

Fever-negative malaria parasitaemia and anaemia among children in Burkina Faso: a cross-sectional analysis linking microscopy and caregiver reports in the 2021 Demographic and Health Survey

Amos Langat

amos.langat@aku.edu

Aga Khan University Nairobi

Research Article

Keywords: malaria, microscopy, fever, anaemia, household survey, Burkina Faso, child health

Posted Date: October 12th, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-11182903/v1>

License:   This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Additional Declarations: No competing interests reported.

Fever-negative malaria parasitaemia and anaemia among children in Burkina Faso: a cross-sectional analysis linking microscopy and caregiver reports in the 2021 Demographic and Health Survey

Amos Kipkorir Langat
Centre of Excellence in Women and Child Health
Aga Khan University, Nairobi, Kenya
Correspondence: amos.langat@aku.edu

Abstract

Background: Symptom-triggered care may not identify all children with malaria parasitaemia. We estimated the share of microscopy-positive children without caregiver-reported recent fever and described their anaemia burden in Burkina Faso. **Methods:** We linked the 2021 Burkina Faso Demographic and Health Survey child and household-member recodes by cluster, household and child line number. Eligible children were living, aged 6–59 months, usual residents present at interview, and had both microscopy and caregiver fever data. Ambiguous child identifiers were excluded. We estimated survey-weighted percentages and 95% percentile confidence intervals from 399 primary-sampling-unit bootstrap replicates sampled within strata. Anaemia was classified using the DHS haemoglobin-based category. Associations are descriptive. **Results:** Among 5,063 linked children, 637 were microscopy positive and 426 of these had no reported fever in the preceding two weeks. Weighted microscopy positivity was 13.4% (95% CI 12.2–14.9). Among microscopy-positive children, 66.1% (61.8–71.0) had no recent fever reported. Positivity was 11.9% (10.6–13.5) among those without fever and 17.8% (15.1–20.5) among those with fever. In the fever-negative group with available anaemia results, anaemia affected 78.2% (74.0–83.0) of microscopy-positive children and 68.2% (66.1–70.2) of microscopy-negative children: an unadjusted difference of 9.9 percentage points (5.0–14.8). **Conclusions:** Reliance on reported recent fever alone would fail to flag many children with microscopy-detectable parasitaemia in this household survey. No reported fever does not establish an asymptomatic infection; temporal mismatch, recent treatment, other symptoms and confounding limit interpretation. Targeted investigation of parasitaemia and anaemia is warranted, without inferring that universal community screening improves outcomes.

Keywords: malaria; microscopy; fever; anaemia; household survey; Burkina Faso; child health.

1 Background

Malaria remains a major cause of childhood illness across sub-Saharan Africa, and Burkina Faso continues to bear a substantial burden despite progress in prevention, diagnostics and treatment [1, 2, 16]. The 2021 Burkina Faso Demographic and Health Survey (DHS) offers two types of information that often come from different systems: reports of a child’s recent fever and parasitological measurements collected at a household visit [6, 7]. Bringing these measurements together may clarify what a service strategy centred on reported fever can observe, as well as what remains outside

that symptom-defined group. The distinction matters for interpreting passive surveillance, designing follow-up studies and identifying children who may have unmet health needs [5, 18].

Previous Burkina Faso surveys also documented unequal access to fever-related care, which underscores how a facility-based symptom denominator can differ from a household denominator [10, 11].

Clinical management appropriately aims for prompt malaria testing when the disease is suspected. World Health Organization guidance recommends parasitological confirmation with a rapid diagnostic test (RDT) or microscopy for suspected cases before treatment, subject to clinical urgency [3, 4]. A household survey answers a different question. Children selected for its biomarker component may be tested whether or not their caregivers report recent fever or sought health care. The resulting cross-section can describe the overlap of symptoms and detectable parasites but cannot estimate the number of clinically missed cases, since it does not observe the full course of each child's illness or their assessment at a facility.

Parasitaemia and fever have different time scales. Microscopically detectable parasites are assessed at the time a blood sample is collected, while the DHS asks whether a caregiver recalls fever during the preceding two weeks. A child with a positive smear and no reported fever could have a recent infection without fever, have other symptoms, develop fever subsequently, or remain well; malaria might also coexist with illness caused by something else. Therefore, a negative fever history does not establish a clinically asymptomatic infection. Likewise, a positive RDT and negative smear cannot be labelled a false-positive clinical diagnosis without further information, because antigens can persist after parasite clearance and the assays have different detection limits [13, 23, 24].

Interest in parasite carriage beyond routine fever presentation has grown as prevention programmes expand. A 2025 systematic review describes substantial heterogeneity in apparently asymptomatic infections across African child populations and associations with anaemia, but study definitions and diagnostic methods vary [21]. Burkina Faso research in Nanoro has documented infections in households living under seasonal malaria chemoprevention (SMC) programmes, including infections that differ by diagnostic method [22, 26]. A separate 2026 Burkina Faso study focused on school-aged children rather than a national sample of children younger than five [9, 9]. These studies motivate careful measurement of fever history and parasitaemia in the same children, without treating the populations or disease definitions as interchangeable.

Anaemia provides an additional dimension of child health, although its relationship with malaria is difficult to isolate in a cross-sectional household survey. Parasite-associated red-cell destruction and inflammatory processes are possible mechanisms, but nutritional deficiencies, other infections, inherited conditions and social disadvantage can also lower haemoglobin [12, 12]. The DHS provides an age-adjusted haemoglobin-based anaemia category, allowing a descriptive comparison between children with and without a positive smear. Neither a higher anaemia prevalence in the infected group nor its confidence interval establishes malaria-attributable disease. A stronger test of mechanisms would require longitudinal infection history and information on competing causes.

Burkina Faso's malaria landscape is also changing. Seasonal chemoprevention, bed nets and newer vaccines may influence prevalence over time, and their effects can vary by location, age and season [17, 20, 27, 28, 29]. The 2021 survey captures one period in this changing context. It should neither be interpreted as a present-day prevalence estimate nor used to attribute observed infection patterns to a specific intervention. More recent analyses of national and regional malaria trends reinforce the need to distinguish survey timing and denominators when making comparisons [30, 25].

A recent article using the same 2021 DHS estimated malaria prevalence and associated socioeconomic

and health-care factors in the full microscopy-tested child population [8]. Our study asks a separate, symptom-defined question within children whose interviewed mother’s child record can be linked unambiguously to the laboratory record. Our primary aim is to estimate the weighted proportion of microscopy-positive children aged 6–59 months whose caregivers reported no fever during the previous two weeks. Secondary aims are to compare microscopy positivity in fever-defined groups, describe anaemia in the four fever-by-smear categories, report age, wealth and regional patterns, and tabulate paired RDT and microscopy results. The investigation is descriptive; no causal effect, treatment policy or clinical screening recommendation is identified from these data [14, 19].

2 Methods

2.1 Design, survey population and permissions

This is a cross-sectional secondary analysis of the Burkina Faso 2021 DHS child recode (KR) and household-member recode (PR). The DHS used a stratified two-stage household sample, and a biomarker subsample supplied malaria and haemoglobin measurements [6, 7]. Only living children aged 6–59 completed months at interview were eligible for the current analysis. We required a household member recorded as a usual resident and present the preceding night, a valid microscopy result, and an unambiguous binary caregiver response for fever in the preceding two weeks. DHS microdata access requires authorisation; the distributed source package contains code and aggregate outputs only. The design and results are reported according to STROBE principles [14].

2.2 Deterministic record linkage and exclusions

Caregiver fever history and laboratory results reside in different recodes. We used cluster number, household number and child’s household line number as the composite key: `v001/hv001`, `v002=hv002` and `b16=hvidx`, respectively. For clarity, the actual merge fields are `(v001,v002,b16)` on KR and `(hv001,hv002,hvidx)` on PR. Child line numbers of zero or missing were invalid. We excluded all 14 KR records belonging to seven positive-line identifiers that recurred across child records in the same cluster and household; selecting an arbitrary caregiver report for such records would risk misassigning a laboratory result. We then verified that the remaining KR key joined PR as one-to-one. Table 1 gives counts after each restriction, including linked records, residence/presence, valid microscopy and fever history. The final group is narrower than the full PR microscopy cohort and is interpreted accordingly [8].

2.3 Variables and pre-specified comparisons

The microscopy result was positive for `hm132=1` and negative for `hm132=0`. Fever history was positive for `h22=1` and negative for `h22=0`; unknown or missing responses were excluded. Fever history concerns the preceding 14 days and is not a concurrent temperature measurement. The primary quantity is *no reported recent fever among smear-positive children*; we avoid labelling it an asymptomatic-malaria prevalence. The RDT comparison used `hm135=0/1` among children with both tests. RDT and smear were presented as paired observations, without designating microscopy as an infallible infection reference standard [23, 24].

We used the DHS haemoglobin-derived `hc57` categories to define any anaemia (codes 1–3) and moderate or severe anaemia (codes 1–2), with code 4 indicating no anaemia. Each anaemia statistic

excludes missing hc57; we did not retroactively recalculate categories using 2024 WHO cutoffs, which postdate the survey’s recode definitions [12]. Child age was grouped as 6–11, 12–23, 24–35, 36–47 and 48–59 months. Household wealth was classified by the survey’s quintiles and geographical summaries used its 13 DHS regions. These groups describe heterogeneity but were not treated as independent risk-factor effects.

2.4 Estimands, weights and uncertainty

The weight for child i was the PR household weight $w_i = \text{hv005}_i/10^6$. For binary response Y_i in a specified domain D_i , the weighted ratio estimator was

$$\hat{p}_{Y|D} = \frac{\sum_{i=1}^n w_i D_i Y_i}{\sum_{i=1}^n w_i D_i}. \quad (1)$$

Let M_i denote a positive smear, F_i reported fever, and A_i any anaemia. The primary estimand and the anaemia contrast among children without reported fever were, respectively,

$$\hat{\theta} = \frac{\sum_i w_i M_i (1 - F_i)}{\sum_i w_i M_i}, \quad \hat{\Delta} = 100 \left[\hat{p}_{A|M=1, F=0} - \hat{p}_{A|M=0, F=0} \right]. \quad (2)$$

The latter expression uses only children with an observed anaemia category. Thus, the two anaemia denominators differ from the denominator for $\hat{\theta}$. Numbers of records in each table are unweighted; percentages use the indicated domain weights. All contrasts are unadjusted descriptive differences in percentage points.

Uncertainty was computed with a stratified cluster bootstrap. Within each survey stratum (hv022) represented in the analytic sample, primary sampling units (hv021) were drawn with replacement, preserving the number of contributing PSUs in that stratum; each selected PSU’s records entered with its selection multiplicity. For $B = 399$ replicates, the displayed percentile interval was $[Q_{0.025}(\hat{p}^{(b)}), Q_{0.975}(\hat{p}^{(b)})]$. The same bootstrap was applied to the anaemia difference. This describes sampling variability conditional on the linked subset and cannot correct non-random non-linkage, non-response, misclassification or confounding. Estimates by age, wealth and region have no interval estimates in this version; the regional chart should not be interpreted as a statistically verified ordering. The finite bootstrap count limits percentile resolution. No hypothesis tests, multivariable risk model, geographic interpolation, malaria-attributable fever calculation or clinical sensitivity analysis was attempted [5, 18, 14].

2.5 Interpretation and study boundaries

Testing and interview occurred at survey contact, whereas caregiver fever recollection covers the previous fortnight. No longitudinal infection onset, contemporaneous symptom examination, parasite density, time since treatment or competing causes of anaemia were available in the analytic summary. Selection was limited to children with an interviewed mother’s link and observed biomarker and fever fields; weighting does not guarantee recovery of characteristics of excluded children. Insecurity and survey implementation may further influence inclusion. These features restrict the estimand to the measured, linked survey population, not to all currently infected children in Burkina Faso. An independent audit of linkage, the official survey weight guidance and ethical permissions is needed before submission [7, 19].

3 Results

3.1 Selection and linkage

Table 1 and Figure 1 show the sequential derivation of the linked cohort from 12,343 child-recode records. Of 10,592 living children aged 6–59 months, 10,205 had a valid household child line. Fourteen records with ambiguous duplicated identifiers were excluded, leaving 10,191 uniquely identified linked children. After restricting to usual residents present at interview, valid microscopy, and recorded fever history, the analysis included 5,063 children. The steep reduction at the microscopy stage reflects the biomarker subsample and eligibility for valid test results. Figure 1 presents record counts rather than a comparison of weighted prevalences.

Table 1: Linked study sample selection

Selection stage	Unweighted n
Child recode records	12343
Living children 6–59 months	10592
Valid child household line	10205
Unambiguous child identifier	10191
Linked to household member	10191
Usual resident and present	10079
Valid microscopy result	5068
Valid microscopy and fever history	5063

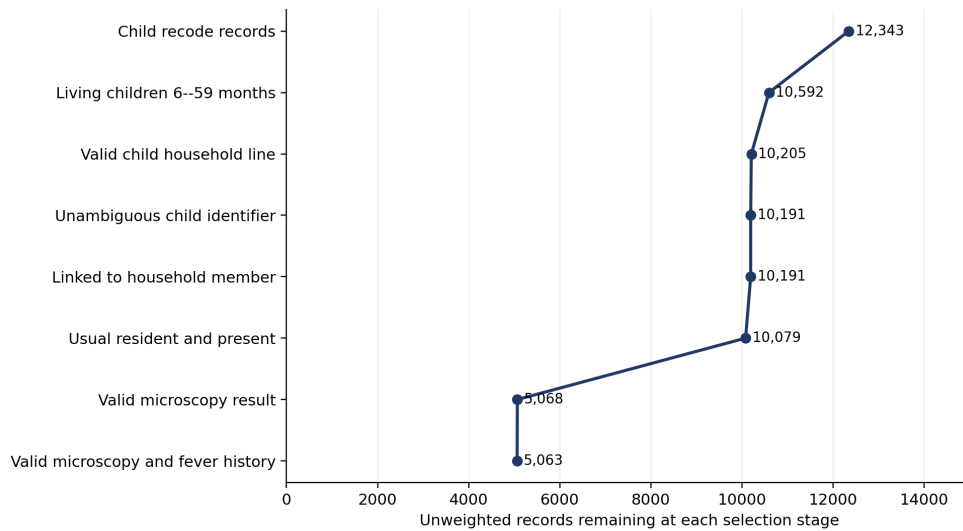


Figure 1: Linked sample flow, including restrictions for microscopy and fever history. The linked sample is smaller than the complete DHS biomarker cohort.

3.2 Fever history and microscopy

Of 5,063 linked eligible children, 637 were microscopy positive, of whom 426 had no caregiver-reported fever during the previous two weeks (Table 2). Weighted microscopy positivity was 13.4% (95% CI 12.2–14.9). Within microscopy-positive children, 66.1% (61.8–71.0) had no reported fever. Positivity was 11.9% (10.6–13.5) in children without fever and 17.8% (15.1–20.5) in those with fever (Figure 2). A hypothetical rule based only on recent reported fever would flag 33.9% (29.0–38.2) of smear-positive children in this linked household sample; it is a descriptive screening property, not an evaluated clinical triage strategy.

Table 2: Joint distribution of caregiver-reported fever and microscopy

Fever history	Microscopy	Unweighted n	Weighted sample %
No reported fever	Negative	3362	65.5
No reported fever	Positive	426	8.9
Reported fever	Negative	1064	21.0
Reported fever	Positive	211	4.6

Table 2 percentages sum to 100% over children with both measurements.

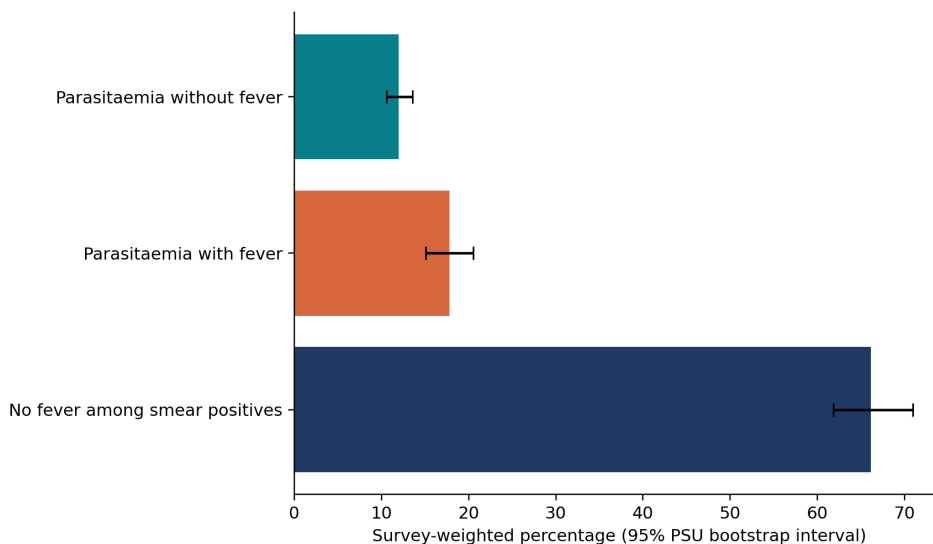


Figure 2: Reported fever and microscopy-positive malaria: weighted percentages with 95% stratified-PSU bootstrap intervals. Each bar has the denominator indicated by its label.

3.3 Age and household wealth

Table 3 reports microscopy positivity and the fever-negative share among smear-positive children in five age bands. Positivity was 7.1% at 6–11 months and 15.7% at 24–35 months; Figure 3 shows the full age pattern. As shown in Table 4 and Figure 4, microscopy positivity was 20.2% in the poorest

wealth quintile and 2.2% in the wealthiest. Both panels are descriptive; their denominators and precision differ, and no adjusted comparisons were fitted.

Table 3: Age-specific microscopy and fever-negative proportions

Age, months	Tested n	Positive n	Smear positive %	No fever among positive %
6–11	550	38	7.1	71.7
12–23	1158	116	11.1	60.2
24–35	1029	148	15.7	58.2
36–47	1270	178	14.9	71.7
48–59	1056	157	15.2	70.9

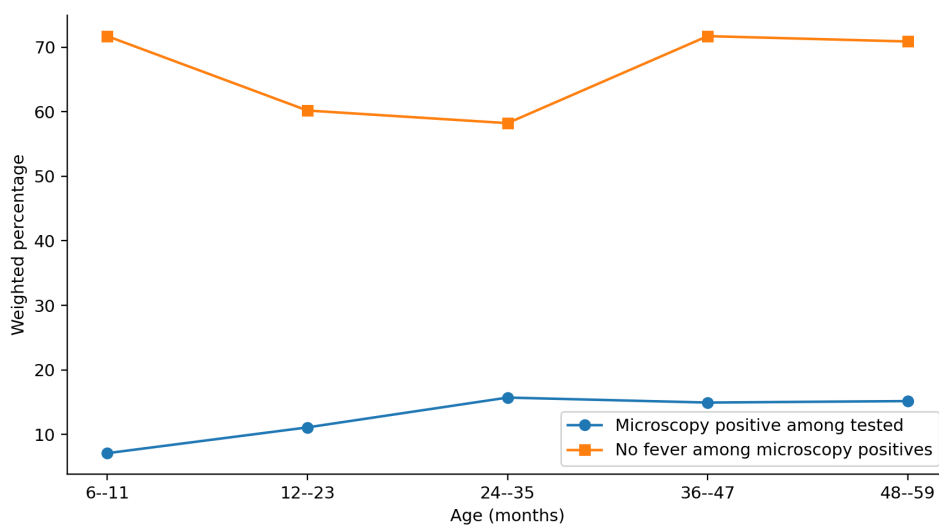


Figure 3: Age-specific microscopy positivity and no-fever proportion among smear-positive children. These two lines have different denominators; subgroup intervals are unavailable.

Table 4: Household wealth and malaria microscopy

Wealth quintile	Tested n	Positive n	Smear positive %	No fever among positive %
1.0	968	191	20.2	63.2
2.0	987	173	19.4	70.2
3.0	1171	148	12.8	69.3
4.0	1112	105	10.8	58.2
5.0	825	20	2.2	79.6

Quintile 1 denotes the poorest households; quintile 5 denotes the wealthiest.

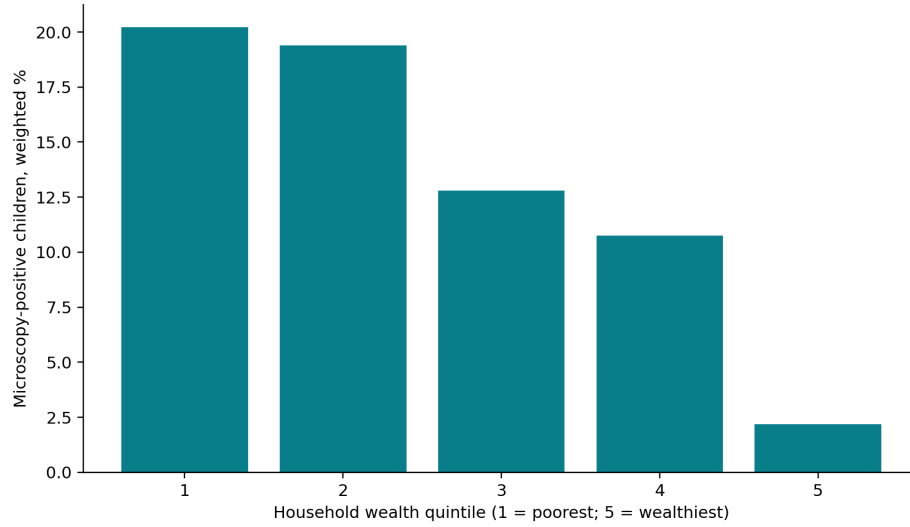


Figure 4: Microscopy positivity by household wealth quintile. Descriptive weighted estimates are shown without subgroup confidence intervals.

3.4 Regional distribution

Table 5 gives tested counts, microscopy-positive counts and weighted percentages across all 13 DHS regions. Sahel had an estimated 30.0% microscopy positivity among 195 linked tested children; Figure 5 displays the regional range. Because confidence intervals were not generated for every regional subgroup and linked sample sizes differ, these estimates should motivate closer investigation rather than a definitive regional ranking.

Table 5: Regional microscopy and fever-negative proportions

DHS region	Tested n	Positive n	Smear positive %	No fever among positive %
Boucle du Mouhoun	440	42	9.8	76.4
Nord	443	43	10.8	71.1
Plateau Central	402	81	20.6	55.7
Sahel	195	40	30.0	66.5
Sud-Ouest	401	39	12.6	62.2
Cascades	275	11	3.9	64.0
Centre	461	22	4.3	47.0
Centre Est	504	52	10.3	52.3
Centre Nord	370	39	11.9	71.0
Centre Ouest	468	111	26.3	64.0
Centre Sud	298	40	13.7	68.3
Est	311	84	27.5	76.3
Hauts-Bassins	495	33	6.5	77.0

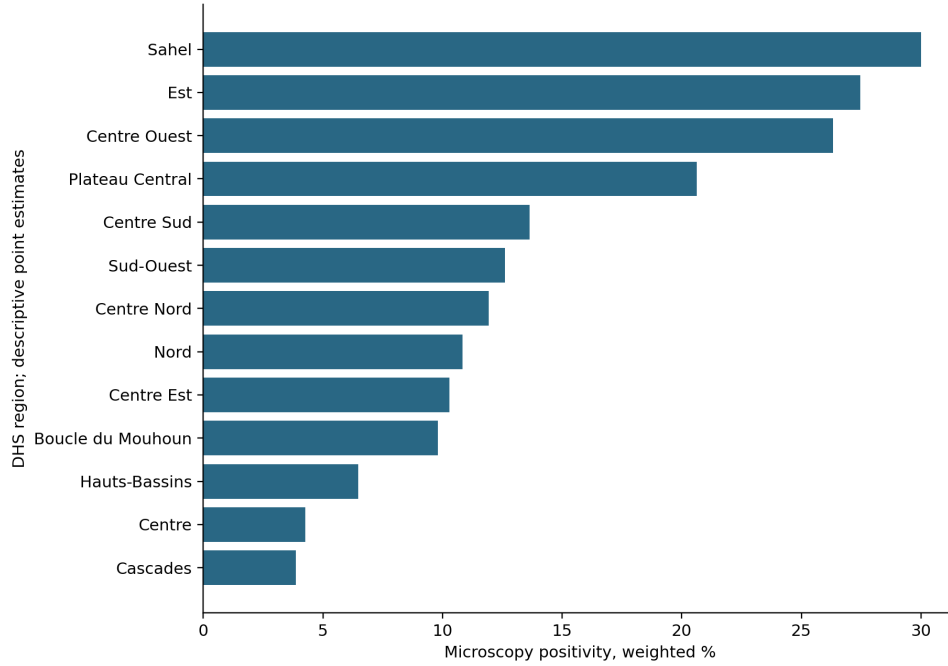


Figure 5: Microscopy positivity across DHS regions. Bars represent area-level estimates for the linked subsample, not the locations of individual children.

3.5 Anaemia and concordance of malaria assays

Among 5,056 children with haemoglobin categories, fever-negative smear-positive children had 78.2% (95% CI 74.0–83.0) any anaemia versus 68.2% (66.1–70.2) in fever-negative smear-negative children. The crude difference was 9.9 percentage points (5.0–14.8). Table 6 provides the four fever-by-smear groups; Figure 6 shows moderate/severe anaemia, which was 53.8% (48.3–58.7) and 38.1% (36.1–40.2), respectively, in those without reported fever. This is an unadjusted relationship and cannot attribute anaemia to malaria.

Table 6: Anaemia categories by fever history and microscopy

Fever (0=no)	Smear+ (1=yes)	Available n	Any anaemia %	Moderate/severe %
0.0	0.0	3355	68.2	38.1
0.0	1.0	426	78.2	53.8
1.0	0.0	1064	79.2	49.4
1.0	1.0	211	88.2	66.8

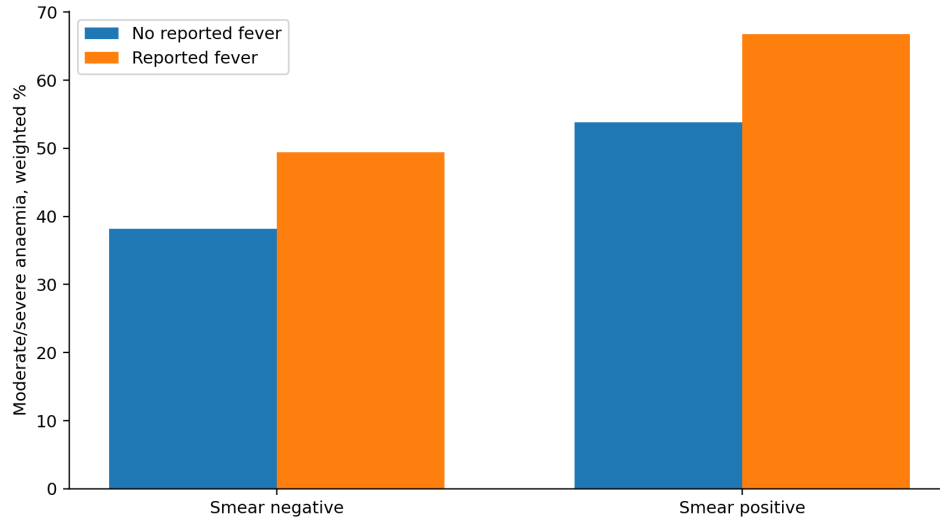


Figure 6: Moderate or severe anaemia by fever and smear result. Weighted descriptive values; no causal comparison is intended.

Table 7 compares the 5,053 paired smear and rapid-test results: 508 children were positive by both, 129 smear-positive/RDT-negative, and 849 smear-negative/RDT-positive. Figure 7 gives the unweighted 2×2 matrix. Test discordance is not proof of erroneous testing because antigen positivity and microscopically visible parasitaemia need not coincide.

Table 7: Paired malaria microscopy and rapid-test results

Microscopy	Rapid test	Unweighted n	Weighted % of paired tests
Negative	Negative	3567	69.9
Negative	Positive	849	16.6
Positive	Negative	129	2.6
Positive	Positive	508	10.8

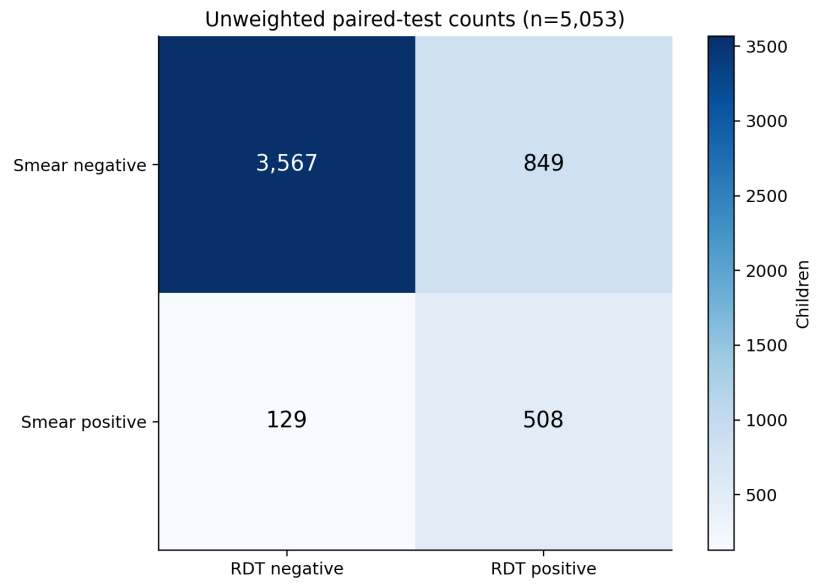


Figure 7: Unweighted RDT–microscopy agreement in children with both tests. Cell values are counts; weighted cell percentages appear in Table 7.

4 Discussion

The central finding is a difference in coverage between a caregiver-reported symptom and a laboratory measure: 66.1% of smear-positive linked children had no fever reported over the previous two weeks. Studies of parasite carriage in Burkina Faso and a recent review of African child populations show why measurements beyond routine symptomatic care merit consideration, although their populations, symptom definitions and diagnostic methods differ from this survey [22, 26, 9, 21]. A recent analysis of the same DHS estimated determinants of microscopy positivity in all tested children; our fever-defined question and narrower linked denominator should not be conflated with its full-cohort result [8].

The observed anaemia difference among fever-negative children warrants prospective study, but anaemia is multifactorial. More severe presentations and anaemia after malaria have been examined in other settings, and programmes combining chemoprevention with nutrition have been evaluated in Burkina Faso [12, 12, 28]. None supplies a causal interpretation of our cross-sectional 9.9-percentage-point contrast. The different biological targets of microscopy and RDT, imperfect detection at low parasite density and possible antigen persistence also make paired-test discordance unsurprising [13, 23, 24].

Burkina Faso’s control setting is evolving, including seasonal chemoprevention and vaccine delivery; these 2021 data cannot evaluate programmes introduced later [17, 20, 27, 29, 30]. Related research by Langat and colleagues spans malaria prevention in pregnancy, health-system constraints, vector-host modelling and a simulated diagnostic machine-learning framework [31, 32, 33, 34, 35]. Those publications provide methodological and health-system context only. The simulated diagnosis work has no clinical validation, and none of the five papers corroborates a Burkina Faso under-five effect estimated here.

Strengths include paired household-based laboratory and caregiver measures, one-to-one linked identifiers, a transparent sample flow, stratified cluster resampling and explicit symptom terminology. Limitations include recall and testing at different times, no assessment of all symptoms at testing, possible residual parasitaemia after an earlier fever, misclassified assay results, selection from maternal linkage and biomarker participation, confounding of anaemia comparisons, and missing subgroup intervals. We cannot infer infectivity, prevalence of truly asymptomatic infection, the number of clinical cases missed, or the effectiveness of community screening. Previous community-screening trials caution that detecting carriers and demonstrating population health benefit are different tasks [15, 19].

5 Conclusions

In the linked sample of children aged 6–59 months from Burkina Faso’s 2021 Demographic and Health Survey, approximately two thirds of children with microscopy-detectable malaria parasites had no caregiver-reported fever during the preceding two weeks. This is a clear difference between symptom history and a laboratory observation collected at a household visit. It should not be translated into a count of clinically missed malaria cases: the survey did not examine every symptom at blood collection, track the time course of infection, or observe each child’s clinical assessment. In particular, the absence of a fever report is not equivalent to an asymptomatic infection.

The additional anaemia findings indicate that fever-negative children with a positive smear may have other important health needs. Anaemia was common in both smear-positive and smear-negative

groups, and the higher prevalence among those with detected parasites was an unadjusted association. It cannot establish how much anaemia was caused by malaria, nor whether testing or treating children without fever would improve haemoglobin or other outcomes. Nutrition, other infections, inherited conditions and household circumstances require direct assessment in future work.

For practice and surveillance, the results support a specific question rather than an immediate change in case-management guidance: what infection and child-health burdens are absent from indicators that depend on a reported fever or a facility visit? Household-based parasite measures can complement clinical surveillance if their age range, sampling frame, assay and observation period are kept explicit. Decisions about screening outside current clinical recommendations would require prospective evidence on feasible targeting, clinical benefits, costs, acceptability and potential harms. The RDT–microscopy discordance reported here also cautions against assuming that either field assay fully represents an unobserved biological infection state.

The study’s strengths are its paired fever and microscopy measurements, documented deterministic linkage, explicit exclusions, survey weighting and cluster-aware uncertainty estimates. Its principal limitations are the timing mismatch between fever recall and blood testing, imperfect assay classification, confounding of the anaemia contrast, and restriction to a smaller maternal-linked sample than the complete DHS biomarker cohort. The regional and wealth summaries are useful descriptions but lack subgroup confidence intervals and cannot establish causes of inequality. These considerations should accompany any use of the study for programme planning or comparison with more recent malaria estimates.

An effective follow-up would also compare children included through the maternal link with all children eligible for DHS malaria testing, and examine whether the linked subset differs by age, household wealth, residence or region. Survey weights alone cannot repair differences that arise from ambiguous identifiers or absent caregiver interviews. Reporting that selection transparently would make the primary estimate easier to interpret and would help determine whether a subsequent nationally representative analysis requires a different linkage or weighting strategy. A pre-specified assessment of missingness and repeat testing would strengthen the evidence before any programmatic recommendation.

A prospective child cohort could clarify the public-health meaning of fever-negative parasitaemia by measuring symptoms and temperature at testing, repeating parasite and haemoglobin assessments, recording antimalarial treatment and examining competing causes of anaemia. It could then test whether a carefully defined response to parasitaemia in children without fever offers a measurable health benefit. Until those data are available, the defensible conclusion is descriptive: fever history alone provides an incomplete picture of microscopically detectable parasitaemia in this linked Burkina Faso survey sample.

List of abbreviations

DHS, Demographic and Health Survey; KR, child recode; PR, household member recode; PSU, primary sampling unit; RDT, rapid diagnostic test; WHO, World Health Organization.

Declarations

Ethics approval and consent to participate

The analysis used de-identified Demographic and Health Survey data accessed through The DHS Program. The survey's original approvals and participant consent are described in its final report.

Consent for publication

Not applicable. The manuscript reports no identifiable individual information.

Availability of data and materials

The child-level Demographic and Health Survey data are available from The DHS Program following registration and approval [7]; the author cannot redistribute these restricted records. The aggregate results are reported in this article. Analysis code is available from the corresponding author on reasonable request.

Competing interests

The author declares no competing interests.

Funding

Funding was received for this study from the BRIDGE NETWORK Project under EDCTP 3.

Authors' contributions

AKL is the sole listed author and is responsible for checking the dataset linkage, analysis, interpretation, reference accuracy and final manuscript before approving submission. submission.

Acknowledgements

Not applicable.

Authors' information

Not applicable.

References

References

- [1] World Health Organization. World malaria report 2025. Geneva: WHO, 2025. <https://www.who.int/teams/global-malaria-programme/reports/world-malaria-report-2025/>.
- [2] World Health Organization. Malaria 2025 Burkina Faso country profile. WHO, 2025. <https://www.who.int/publications/m/item/malaria-2025-burkina-faso-country-profile>.
- [3] World Health Organization. WHO guidelines for malaria, 13 August 2025. <https://www.who.int/publications/i/item/guidelines-for-malaria>.
- [4] World Health Organization. Malaria case management: diagnosis. <https://www.who.int/teams/global-malaria-programme/case-management/diagnosis>.
- [5] World Health Organization. Malaria surveillance, monitoring and evaluation: a reference manual. 2nd ed. 2025. <https://www.who.int/publications/i/item/9789240112476>.
- [6] Institut National de la Statistique et de la Démographie and ICF. Enquête Démographique et de Santé du Burkina Faso 2021. Final report. <https://dhsprogram.com/publications/publication-FR378-DHS-Final-Reports.cfm>.
- [7] Croft TN, Marshall AMJ, Allen CK, et al. Guide to DHS Statistics. ICF, 2018. <https://dhsprogram.com/Data/Guide-to-DHS-Statistics/>.
- [8] Kinda R, et al. Sociodemographic and healthcare determinants of malaria infection among children under five in Burkina Faso: analysis of the 2021 Demographic and Health Survey data. Malaria Journal. 2026. doi:10.1186/s12936-026-05832-0.
- [9] Tarama CW, et al. School-aged children as a silent reservoir of Plasmodium falciparum: findings from a cross-sectional survey conducted in Burkina Faso in 2022. Malaria Journal. 2026. doi:10.1186/s12936-026-05867-3.
- [10] Samadoulougou S, Negatou M, Ngawisiri C, et al. Effect of the free healthcare policy on socioeconomic inequalities in care seeking for fever in children under five years in Burkina Faso: a population-based surveys analysis. International Journal for Equity in Health. 2022;21:124. doi:10.1186/s12939-022-01732-2.
- [11] Kaboré JMT, et al. Attitudes, practices, and determinants of community care-seeking behaviours for fever/malaria episodes in the health district of Kaya, Burkina Faso. Malaria Journal. 2022. doi:10.1186/s12936-022-04180-z.
- [12] World Health Organization. Guideline on haemoglobin cutoffs to define anaemia in individuals and populations. WHO, 2024. <https://www.who.int/publications-detail-redirect/9789240088542>.
- [13] Dalrymple U, Arambepola R, Gething PW, Cameron E. How long do rapid diagnostic tests remain positive after anti-malarial treatment? Malaria Journal. 2018. <https://pubmed.ncbi.nlm.nih.gov/29884184/>.

- [14] von Elm E, Altman DG, Egger M, et al. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement. *PLoS Medicine*. 2007;4:e296. doi:10.1371/journal.pmed.0040296.
- [15] Tiono AB, et al. A controlled, parallel, cluster-randomized trial of community-wide screening and treatment of asymptomatic carriers of *Plasmodium falciparum* in Burkina Faso. *Malaria Journal*. 2013;12:79. doi:10.1186/1475-2875-12-79.
- [16] World Health Organization. World malaria report 2024. Geneva: WHO, 2024. <https://www.who.int/publications/i/item/9789240104440>.
- [17] WHO Regional Office for Africa. WHO biennial report 2024–2025 for Burkina Faso: health system resilience and access to essential services. 2026. [WHO report page](#).
- [18] World Health Organization. Core indicators for malaria surveillance, monitoring and evaluation. 2025. <https://www.who.int/publications/m/item/core-indicators-for-malaria-surveillance-monitoring-and-evaluation>.
- [19] World Health Organization. Malaria surveillance assessment toolkit: implementation reference guide. 2nd ed. 2026. <https://www.who.int/publications/i/item/9789240110977>.
- [20] World Health Organization. Life-saving malaria vaccines reach children in 17 endemic countries in 2024. 2024. <https://www.who.int/news-room/feature-stories/detail/life-saving-malaria-vaccines-reach-children-in-17-endemic-countries-in-2024>.
- [21] The burden of asymptomatic malaria infection in children in sub-Saharan Africa: a systematic review and meta-analysis exploring barriers to elimination and prevention. *Journal of Epidemiology and Global Health*. 2025. doi:10.1007/s44197-025-00365-2.
- [22] Prevalence of asymptomatic parasitaemia among household members of children under seasonal malaria chemoprevention coverage and comparison of standard with ultrasensitive rapid diagnostic tests in Nanoro, Burkina Faso. *Parasitology Research*. 2024. doi:10.1007/s00436-024-08380-1.
- [23] Field evaluation of the Bioline Malaria Ag P.f/Pan rapid diagnostic test: causes of microscopy discordance and performance in Uganda. 2025. <https://pubmed.ncbi.nlm.nih.gov/40312382/>.
- [24] Diagnostic accuracy of PfHRP2-based malaria rapid diagnostic tests and antigenemia persistence in Kenyan children from a holoendemic region: implications for case management and surveillance. *Experimental Biology and Medicine*. 2025. doi:10.3389/ebm.2025.10585.
- [25] A cohort study to identify risk factors for *Plasmodium falciparum* infection in Burkinabe children: implications for other high-burden countries. *Malaria Journal*. 2020. doi:10.1186/s12936-020-03443-x.
- [26] Patterns of patent and sub-patent *Plasmodium falciparum* infections in household members of children under seasonal malaria chemoprevention coverage in Nanoro, Burkina Faso. *Malaria Journal*. 2025;24:281. doi:10.1186/s12936-025-05453-z.
- [27] Trends in uncomplicated and severe malaria following seasonal malaria chemoprevention administration in Nouna, Burkina Faso: a quasi-experimental pre-post study. *Malaria Journal*. 2025;24:376. doi:10.1186/s12936-025-05597-y.

- [28] Enhanced effect of seasonal malaria chemoprevention when coupled with nutrient supplementation for preventing malaria in children under five in Burkina Faso: a randomized open-label trial. *Malaria Journal*. 2023. doi:10.1186/s12936-023-04745-6.
- [29] Seasonal vaccination with RTS,S/AS01E vaccine with or without seasonal malaria chemoprevention in children up to 5 years in Burkina Faso and Mali: a double-blind, randomised, controlled phase 3 trial. *The Lancet*. 2023. <https://pubmed.ncbi.nlm.nih.gov/37625434/>.
- [30] Yahoue G, Thiombiano A, Sewade W, et al. Two decades of malaria in Burkina Faso (2004–2024): national and regional trends and coverage of preventive interventions in children under five and pregnant women. *Malaria Journal*. 2026. doi:10.1186/s12936-026-06142-1.
- [31] Langat AK, Chepkonga D, Kamwele JM, et al. Malaria in pregnancy across sub-Saharan Africa: a scoping review of prevalence, risk factors, and preventive interventions. *International Journal of Infectious Diseases*. 2026. doi:10.1016/j.ijid.2026.108983.
- [32] Akilimali A, et al. (including Langat AK). Malaria in the Democratic Republic of Congo: how support programs consolidate elimination gains and protect at-risk populations from recrudescence. *Annals of Medicine and Surgery*. 2025. doi:10.1097/MS9.0000000000004085.
- [33] Akilimali A, et al. (including Langat AK). Time to act; let us unite to eliminate malaria among pregnant women in war zone from eastern Democratic Republic of the Congo: a review. 2026. <https://pubmed.ncbi.nlm.nih.gov/41948631/>.
- [34] Kulei W, Langat AK, Chepkonga D, Kamwele JM. Optimizing control measures for a vector-host epidemic model: a mathematical analysis. *Applied Mathematics on Science and Engineering*. 2025;2(1):57–82. doi:10.65036/amse215.
- [35] Chepkonga DK, Langat AK, Esenogho E, et al. Explainable AI for malaria diagnosis: comparative analysis of ML models using random forest feature selection and SHAP interpretability. *Asian Journal of Research in Computer Science*. 2026;19(8):172–193. doi:10.9734/ajrcos/2026/v19i8899.