

A Study Protocol for Facility Based Surveillance of Lymphatic Filariasis Integrated into Routine Malaria Diagnostic Services in Districts That Have Stopped Transmission Assessment Surveys

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Abstract

Lymphatic filariasis (LF) is a neglected tropical disease targeted by WHO for elimination as a public health problem by 2030. The main strategy involves Mass Drug Administration (MDA) of ivermectin and albendazole, to entire endemic communities for several years to interrupt transmission. After MDA ends, continued surveillance is essential to detect signal of resurgence and maintain gains. In 2024, a preliminary assessment in Gomoa West, Ghana, where MDA ceased in 2014, found low LF antigen prevalence in humans (0.4%) but mosquito infection rates above the WHO's 1% threshold. These findings require confirmation before any re-initiation of interventions. This project proposes a post validation surveillance (PVS), using facility-based surveillance (FBS), to assess LF transmission in post-validation settings in two Ghanaian districts that have stopped MDA and three rounds of Transmission Assessment Surveys (TAS). FBS will integrate LF and malaria testing at community level health facilities. Objectives include validating the FBS surveillance approach, confirming LF prevalence in Gomoa West and Komenda-Edina-Eguafo-Abrem (KEEA) Districts, evaluating feasibility, cost of FBS, stakeholder perspective of the approach and identifying implementation barriers and enablers. Data on human infection rates, and cost-effectiveness will be collected. Additionally, in-depth interviews with health workers and community members will explore perspectives on integrated surveillance. This study aims to provide actionable evidence for the National NTD program to guide post-validation surveillance. Integrating malaria and LF diagnosis is expected to improve testing efficiency and reduce costs, supporting sustainable LF elimination efforts in Ghana.

Introduction

Having targeted the elimination of lymphatic filariasis as a disease of public health problem, several endemic countries have been implementing mass drug administration (MDA) among at-risk populations to reduce community infection levels below the threshold required to sustain disease transmission [1]. Thus, with many years of MDA since the launch of the Global Programme to Eliminate Lymphatic Filariasis (GPELF), many countries have successfully been validated for elimination as public health problem, while others have stopped MDA in many endemic districts or implementation units. However, an important aspect in ensuring successful elimination and maintaining the gains achieved is the need for effective surveillance systems to detect recrudescence and institute measures to address any occurring challenges effectively.

There are existing reports of recrudescence of LF following the cessation of MDA from multiple nations [2–5]. In Ghana, numerous studies have examined the impact of MDA during active intervention periods, but there is relative paucity of data on transmission following cessation of MDA operations. WHO recommends ongoing surveillance in previously endemic areas to monitor signs of recrudescence and guide necessary interventions [6]. A preliminary study was therefore conducted in the Gomoa West District, where MDA has been stopped since 2014 following three successful rounds of transmission assessment surveys (TAS), to assess the prevalence of infection in human and mosquito populations [7]. The results showed that 2/524 (0.38%; 95% CI: 0.0% – 0.9%) individuals tested by Filariasis Test Strip

(FTS) positive for antigen. Five out of 107 *Anopheles gambiae* mosquitoes from one community were infected, an infection rate of 4.67% (95% CI: 2.2%, 8.5%). Three of these infected mosquitoes harbored the infective L3 stage of *Wuchereria bancrofti*, an infectivity rate of 2.80% (95% CI: 0.9%, 7.5%). Considering the total number of *An. gambiae* collected from all study communities (n = 337), the infection rate was 1.48% (95% CI: 0.8%, 2.9%), while the infectivity rate was 0.89% (95% CI: 0.5%, 2.3%). In total, 57 pools of mosquitoes (up to 20 mosquitoes per pool) were screened. Seven were found positive for *W. bancrofti*. The estimated maximum likelihood of infection for all *Anopheles* spp. was 1.6% (95% CI: 0.7%, 3.1%) while that of *An. gambiae* was 2.2% (95% CI: 1.0%, 4.3%) for all sites. However, infection was detected in two communities with infection rates for *An. gambiae* being 6.5% (95% CI: 3.3%, 12.7%) and 2.4% (95% CI: 0.2%, 13.3%) respectively. Despite the small sample sizes, the infection levels in tested mosquitoes exceeded the provisional thresholds of 1% established by WHO[6] in *Anopheles*-transmitted areas. However, this requires confirmation before re-initiating interventions in the district.

In this study, we propose a post validation surveillance (PVS) protocol based on surveillance in public health facilities to support NTD programmers' decisions while waiting for validation of LF elimination as a disease of public health concern. Facility-based surveillance (FBS) will integrate the diagnosis of LF and malaria. This is premised on the fact that both LF and malaria share vectors in Ghana and most parts of endemic Africa [8], and exposure to malaria which is a more severe problem in LF endemic countries is a potential exposure to LF. Due to case fatality rates of malaria, many patients in endemic areas report to health facilities for malaria testing and treatment, during which LF testing can be done simultaneously.

Integration of LF with malaria diagnosis as a FBS strategy is expected to yield several benefits. First, integrating LF surveys with malaria diagnosis in health facilities will reduce the financial and human resources needed for standalone population-based surveys. Secondly, it is anticipated that by integrating LF and malaria diagnosis, public intrusion and imposition (in terms of time required, parallel consent processes, and multiple specimen collections) will be reduced. Tertiarily, the FBS approach offers scope to address the sample size requirements necessary for PVS to achieve sufficient statistical power in settings of elimination where the prevalence of LF is very low. Finally, integration of LF and malaria diagnosis through facilities distributed over an evaluation unit, demographic and other environmental variables will enable geospatial predictions and identification of areas where control interventions must be focused.

Methodology

Study sites:

This study will be conducted in the Gomoa West and Komenda-Edina-Eguafo-Abrem (KEEA) districts in Ghana (Figure 1).

Gomoa West District was created in 2008, following the redistricting of the former Gomoa District into Gomoa East and West Districts. It is Health - Gomoa West District Assembly (gomoawda.gov.gh)

situated in the Central Region of Ghana. The district is subdivided into seven sub-districts with seven urban towns and area councils for local administration. The district covers a total land area of 458.5km². Apam, the district capital, is 68 km from Cape Coast, the regional capital and 69 km from Accra, the national capital.

Gomoa's total population is 129,512 according to the 2021 Population and Housing Census. The rural population is estimated at 76,540. About 20% of the population is under 5 years of age. The health facilities in the district consist of one Mission Hospital, one Polyclinic, six Health Centers, one Reproductive and Child Health Centre, and one Maternity Home, as well as 30 Community-Based Health Planning and Services (CHPS) zones. The CHPS are the lowest level of the health system, each serving 3 - 4 communities. The CHPS are manned by community health nurses (CHNs) who are trained to perform malaria RDT and provide basic health interventions [8].

Prior to redistricting, the Gomoa district had a baseline micro filarial (mf) prevalence ranging from 0 - 12% in study sentinel sites and an Immuno-Chromatographic Test (ICT) prevalence between 3.8 and 36%. The district received 12 rounds of MDA with ivermectin and albendazole with the most recent delivered in 2014. TAS3 in 2019 identified one positive case out of 1558 children surveyed using FTS (<https://espen.afro.who.int/maps-data/countries/ghana#lf--data>).

KEEA district is also situated along the coast in Central Region and last received MDA in 2014. Elmina, the district capital, is located 150 km from Accra, the capital of Ghana. The population of the district, according to the 2021 Population and Housing Census, was 166,017. The rural population is estimated to be 104,360. About 14% of the population is below the age of 5 years. The district covers a total area of 372.45 km² and is divided into six sub-districts or area councils for local administration. The district has 25 CHPS compounds.

Temperatures are generally high, and the variability in climate and vegetation is influenced more by rainfall than temperature. The region experiences a double maxima annual rainfall ranging between 750 mm and 1,000 mm along the coast and 1,200 mm and 1,500 mm in the interiors. The district is generally humid, with relative humidity varying between 50% and 99%. The vegetation of the district varies according to the rainfall pattern but consists of shrubs and secondary forests [9].

Malaria is the district's topmost disease recorded at health facilities. Health services are structured at community level (principally delivered through outreach programmes such as CHPS), Sub-district level health centers and rural clinics, and the district level urban health center at Elmina and two specialist hospitals at Ankaful (Leprosarium and psychiatric hospitals), which also provide general services.

The district had a baseline mf prevalence ranging from 0 - 2.9% in study sentinel sites and an ICT prevalence between 1.6 and 7.8%. The district started MDA with ivermectin and albendazole in 2004 and received 10 rounds of MDA, the last one delivered in 2014. Studies conducted in 2012 in Ankwanda and Brenu-Akyinim communities identified 7.8% ICT prevalence through community surveys and 1.6% ICT prevalence through school surveys [10]. Molecular xenomonitoring (MX) based on 401 Anopheles

mosquitoes analyzed in 30 pools revealed 13 of these pools positive for *W. bancrofti* DNA with a maximum likelihood of infection estimate of 4.33% (95% CI: 2.17-7.58).

Study design

This is a cross-sectional study employing qualitative and quantitative techniques for data collection. Quantitative data will be collected by using data collection tools designed to capture data at the testing facilities. Data to be captured include participants' age, gender, community name, name of the sub-district. The coordinates of the testing facility, the QFAT and malaria test results will also be captured. All these Data will be recorded using the RedCap app. Qualitative data will be collected using validated In-depth interview guide adapted to suit each respondent group appropriately. All the tools will be pretested to determine their suitability to generate the expected data, ease of use and consistency across multiple users.

Study population and sample size

The study population is made up of all residents living in the catchment areas of the participating health facilities (CHPS compounds), out of which, those presenting to the health facility for malaria diagnosis will be recruited to participate in FBSs. The sample size was calculated to estimate a 2% prevalence in a cross-sectional survey using the single population proportion formula [12]. We assumed a 95% confidence level, $p = 0.02$ and a design effect of 2. Thus, the minimum estimated sample size for each district was 1,498. At the cluster (CHPS) level, a minimum of 60 participants is required. This was however increased to 100 participants per CHPS, to enable the sampling of 25 participants per community (since each CHPS serves up to 4 communities). For a total of 120 communities in Gomoa West and 100 communities in KEEA, 3,000 and 2,500 participants are expected to be recruited respectively. For each community under the CHPS, the first 10 children and 15 adult patients meet the inclusion criteria below will be tested. The sample collections will take place over a period of six months, with an average of four participants recruited per community per month. In situations where the expected sample sizes are not achieved within the proposed sampling periods, the study will allow additional short recruitment windows to meet the sample size.

Survey participant eligibility criteria

Inclusion criteria:

- Presentation at a health facility for malaria testing
- Willingness to provide informed consent (or assent with parental/guardian consent)
- Age ≥ 5 years
- Residency in the study community for at least the previous five years

Exclusion criteria:

- Pregnant women
- People with cognitive impairment or mental illnesses who are unable to provide informed consent or assent, unless an authorized representative is available.
- Severely ill people, such that participation will interfere with clinical care

Pregnant women and children under five years of age are normally excluded from LF MDA treatment and other M&E activities. Their exclusion from this study is to follow the current procedures for LF treatment and M&E activities.

Data collection

Data will be collected using data collection forms designed to capture the name and GPS location of health facility, and the number of participants attending. At the participant level data on age, occupation, place/community of residence, contact address of participants, house number or identifier such as a recognized landmark close to the participant's home, consent, perceived distance from home to the attended health facility and means of transport to the facility shall be recorded. Additionally, data will capture malaria test and result, number of malaria tests performed per month, QFAT test and result, number of QFAT performed and result as well as the number of refusals, and the results of the night blood tests. See Supplementary File 1 for the data tools.

1. Assessing the prevalence of LF through FBS

Working with the NTD programme through the District Health Management Teams (DHMT), we will place the SD Biosensor's STANDARD Q Filariasis Antigen Test (QFAT) at all CHPS in both districts. The CHNs staffing these facilities will be trained in using the QFAT (following the manufacturer's procedures) to test patients visiting their facility for malaria diagnosis over a six-month period. Figure 2 is a flow chart of the study procedures. The final distribution of tests and sample size across districts will be based on discussion with the DHMTs. For each participant tested, age, gender, community, and sub-district of residence will be recorded. The coordinates of each testing facility and community of QFAT-positive individuals will be recorded using the RedCap app. All QFAT-positive individuals will be noted, and time will be arranged for collecting night blood for mf identification. Night blood collection and microscopy will be conducted by the study team. Aside from the introduction of the QFAT at the CPHS, all malaria testing, reporting and treatment procedures will not be changed. These will be implemented following the WHO's test, treat and track (T3) policy, adopted by Ghana [11].

Feasibility assessment

To assess the feasibility of FBS, the following will be considered.

Operational Feasibility: FBS leverages existing health infrastructure (CHPS zones, malaria testing centers), making it logistically simpler and more scalable across large populations. However, it depends

on participant attendance at health facilities, which may limit geographical coverage. Data collected will include the number of patients tested for malaria and the number positive, the number of patients consenting to QFAT testing, the number of patients positive by QFAT, cost per patient tested, and cost per patient positive.

Cost and Resource Efficiency:

FBS is expected to be cost effective due to its integration with malaria diagnosis, reducing the need for standalone surveys. However, testing supplies, staff training, and community engagement still represent significant costs. The cost per patient tested, and the cost per patient positive will be estimated for this analysis. The data on cost of collection, cost per sample tested, and cost to detect a positive individual will be estimated.

2. In-Depth Interviews

In-depth interview (IDI) guide will be developed and administered (in English) to CHNs (health facility in-charge or their representatives), DHMT staff (district director, district disease control officers, district public health nurses), and NTD programme officers to understand the barriers and facilitators of integrating malaria testing and LF testing at the periphery health facility level and the resources needed for long-term sustainability of such a programme (including training programs, supply chains for diagnostic tests, and data management). See Supplementary File 2 for the interview guide. Selected study participants (both those who were tested with QFAT and those who were not) will also be interviewed in their local language (Twi or Fante). See Supplementary File 2 for the interview guide for participants. Information to collect includes acceptability, time spent at the health facility beyond malaria testing and treatment, additional time and effort put in by health workers and facilitators, and barriers to performing FBS. All interviews will be conducted by a trained social scientist.

The number of in-depth interviews to be conducted will be informed by a theoretical saturation point, where no new information is generated from the subsequent interviews during fieldwork. Respondents will be purposively selected to include equal numbers of males and females as much as possible.

Data Analyses

Data will be analyzed to determine the prevalence of infection in the population. All prevalence estimates will be accompanied by their 95% confidence intervals. Analyses will be disaggregated to present infection rates at the district, CHPS, and community levels. Gender and age specific analyses will also be undertaken.

To assess the epidemiological feasibility of FBS, we will determine whether the surveillance system can detect *W. bancrofti* infections at very low prevalence while providing sufficient statistical precision for programmatic decision-making. Overall antigen prevalence and corresponding 95% confidence intervals will be estimated, accounting for the clustered sampling design at the health facility and community levels.

Because participants will be recruited from multiple CHPS compounds and health facilities, observations are expected to be correlated within facilities. The reliance on health facility attendance introduces the potential for selection bias because individuals who seek healthcare may differ systematically from the general population. This potential bias will be evaluated by comparing the demographic characteristics of the FBS participants with available census and district population data to assess representativeness with respect to age, sex, and geographic distribution. In addition, participation rates and recruitment patterns across health facilities, communities, and seasons will be examined to identify systematic differences in healthcare utilization. Therefore, mixed-effects logistic regression models (or alternatively generalized estimating equations with robust standard errors), adjusting for measured demographic and geographic factors associated with both healthcare attendance and LF infection, will be used to account for clustering of participants within health facilities. The primary outcome variable will be LF infection status, with individual-level variables (age, sex, malaria RDT result, occupation, duration of residence in the community and distance from residence to the health facility), community-level variables (community of residence, CHPS catchment area) and health facility-level variables (average malaria testing volumes, district) assessed. Variables associated with infection at $p < 0.20$ in univariable analyses or considered biologically plausible based on existing evidence will be entered into the multivariable model. Adjusted odds ratios (aORs) with 95% confidence intervals will be reported. These analyses will provide important evidence on the representativeness of FBS and inform the interpretation of prevalence estimates generated through routine health facility surveillance.

To evaluate whether FBS provides adequate statistical power for surveillance in low-prevalence settings, the observed precision of prevalence estimates will be assessed by examining the width of the 95% confidence intervals and estimating the design effect attributable to clustering. Intraclass correlation coefficients (ICCs) will also be estimated to quantify clustering within facilities. These analyses will determine whether the proposed sample size is sufficient to detect antigen prevalence at or below anticipated post-MDA levels with acceptable precision.

LF infection data will be mapped in ArcGIS (Environmental Systems Research Institute, Redlands, CA, USA) to identify hotspots where interventions are needed. The spatial distribution of human infections detected via FBS will be assessed. Environmental and ecological variables, including rainfall, temperature, relative humidity, normalized difference vegetation index (NDVI), elevation, land cover, distance to surface water, and population density, will be obtained from the Ghana Meteorological Agency and complementary geospatial datasets (e.g., ERA5, MODIS, WorldClim). These variables will be linked to participants' communities of residence and incorporated into spatial regression models to identify environmental determinants of LF infection and predict areas at increased risk of residual transmission. Cluster analysis will be performed in ArcGIS to highlight areas with concentrated infection rates. Geospatial analysis will combine environmental covariates and human infection data to identify high-risk clusters for targeted interventions.

To assess the feasibility of FBS, the practicality and logistical challenges of implementing FBS will be analyzed. Key metrics such as geographical coverage and population reach, participation rates,

availability and cost of human resources, time taken to conduct surveillance, the number of individuals, the duration required for the surveillance, and the level of community engagement needed to sustain the surveillance methods will be collected.

For cost-effective analysis, the financial feasibility of FBS will be assessed. The cost per case detected, the cost per person tested, taking into consideration the cost of supplies and equipment, and training for surveillance. A one-way sensitivity analysis will be conducted to explore the effects of key assumptions on the cost estimate. The effects of varying the following parameters will be explored on the projected costs for the sensitivity analysis for the FBS with or without additional personnel costs.

To assess the health system's feasibility and sustainability for the FBS, we will analyze the work capacity of the health system to support continued surveillance for LF through the IDI interview data collected. Transcripts from the IDI will be imported into MAXQDA (VERBI GmbH), coded by two independent coders, and analyzed using content analysis to identify emerging themes. Following descriptive analysis, patterns and linkages among the views, experiences and behaviors of participants will be explored. The collected data will provide important contextual information and a basis for evaluating the generalizability of the study findings.

Ethical Approval and Accordance

The protocol was reviewed and approved by the Institutional Review Board of Noguchi Memorial Institute for Medical Research (NMIMR-IRB CPN 123/24-25) and the Ethics Review Committee of Ghana Health Service (GHS-ERC: 007/09/25) in accordance with the ethical standards of the institutional research committees and with the Declaration of Helsinki.

Consent to Participate

Written informed consent to participate in the study will be obtained from all eligible participants prior to enrolment. For participants younger than 16 years, informed consent will be obtained from their parent or legally authorized guardian, and assent will be obtained from the child where appropriate. Participants will be informed about the purpose and procedures of the study, the potential risks and benefits, their right to decline participation or withdraw from the study at any time without penalty, and how their information will be handled confidentially.

Consent to Publish

Consent for publication is not applicable to this study protocol because no individually identifiable participant information will be reported. Any data generated from the study will be presented in aggregate form to ensure that individual participants cannot be identified.

Clinical Trial Number: Not Applicable

Discussion

As countries advance toward WHO's target of eliminating LF as a public health problem by 2030[13], the need for robust, sensitive, and sustainable surveillance systems becomes increasingly critical, particularly in settings that have completed MDA. The current WHO recommended monitoring and evaluation framework, comprising epidemiological monitoring surveys (EMS) and TAS [6], has been instrumental in guiding programmatic decision-making, including when to stop MDA and how to monitor post-treatment trends. However, several operational and epidemiological challenges persist, especially in low-prevalence, post-TAS3 settings where detecting residual transmission is inherently difficult. This study evaluates an FBS approach integrated with malaria diagnosis as a complementary strategy to address these limitations.

A key advantage of this study is its focus on districts such as Gomoa West District and Komenda-Edina-Eguafo-Abrem District, where MDA ceased over a decade ago. The preliminary findings from the recent study conducted ten years after cessation of MDA in the Gomoa West District of Ghana, showing very low human antigen prevalence but elevated mosquito infection rates, highlight an important epidemiological uncertainty[14]. This discordance underscores the limitations of relying solely on human infection indicators in low-prevalence settings and supports the inclusion of entomological surveillance [15]. Further, MX has increasingly been recognized as a sensitive complementary surveillance tool for detecting residual LF transmission in post-validation settings. Several studies have demonstrated the utility of MX for identifying ongoing transmission where human infection indicators are very low or absent, including studies from Togo and broader systematic evaluations of MX performance and mosquito sampling strategies [16,17].

For many years, the integration of activities between disease programmes has been a topic of interest [18,19], in strengthening health systems and optimizing resources. The integration of LF testing into routine malaria diagnostics represents a realistic and potentially transformative strategy. Given that LF and malaria share common vectors in many parts of sub-Saharan Africa [20], including Ghana, leveraging existing malaria testing platforms at peripheral health facilities provides an opportunity to maximize efficiency. This approach is expected to reduce operational costs, minimize duplication of efforts, and improve acceptability among both healthcare workers and patients by limiting additional procedures.

A key limitation of EMS and TAS lies in their reliance on cross-sectional survey designs with relatively limited sample sizes and spatial coverage. Although recent revisions have improved survey sensitivity through smaller evaluation units and refined thresholds [6], these surveys remain constrained by their episodic nature and dependence on selected sentinel, spot-check, or cluster-based sampling strategies. In contrast, FBS aims to leverage routine healthcare interactions to enable continuous data collection over extended periods. By embedding LF testing within malaria diagnostic workflows at peripheral health facilities, it is expected that FBS will achieve substantially larger cumulative sample sizes and broader geographic representation. This approach may enhance the likelihood of detecting low-level or focal transmission that may be missed by traditional survey methods.

Another important challenge with EMS and TAS is the issue of representativeness. TAS focuses primarily on young children, while EMS targets adult populations, yet both depend on voluntary participation within structured survey settings. This introduces the potential for selection bias and limits the inclusion of individuals who may not typically participate in community-based surveys. FBS aims to mitigate this limitation by capturing individuals who present for routine malaria testing, thereby reflecting real-world healthcare-seeking behavior. In endemic settings where malaria exposure overlaps with LF transmission risk, this strategy may provide a pragmatic proxy for identifying populations at risk of LF infection while improving inclusivity across age groups and demographic profiles.

Temporal limitations also constrain the effectiveness of EMS and TAS. As cross-sectional assessments conducted at specific time points, these surveys may fail to capture seasonal variations in transmission or detect early signs of recrudescence. This is particularly relevant given studies pointing to the recognition that resurgence of infection may occur several years after cessation of MDA, and that sustained surveillance is required for at least a decade post-validation [2–5]. FBS may address this gap by enabling longitudinal data collection over months, allowing for the identification of temporal trends and improving the sensitivity of surveillance systems to detect emerging transmission dynamics.

From an operational perspective, the implementation of EMS and TAS requires significant logistical investment, including trained survey teams, transport, and per diem costs. These resource demands can limit the frequency and scalability of surveillance activities, particularly in resource-constrained settings. In contrast, FBS aims to capitalize on existing health system infrastructure, including CPHS compounds and malaria testing platforms. By integrating LF diagnostics into routine service delivery, FBS aims to reduce operational costs and enhance scalability, aligning with WHO recommendations to strengthen integrated and sustainable surveillance platforms [6].

The integration of LF testing with malaria diagnosis also represents a strategic alignment with WHO guidance advocating multi-disease surveillance approaches [13]. It also aligns with the guidelines on integrated post-validation and post-verification surveillance planning for neglected tropical diseases [21]. Given that LF and malaria share common mosquito vectors in many endemic regions, including Ghana [20], integrating diagnostic activities maximizes efficiency and minimizes duplication of effort. This approach will not only reduce the burden on both healthcare workers and patients but also facilitates the collection of richer datasets that can support geospatial analyses and targeted interventions.

Importantly, FBS complements rather than replace existing WHO-recommended tools. While TAS provides a standardized method for determining whether transmission thresholds have been reached, and EMS improves sensitivity in adult populations, both approaches may benefit from integration with continuous surveillance platforms. The addition of MX may further strengthen the surveillance framework by providing an independent measure of parasite presence in vector populations, addressing the limitations of relying solely on human infection indicators [13]. The discordance observed between low human antigen prevalence and elevated mosquito infection rates in preliminary studies underscores

the importance of combining multiple surveillance modalities to obtain a comprehensive understanding of transmission dynamics.

Furthermore, FBS may facilitate continuous data collection over extended periods, enhancing the sensitivity of surveillance systems compared to cross-sectional community surveys, particularly in detecting low-level transmission. While the current FBS targets post-TAS settings, the approach could also be used for routine surveillance activities. Table 1 below shows the similarities and differences between the current surveillance approaches and the FBS. The FBS represents a practical evolution of WHO-recommended surveillance strategies[6], addressing key limitations of EMS and TAS by improving representativeness, spatial resolution, temporal sensitivity, and sustainability, while aligning with WHO’s call for integrated, health-system-based surveillance platforms.

Table 1: Comparison of EMS/TAS and FBS

EMS/TAS	Facility-Based Surveillance
To assess the impact of MDA, Epidemiological Monitoring Surveys (EMS) serves as the first step in the stop-MDA strategy by evaluating whether infection levels have declined sufficiently to proceed to the next phase. This is followed by Transmission Assessment Surveys (TAS), which determine whether transmission has been reduced to a level at which MDA can be safely discontinued in the community.	As part of the WHO-recommended post-validation surveillance strategy, health facility screening (facility-based surveillance - FBS) is suggested as a post-validation surveillance platform to detect residual infections through the routine health system.
Limited sample sizes to represent entire districts. TAS typically samples ~1500–1800 children per evaluation unit and EMS uses structured but still limited samples.	FBS targets much larger sample sizes of 2500 to 3000 per district. This will improve statistical power in low-prevalence settings.
Limited number of communities surveyed. Surveys are conducted in selected sentinel sites, spot-check sites and clusters. Even with improved EU sizes, coverage remains incomplete. Thus, there is a risk of missing low-level transmission or focal hotspots in heterogeneous settings.	All communities assessed. This offers a large-scale spatial representation of districts. FBS aims to assess presence of infection based on which detailed community assessments could be made to determine the actual prevalence, thus avoiding hotspots. This offers better detection of residual transmission and recrudescence, reducing the risk of hidden hotspots, a known limitation of TAS.
EMS/TAS requires dedicated survey teams from the national NTD office.	FBS leverages local existing health system personnel. CHNs living in endemic communities are trained to undertake malaria RDT and can be trained to add QFAT
EMS/TAS is resource-intensive, and costs include per diem for programme staff, vehicle and fuel costs.	FBS' cost is expected to be minimized through the leveraging of existing local health system personnel and routine activities.
Data collected over a couple of days per community or site. EMS/TAS surveys are periodic, cross-sectional snapshots, and may miss seasonal transmission variation and early resurgence signals.	Data collection may be extended over months to account for seasonal variations in transmission. This will improve early detection of resurgence, which WHO highlights as a key risk post-MDA.
TAS focuses on children (6–7 years), and EMS focuses on adults ≥20 years. TAS does not account for residual infection in adults.	FBS considers both children and adults.
Only consenting people take part in surveys, with the risk that the same people will take part in surveys all the time. Thus, there is reduced representativeness and a risk of selection bias. A loyal group of respondents may not accurately reflect the general population, as consenting, available individuals may have different characteristics than those who decline or leave.	People reporting to health facilities for malaria-diagnosis take part in the FBS. This may include people who will normally not consent for community-based LF testing, thus increasing representativeness. This reflects real exposure patterns (especially malaria-exposed populations), with a more representative and less biased sampling.
Data collection is episodic, usually aggregated and is not currently in a format for entry into DHIMS.	Potential for the data to be entered into DHIMS, alongside the malaria data. This may offer opportunities for real-time monitoring and

	programmatic decision-making, moving toward routine surveillance intelligence.
Need for community and individual engagement and the potential for long term community fatigue in sentinel sites.	Only individual engagement is required.
WHO explicitly notes the need for long-term surveillance (≥ 10 years).	FBS provides a ready-made platform for continuous surveillance. This can be maintained as part of routine health services.
Tests may be more appropriately stored in central storage facilities until used.	Once distributed to low-level health facilities, test kits may not be stored adequately and may be exposed to high temperatures and humidity.
	FBS proposes an opportunistic testing integration. One time finger-prick blood collection for both malaria and LF. This aligns with WHO recommendation for integrated surveillance platforms in post-validation phases. It will enhance efficiency and sustainability.

Despite these advantages, several limitations inherent to FBS must be considered. First, reliance on health facility attendance introduces the potential for selection bias because individuals who seek healthcare may differ systematically from the general population. Healthcare attendance may be influenced by factors such as age, sex, socioeconomic status, distance to health facilities, health-seeking behaviour, and severity of illness. Consequently, individuals who rarely access healthcare, including those living in remote communities, those with limited financial resources, or asymptomatic individuals who have no reason to seek care, may be underrepresented. Conversely, individuals with febrile illnesses or greater healthcare utilization may be overrepresented. These differences could result in under- or over-estimation of the true community prevalence of LF if the probability of attending a health facility is associated with the probability of infection. Second, and for this study particularly, the requirement for informed consent for LF testing (which is not required for malaria testing) may reduce participation rates and affect sample size attainment. The study's design attempts to mitigate these limitations by ensuring broad geographic coverage through CHPS zones. It is, however, expected that the adoption of this approach by the Ghana Health Service will remove the need for consenting in the future.

The feasibility component of this study is particularly important, as it addresses not only operational and epidemiological considerations but also health system capacity and sustainability. By incorporating cost analyses and qualitative assessments through in-depth interviews, the study acknowledges that successful implementation of integrated surveillance depends on more than technical validity. Factors such as health worker workload, supply chain reliability, training needs, and community perceptions will play a critical role in determining whether FBS can be adopted at scale. The inclusion of multiple stakeholder perspectives strengthens the study's potential to generate actionable recommendations for national programs.

Another notable contribution of this study is its emphasis on geospatial analysis. Mapping infection patterns and integrating environmental variables will enable the identification of localized transmission hotspots, which is essential for targeted interventions in the endgame of elimination [22,23]. Such precision public health approaches are increasingly recognized as necessary for sustaining gains achieved through MDA and preventing resurgence [6].

The findings from this study are expected to have important implications for LF elimination programs in Ghana and similar endemic settings. If FBS proves to be feasible, cost-effective, and sufficiently sensitive, it will serve as a viable approach to LF surveillance post TAS. Moreover, the integration model proposed here can be adapted for other neglected tropical diseases, contributing to broader health system strengthening and more efficient use of limited resources.

In conclusion, this study addresses a critical gap in post-validation surveillance by evaluating an integrated, facility-based approach alongside established entomological methods. It aims to demonstrate that FBS offers a feasible, cost-effective, and scalable complement to existing EMS and TAS approaches. By addressing key limitations related to sampling, representativeness, temporal sensitivity, and operational feasibility, FBS aligns closely with WHO's evolving emphasis on integrated, health system-based surveillance strategies. As countries approach elimination and transition into post-validation surveillance, such innovative approaches will be essential for sustaining gains, detecting recrudescence early, and ultimately achieving the long-term goal of interrupting transmission. The results from this study will provide essential evidence to inform national and global strategies for sustaining LF elimination and preventing resurgence. As the global community moves closer to the 2030 elimination target, such innovative and context-appropriate surveillance strategies will be indispensable.

Declarations

Funding Declaration

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Data Availability Statement

All data generated or analysed during this study are included in this published article [and its supplementary information files].

References

1. Global programme to eliminate. lymphatic filariasis: progress report, 2022 [Internet]. [cited 2026 Jun 6]. Available from: <https://www.who.int/publications/i/item/who-wer9841-489-502>

2. Santoso Y, Supranelfy Y, Suryaningtyas NH, Taviv Y, Yenni A, et al. Risk of Recrudescence of Lymphatic Filariasis after Post-MDA Surveillance in Brugia malayi Endemic Belitung District, Indonesia. *Korean J Parasitol.* 2020;58(6):627–34. .6.627 PubMed PMID: 33412766.
3. Rebollo MP, Mohammed KA, Thomas B, Ame S, Ali SM, Cano J, et al. Cessation of Mass Drug Administration for Lymphatic Filariasis in Zanzibar in 2006: Was Transmission Interrupted? *PLoS Negl Trop Dis.* 2015;9(3):e0003669. 10.1371. /JOURNAL.PNTD.0003669 PubMed PMID: 25816287.
4. Coulibaly YI, Coulibaly SY, Dolo H, Konate S, Diallo AA, Doumbia SS, et al. Dynamics of antigenemia and transmission intensity of *Wuchereria bancrofti* following cessation of mass drug administration in a formerly highly endemic region of Mali. *Parasit Vectors.* 2016;9(1). 10.1186/S13071-016-1911-9 . PubMed PMID: 27912789.
5. Richards FO, Eigege A, Miri ES, Kal A, Umaru J, Pam D, et al. Epidemiological and Entomological Evaluations after Six Years or More of Mass Drug Administration for Lymphatic Filariasis Elimination in Nigeria. *PLoS Negl Trop Dis.* 2011;5(10):e1346. 10.1371. /JOURNAL.PNTD.0001346 PubMed PMID: 22022627.
6. Monitoring. and epidemiological assessment of mass drug administration in the global programme to eliminate lymphatic filariasis: a manual for national elimination programmes, 2nd ed [Internet]. [cited 2026 May 25]. Available from: <https://www.who.int/publications/i/item/9789240105959>
7. Boateng CA, Afatodzie MS, McLure A, Kwansa-Bentum B, de Souza DK. Lymphatic filariasis transmission 10 years after stopping mass drug administration in the Gomaa west district of Ghana. *Int J Infect Dis.* 2025;152. 10.1016/j.ijid.2025.107790 . PubMed PMID: 39842689.
8. Asiedu A, Haws RA, Gyasi A, Boateng P, Malm K, Ntummy R, et al. Improving Malaria Case Management and Referral Relationships at the Primary Care Level in Ghana: Evaluation of a Quality Assurance Internship. *Glob Health Sci Pract.* 2023;11(6). 10.9745. /GHSP-D-23-00050 PubMed PMID: 38135513.
9. Assembly Profile. – KEEAMA official website [Internet]. [cited 2026 Jul 3]. Available from: <https://keeama.gov.gh/index.php/assembly-profile/>
10. Owusu IO, de Souza DK, Anto F, Wilson MD, Boakye DA, Bockarie MJ, et al. Evaluation of human and mosquito based diagnostic tools for defining endpoints for elimination of *Anopheles* transmitted lymphatic filariasis in Ghana. *Trans R Soc Trop Med Hyg.* 2015;109(10):628–35. 10.1093. /TRSTMH/TRV070 PubMed PMID: 26385935.
11. Kyei C, Tawiah C, Agbokey F, Anim JA, Tivura M, Afari-Asiedu S, et al. Adherence to the test, treat and track malaria policy among selected health facilities in Ghana: the clients' perspective. *Malar J.* 2025;24(1). 10.1186/S12936-025-05467-7 . PubMed PMID: 41088175.
12. Cochran WG, Wiley J, Sons. New York. - References - Scientific Research Publishing [Internet]. [cited 2026 Jul 2]. Available from: <https://www.scirp.org/reference/ReferencesPapers?ReferenceID=1390266>
13. Ending the Neglect. to Attain the Sustainable Development Goals: A Road Map for Neglected Tropical Diseases 2021–2030. 2021;196.

14. Boateng CA, Afatodzie MS, McLure A, Kwansa-Bentum B, de Souza DK. Lymphatic filariasis transmission 10 years after stopping mass drug administration in the Gomoe west district of Ghana. *Int J Infect Dis.* 2025;152. 10.1016/j.ijid.2025.107790 . PubMed PMID: 39842689.
15. Zulch MF, Pilotte N, Grant JR, Minetti C, Reimer LJ, Williams SA. Selection and exploitation of prevalent, tandemly repeated genomic targets for improved real-time PCR-based detection of *Wuchereria bancrofti* and *Plasmodium falciparum* in mosquitoes. *PLoS ONE.* 2020;15(5):e0232325. 10.1371. /JOURNAL.PONE.0232325 PubMed PMID: 32357154.
16. Dorkenoo MA, De Souza DK, Apetogbo Y, Oboussoumi K, Yehadji D, Tchalim M, et al. Molecular xenomonitoring for post-validation surveillance of lymphatic filariasis in Togo: no evidence for active transmission. *Parasit Vectors.* 2018;11(1):52. 10.1186/S13071-017-2611-9 . PubMed PMID: 29361964.
17. Pryce J, Reimer LJ. Evaluating the Diagnostic Test Accuracy of Molecular Xenomonitoring Methods for Characterizing Community Burden of Lymphatic Filariasis. *Clin Infect Dis.* 2021;72(Suppl 3):S203–9. 10.1093. /CID/CIAB197 PubMed PMID: 33906238.
18. Gyapong JO, Gyapong M, Yellu N, Anakwah K, Amofah G, Bockarie M, et al. Integration of control of neglected tropical diseases into health-care systems: challenges and opportunities. *Lancet.* 2010;375(9709):160–5. 10.1016/S0140-6736. (09)61249-6 PubMed PMID: 20109893.
19. Lammie PJ, Fenwick A, Utzinger J. A blueprint for success: integration of neglected tropical disease control programmes. *Trends Parasitol.* 2006;22(7):313–21. 2006.05.009 PubMed PMID: 16713738.
20. De Souza DK, Koudou B, Kelly-Hope LA, Wilson MD, Bockarie MJ, Boakye DA. Diversity and transmission competence in lymphatic filariasis vectors in West Africa, and the implications for accelerated elimination of *Anopheles*-transmitted filariasis. *Parasit Vectors.* 2012;5(1). 10.1186/1756-3305-5-259 . PubMed PMID: 23151383.
21. Integrated post-validation. and post-verification surveillance planning toolkit for neglected tropical diseases: a planning toolkit [Internet]. [cited 2026 Jul 2]. Available from: <https://www.who.int/publications/i/item/9789240120310>
22. Kwarteng EVS, Andam-Akorful SA, Kwarteng A, Asare DCB, Quaye-Ballard JA, Osei FB et al. Spatial variation in lymphatic filariasis risk factors of hotspot zones in Ghana. *BMC Public Health* 2021 21:1. 2021;21(1):230-. 10.1186/S12889-021-10234-9 PubMed PMID: 33509140.
23. Martin BM, Cadavid Restrepo A, Mayfield HJ, Lau CL. Towards global elimination of lymphatic filariasis: a systematic review of the application of spatial epidemiological methods to enhance surveillance and support elimination programmes. *BMJ Public Health.* 2024;2(1):e000534. 10.1136/BMJPH-2023-000534. PubMed PMID:.

Figures

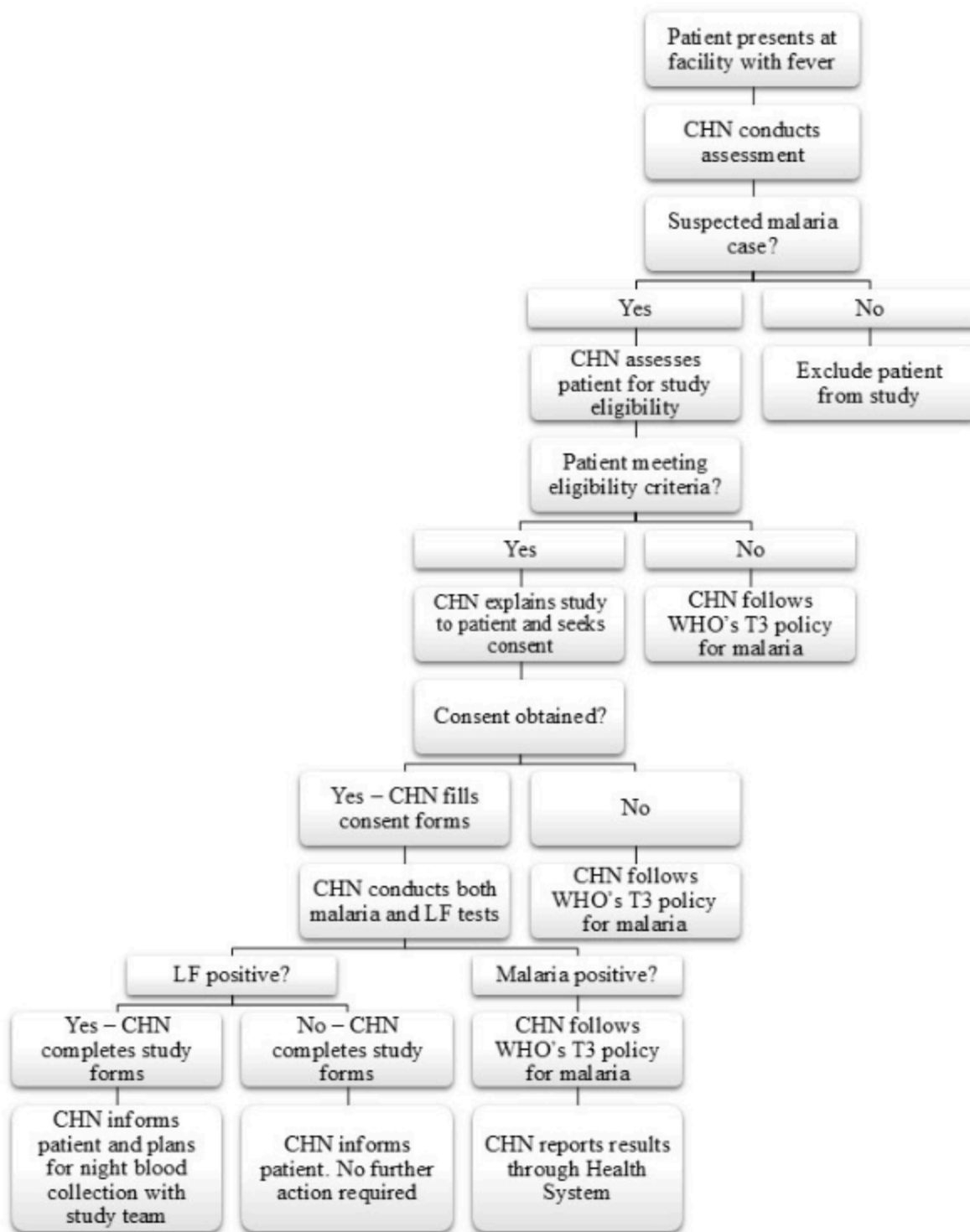


Figure 2

Facility-Based Surveillance Workflow. CHN – Community Health Nurse; T3 – test, treat and track malaria policy (11).

Supplementary Files

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