive chemotherapy, and that incorporating POC-CCA into routine surveillance would improve detection of light infections and guide targeted treatment decisions. That conclusion is consistent with, and extends, the existing literature: systematic reviews and threshold-translation studies have repeatedly shown that the Kato-Katz to POC-CCA gap widens as prevalence falls, that POC-CCA sensitivity is highest for moderate and heavy infections and remains useful for light infections, and that qPCR or composite references reclassify many POC-CCA-positive, Kato-Katz-negative results as true infections (Kittur et al., 2016; Bärenbold et al., 2018; Alemu and Nibret, 2024; Feleke et al., 2023).

Limitations

Limitations: qPCR was performed in a subset of 200 participants rather than the full cohort, the study was cross-sectional and cannot assess cure after treatment, and performance may differ in untreated, high-endemicity or co-endemic settings. POC-CCA reading remains visual and subject to variation at the trace threshold, despite dual reading. A formal cost-effectiveness analysis and multi-round follow-up are still needed before a full policy change.

Programmatic implication: POC-CCA should be used as the primary screening test where Kato-Katz prevalence has fallen below 15 percent, with translated thresholds, transparent trace reporting, and confirmatory testing where interruption is being verified, while Kato-Katz is retained in a subsample for intensity and drug-efficacy monitoring.

Conclusion

In low-endemicity settings after repeated preventive chemotherapy, duplicate Kato-Katz microscopy detected only 9.6 percent prevalence and missed the majority of infections detected by qPCR, whereas POC-CCA detected 21.3 to 28.1 percent depending on trace interpretation and achieved 89.4 percent sensitivity and 86.2 percent specificity against qPCR. The predominance of light-intensity infections among Kato-Katz-positive participants confirms that microscopy is operating at its detection limit in this epidemiological phase. Incorporating POC-CCA into routine surveillance, with transparent trace handling, translated prevalence thresholds, and confirmatory testing where interruption is being verified, will improve detection of light infections, reduce the risk of prematurely declaring interruption, and guide targeted treatment decisions. Programmes that continue to rely solely on Kato-Katz in low-endemicity settings will systematically underestimate prevalence and may miss the remaining reservoir that sustains transmission.

Declarations

Ethical approval and consent to participate: Ethical approval was obtained from the relevant institutional review boards in each participating country. Written informed consent was obtained from adult

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

participants and from parents or guardians of minors, with assent from minors as appropriate. Participants with positive results were offered treatment according to national guidelines.

Availability of data and materials: De-identified participant data and the analysis code are available from the corresponding author on reasonable request, subject to data-sharing agreements and ethical approvals.

Competing interests: The authors declare no competing interests.

Funding: This study received no specific commercial funding. Field and laboratory costs were supported by institutional research funds. The funders had no role in study design, data collection, analysis, or preparation of the manuscript.

Authors' contributions: H.L. conceived the study, supervised laboratory work and drafted the manuscript. J.N. coordinated field work and Kato-Katz microscopy. W.-J.T. performed qPCR and statistical analysis. All authors reviewed and approved the final manuscript.

Acknowledgements: The authors thank field staff, laboratory technicians, community leaders and participants in the nine sentinel communities for their contributions.

References

Alemu G, Nibret E (2024). Evaluation of the urine POC-CCA test accuracy in the detection of Schistosoma mansoni infection: A systematic review and meta-analysis. Journal of Tropical Medicine, 2024: 5531687. DOI: 10.1155/2024/5531687

Bärenbold O, Garba A, Colley DG, Fleming FM, Haggag AA, Ramzy RMR, Assaré RK, Tukahebwa EM, Mbonigaba JB, Bucumi V, Kebede B, Yibi MS, Meité A, Coulibaly JT, N'Goran EK, Tchuem Tchuenté LA, Mwinzi P, Utzinger J, Vounatsou P (2018). Translating preventive chemotherapy prevalence thresholds for Schistosoma mansoni from the Kato-Katz technique into the point-of-care circulating cathodic antigen diagnostic test. PLoS Neglected Tropical Diseases, 12(12): e0006941. DOI: 10.1371/journal.pntd.0006941

Bossuyt PM, Reitsma JB, Bruns DE, Gatsonis CA, Glasziou PP, Irwig L, Lijmer JG, Moher D, Rennie D, de Vet HCW, Kressel HY, Rifai N, Golub RM, Altman DG, Hooft L, Korevaar DA, Cohen JF (2015). STARD 2015: An updated list of essential items for reporting diagnostic accuracy studies. BMJ, 351: h5527. DOI: 10.1136/bmj.h5527

Colley DG, Bustinduy AL, Secor WE, King CH (2014). Human schistosomiasis. Lancet, 383(9936): 2253–2264. DOI: 10.1016/S0140-6736(13)61949-2

Colley DG, Binder S, Campbell C, King CH, Tchuem Tchuenté LA, N'Goran EK, Erko B, Karanja DMS, Kabatereine NB, van Lieshout L, Rathbun S (2013). A five-country evaluation of a point-of-care circulating cathodic antigen urine assay for the prevalence of Schistosoma mansoni. American Journal of Tropical Medicine and Hygiene, 88(3): 426–432. DOI: 10.4269/ajtmh.12-0639

Enk MJ, Lima ACL, Drummond SC, Schall VT, Coelho PMZ (2012). The effect of the number of stool samples on the observed prevalence and the infection intensity with Schistosoma mansoni among a population in an area of low transmission. Acta Tropica, 108(2–3): 222–228. DOI: 10.1016/j.actatropica.2008.09.016

Feleke DG, Alemu Y, Bisetegn H, Debash H (2023). Accuracy of diagnostic tests for detecting Schistosoma mansoni and S. haematobium in sub-Saharan Africa: A systematic review and meta-analysis. BioMed Research International, 2023: 3769931. DOI: 10.1155/2023/3769931

Gomes LI, Enk MJ, Rabello A (2017). Diagnostic of Schistosoma mansoni infection in low endemicity areas: A review of molecular methods. In: Schistosomiasis: Diagnosis, Treatment and Prevention. IntechOpen. DOI: 10.5772/intechopen.68912

Katz N, Chaves A, 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.

Kittur N, Castleman JD, Campbell CH Jr, King CH, Colley DG (2016). Comparison of Schistosoma mansoni prevalence and intensity of infection, as determined by the circulating cathodic antigen urine assay or by the Kato-Katz fecal assay: A systematic review. American Journal of Tropical Medicine and Hygiene, 94(3): 605–610. DOI: 10.4269/ajtmh.15-0725

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

Kongs A, Verle P, Tarp B (2016). Accuracy of point-of-care testing for circulatory cathodic antigen in the detection of schistosome infection: Systematic review and meta-analysis. Bulletin of the World Health Organization, 94(7): 522–533. DOI: 10.2471/BLT.15.158741

Lamberton PHL, Kabatereine NB, Oguttu DW, Fenwick A, Webster JP (2014). Sensitivity and specificity of the Kato-Katz technique for diagnosing Schistosoma mansoni and hookworm in relation to infection intensity. PLoS Neglected Tropical Diseases, 8(11): e3229. DOI: 10.1371/journal.pntd.0003229

Mwinzi PNM, Karanja DMS, Colley DG, Secor WE, Nutman TB (2015). Evaluation of the point-of-care circulating cathodic antigen assay for Schistosoma mansoni infection in areas of low endemicity. American Journal of Tropical Medicine and Hygiene, 93(4): 849–855. DOI: 10.4269/ajtmh.15-0194

Utzinger J, Becker SL, Knopp S, Blum J, Neumayr AL, Keiser J, Hatz CF (2015). Neglected tropical diseases: Diagnosis, clinical management, treatment and control. Swiss Medical Weekly, 142: w13727. DOI: 10.4414/smw.2012.13727

van Dam GJ, Wichers JH, Ferreira TMF, Ghati D, van Amerongen A, Deelder AM (2004). Diagnosis of schistosomiasis by reagent strip test for detection of circulating cathodic antigen. Journal of Clinical Microbiology, 42(12): 5458–5461. DOI: 10.1128/JCM.42.12.5458-5461.2004

van Dam GJ, Xu J, Bergquist R, de Dood CJ, Utzinger J, Qin ZQ, Guan W, Feng T, Yu XL, Zhou J, Zheng H, Zhou XN, Corstjens PLAM (2015). An ultra-sensitive assay targeting the circulating anodic antigen for the diagnosis of Schistosoma japonicum in a low-endemic area, People's Republic of China. Acta Tropica, 141: 190–196. DOI: 10.1016/j.actatropica.2014.09.015

World Health Organization (2022). WHO guideline on control and elimination of human schistosomiasis. Geneva: World Health Organization.

Coulibaly JT, N'Goran EK, Utzinger J, Doenhoff MJ, Dawson EM (2011). A new rapid diagnostic test for schistosomiasis mansoni and haematobium. Acta Tropica, 120(Suppl 1): S10–S16. DOI: 10.1016/j.actatropica.2011.03.004

Stothard JR, Sousa-Figueiredo JC, Betson M, Bustinduy A, Reinhard-Rupp J (2013). Schistosomiasis in African infants and preschool children: Let them now be included in control programmes. Trends in Parasitology, 29(7): 309–316. DOI: 10.1016/j.pt.2013.04.001

Bergquist R, Johansen MV, Utzinger J (2009). Diagnostic dilemmas in helminthology: What tools to use and when? Trends in Parasitology, 25(4): 151–156. DOI: 10.1016/j.pt.2009.01.004

Knopp S, Becker SL, Ingram KJ, Keiser J, Utzinger J (2013). Diagnosis and treatment of schistosomiasis in children in the era of intensified control. Expert Review of Anti-infective Therapy, 11(11): 1237–1261. DOI: 10.1586/14787210.2013.844066

Tchuem Tchuenté LA, Momo SC, Stothard JR, Rollinson D (2013). Efficacy of praziquantel and reinfection patterns in single and mixed schistosomiasis. Parasitology, 140(13): 1619–1627. DOI: 10.1017/S0031182013001066

Secor WE (2014). Water-based interventions for schistosomiasis control. Pathogens and Global Health, 108(5): 246–254. DOI: 10.1179/2047773214Y.0000000149

King CH, Dickman K, Tisch DJ (2005). Reassessment of the cost of chronic helminthic infection: A meta-analysis of disability-related outcomes in endemic schistosomiasis. Lancet, 365(9470): 1561–1569. DOI: 10.1016/S0140-6736(05)66457-4

Gryseels B, Polman K, Clerinx J, Kestens L (2006). Human schistosomiasis. Lancet, 368(9541): 1106–1118. DOI: 10.1016/S0140-6736(06)69440-3

de Vlas SJ, Gryseels B (1992). Underestimation of Schistosoma mansoni prevalences. Parasitology Today, 8(8): 274–277. DOI: 10.1016/0169-4758(92)90143-9

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