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Confirmatory mapping for lymphatic filariasis in districts previously considered nonendemic in Ghana

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ABSTRACT

Objectives: Lymphatic filariasis (LF) elimination efforts in Ghana have been ongoing since 2001, achieving substantial progress through mass drug administration (MDA). However, despite significant advances, LF transmission persists in certain areas. Some districts previously classified as nonendemic have reported lymphedema and hydrocele cases, raising concerns about LF endemicity. To address these gaps, a confirmatory mapping survey was conducted to reassess LF prevalence in districts with uncertain morbidity.

Methods: A cross-sectional survey using the WHO-approved LF confirmatory mapping tool was conducted in 38/261 districts Ghana. Schoolchildren aged 9-14 years were randomly selected using the TAS Survey Sample Builder tool. Circulating filarial antigen (CFA) levels were measured using the Filaria Test Strip (FTS). Districts were classified as endemic if more than three positive cases were identified out 480 sampled. Subdistrict-level community surveys were conducted to confirm findings.

Results: A total of 18,459 children were tested across the selected districts. Positive antigen cases were detected in 17 districts, with two districts (Nkoranza South and Wenchi Municipal) exceeding the critical threshold of three positive cases. Subdistrict surveys further confirmed high antigen prevalence of 1.68% (95% CI, 0.92-2.80; range: 1.00-5.00) and 4.73% (95% CI, 3.35-6.46; range: 0.96-14.29) in the Nkoranza South and Wenchi Municipal districts respectively.

Conclusion: The confirmatory mapping survey revealed ongoing LF transmission in two previously classified nonendemic districts. These districts were reclassified as endemic, requiring MDA. Treatment has therefore been initiated in the Nkoranza South and Wenchi Municipal districts. This study underscores the importance of reassessing endemicity and implementing targeted interventions in areas with uncertain LF transmission.

Introduction

Ghana has made tremendous progress towards the elimination of lymphatic filariasis (LF). Starting with the implementation of mass drug administration (MDA) with ivermectin and albendazole through the Global Programme to Eliminate Lymphatic Filariasis (GPELF) in 2001, Ghana achieved 100% geographic coverage by 2006 [1]. Despite the progress, many challenges were encountered. Among these was the presence of hotspots of infection that despite several years of MDA, have not met the threshold for stopping treatment [2]. Currently, there are only 5 out of 114 endemic districts remaining (Ghana NTD Programme 2023, unpublished). Furthermore, lymphedema cases have been reported in communities from districts previously considered to be nonendemic. In some of these communities, the baseline prevalence was higher than the required 1% to initiate MDA, but the district prevalence was sufficiently low [3]. As such, the extent of LF endemicity in these districts is unknown. The current roadmap for Neglected Tropical Dis-

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eases (NTDs) aims to globally eliminate LF as a public health concern by 2030 [4]. However, to achieve the elimination targets and prevent the resurgence of infection many years after MDAs have stopped in the country, it is important to determine the prevalence of LF in the districts with uncertain or nonendemic status.

To tackle the issue of uncertain endemicity, a novel LF confirmatory mapping tool was approved following review at the 2014 meeting of the WHO's Regional Program Review Group for Africa [5] and evaluated in Ethiopia and Tanzania [6,7]. Unlike the WHO LF mapping protocol [8], the confirmatory mapping tool, designed to offer greater precision, aims for a more comprehensive geographical representation at the district level and focuses on testing children rather than adults. Further, unlike the Transmission Assessment Surveys (TAS) [8] which use data from young children to make decisions about stopping LF treatment, the confirmatory mapping tool targets older children with an extended potential exposure period to LF infection.

In 2018, lymphedema cases were reported in some districts classified as nonendemic, and a survey was conducted in three of these districts (Hohoe, Adaklu and East Akyim) to ascertain the infection levels. The results indicated antigen prevalence above the 2% antigen threshold in Adaklu district (Unpublished). This prompted the Ghana NTD programme to implement a confirmatory mapping survey in selected districts across the country. This paper presents the approach used in selecting the districts for assessment, the results of this survey and the implications to the Ghana LF elimination goals.

Methods

Data review

The baseline mapping for LF was conducted in Ghana between 1998 and 2000 [3,9]. At the time, 49 out of the 110 districts were designated as LF endemic. MDA was started in 2001 and scaled up to cover all endemic districts in 2006 [1]. However, the number of endemic districts increased to 114 dues to redistricting (Figure 1). As of 2017, 99 LF endemic districts passed TAS1 and 84 of these passed TAS3 as of 2019. A total of 15 endemic districts classified as hotspots have conducted at least 13 rounds of MDA (13-18) and failed pre-TAS at least three (3-4) times. At the time of this confirmatory mapping, four of the hotspot districts passed TAS1 increasing the number of districts that have stopped MDA to 103. The country has no history of TAS failure.

As the country strives to address challenges in hotspot districts to achieve elimination, there are increasing reports on LF morbidity in nonendemic districts. In 2020, the Neglected Tropical Diseases Programme (NTDP) of the Ghana Health Services and health partners reviewed the LF data to identify areas where LF transmission may be ongoing and confirmatory mapping may be required. The following data were reviewed: mapping, lymphedema and hydrocele cases, geographical relation of nonendemic districts to LF hotspot districts and distribution of vectors. The morbidity data included hydrocele and lymphedema cases collected during MDA for onchocerciasis and hydrocele cases diagnosed hospitals in nonendemic districts from 2014 to 2019.

Confirmatory mapping

Following the review, confirmatory mapping was conducted in selected districts following the WHO protocol for confirmation of LF where transmission is uncertain [5] A cross-sectional cluster survey method was adopted. The survey sites were basic schools within the districts. The confirmatory mapping Survey Sample Builder (SSB) tool [10] was used to randomly select the schools in each district as well as generate the random number for the selection of students. The SSB also generated the sample size (320-480 children per district) and the cut-off for decision-making.

In each school, children aged 9-14 years (corresponding to children in grades 4-9) were selected for the survey using the random numbers generated by the SSB. Children who lived in the district for less than one year and outside of the age groupings and classes were excluded from the survey. A semi-structured questionnaire was administered to each student using the ESPEN Collect mobile data collection tool [11], to gather information on the name of the region, district, sub-district, circuit, school and GPS coordinates of school, participant's name, sex, age, class, and duration lived in the district.

Daytime finger prick blood was collected to determine the prevalence of circulating filarial antigen using the Filaria Test Strip (FTS). Positive children were offered treatment with ivermectin and albendazole using the dosage pole.

The data were analyzed by comparing the number of valid tests to the cut-off threshold for positive cases. If the number of positives exceeds the critical cut-off value, the district is classified as LF endemic. Thus, districts are considered endemic and require MDA if more than 3 positive children are identified in an evaluation unit.

To further confirm the results before initiating MDA in districts found to be endemic, the NTD programme conducted surveys to determine antigen prevalence in three subdistricts per district. Community members aged 5 years and above were tested using the FTS.

Table 1
Distribution and prevalence of districts not previously classified as endemic by region.

Region	Number of districts	Antigen prevalence range (%)
Ashanti	23	1.0-6.0
Ahafo	2	4.0
Bono	4	3.0-5.0
Bono East	2	3.0
Greater Accra	2	4.9
Oti	1	1.0
Volta	7	1.0-3.0
Western North	3	5.3

Results

Review of mapping data

Country LF mapping data for 150 communities in 80 districts were reviewed. A total of 54 of the districts recorded ICT prevalence $\geq$ 1% with a range of 1.0% to 39.4% while 26 districts recorded a 0% prevalence. Only 33 out of the 54 districts are included in the current LF endemic districts; the remaining 21 districts with at least one community with ICT prevalence of 1.0%-6.0% were classified as nonendemic and have not received MDA. A total of 15 out of the 21 districts are in two regions (Ashanti and Volta) considered nonendemic for LF in the country. They are the only two out of 10 regions at the time with no endemic districts. Volta region has subsequently been divided into two regions (Volta and Oti). The 21 districts currently correspond to 44 districts due to multiple redistricting (Table 1).

The data used in the multicountry mapping study to determine the distribution of bancroftian filariasis in Benin, Burkina Faso, Ghana and Togo [3], was also assessed. 176 sites were surveyed in Ghana. In 13 sites the initial mapping data was validated by an independent survey, with a higher prevalence (5.0-48.0%) than the initial survey (0.0-12.3%). This review therefore concluded that confirmatory mapping may be required in 44 districts previously classified as nonendemic but with uncertain mapping data. From

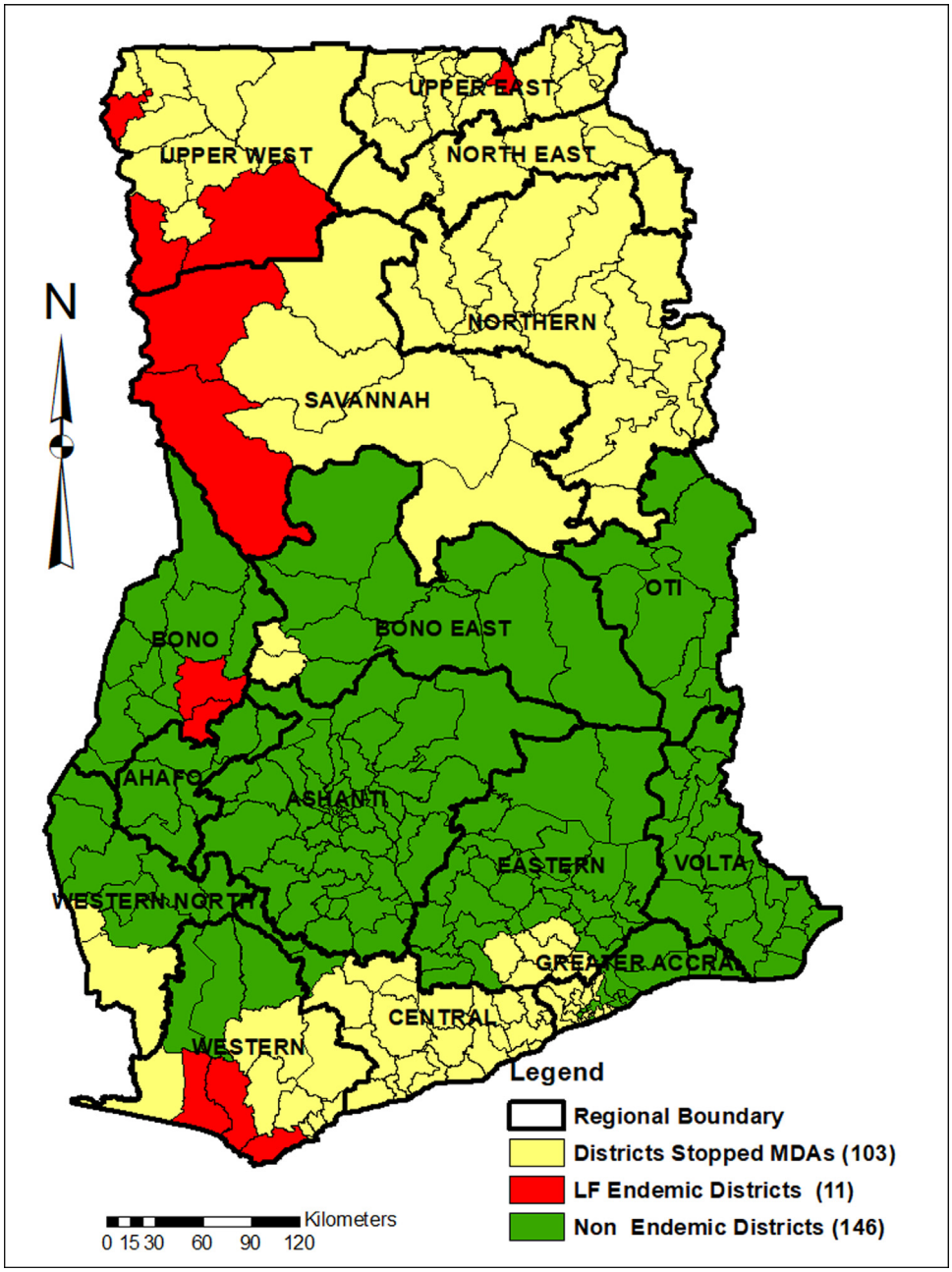

Figure 1. LF endemicity in Ghana. Source: Ghana neglected tropical diseases programme, 2021.

the review, 28 districts had at least one site with mapping ICT prevalence $\geq$ 2%. It was therefore recommended that confirmatory mapping be conducted in these 28 districts.

Analysis of the geographical relation between nonendemic districts and endemic districts

The review of districts previously considered nonendemic revealed that forty-three (43) out of 146 LF nonendemic districts share boundaries with at least one LF endemic district. 31 out of the 43 LF nonendemic districts share boundaries with districts that have passed TAS3 or TAS2. 12 LF nonendemic districts share boundaries with 5 out of the 15 LF hotspot districts identified in the country. The five hotspot districts had a baseline antigen (ICT) prevalence of 6.2-22.0%, conducted between 1998 and 2000. At the pre-TAS conducted in 2019 these 5 hotspot districts had a prevalence of 2.2-8.4%, after 13-17 rounds of MDA.

Of the 12 LF nonendemic districts, 10 are endemic for onchocerciasis and received annual (5 districts) or biannual (5 districts) MDA with ivermectin. Nine of the 12 districts reported the highest annual hydrocele cases of 11-56 with a mean of 25.6 (in 2014-2019) from hospitals conducting hydrocelectomies while the remaining three districts did not have a hospital with the capacity to conduct hydrocele surgery, and hence did not report cases on the District Health Information System (DHIS2) platform. Nine of the districts reported 1-32 cases of lymphedema with a mean of 10 cases. Six of the 9 districts reported the highest annual lymphedema cases of 5-32 while the remaining three districts with no district hospitals reported highest annual lymphedema cases of 1 to 5 from 018 to 2020.

Based on this review, the 12 districts were considered by the NTDP and partners for confirmatory mapping due to persistent ongoing transmission in the five endemic districts they share boundaries with, and the high cases of hydrocele (mean = 25.6) or lym-

phedema (mean = 10) reported in 9 of the districts. In a LF endemic population, it is projected that about 12.5% of infections result in lymphedema, 20.8% result in hydrocele, 66.7% of infections have subclinical damage [12,13].

Review of hydrocele data

Reviewing the hydrocele data reported in DHIS2 from 2014 to 2019, 86 out of the 146 nonendemic districts reported annual hydrocele cases of 1-93 (mean = 20) and cumulative hydrocele cases of 1 to 315 (mean = 58) per district. The cumulative cases were considered less reliable due to the possibility of double counting, therefore the highest annual cases per district were analyzed. The mean highest annual hydrocele case per district was 19.4 with a median of 14 cases. 76 districts reported ≥5 annual cases, and 7 districts reported ≥50 annual cases.

The analysis of hydrocele cases in the 86 districts revealed 0.3 to 24.5 cases per 10,000 adult male population (≥15 years). Assuming a 2%-10% infection prevalence and 20.8% of infected persons developing hydrocele, 42-208 hydrocele cases are expected per 10,000 adult male population [12]. 72 districts recorded <10 hydrocele cases per 10,000, 11 districts recorded 10-19 hydrocele cases per 10,000 and 3 districts recorded ≥20 hydrocele cases per 10,000 adult male population.

It is unclear the minimum number of hydrocele cases that would predict a high risk of ongoing W. *bancrofti* transmission. However, it is also well known that community prevalence of W. *bancrofti* infection has a positive correlation with morbidity prevalence [14,15]. Thus, it was suggested by the NTDP and partners that districts that recorded the highest annual hydrocele cases ≥20 per 10,000 adult male population should be prioritized for confirmatory mapping.

Review of lymphedema data

Two lymphedema datasets were reviewed. The first dataset was collected by Community drug distributors (CDDs) during the 2018 and 2019 MDA for onchocerciasis in 86 districts. The CDDs were given a brief description of lymphedema and hydrocele and photos of cases during training for the MDA. The CDDs carried photos of lymphedema and hydrocele while visiting homes to administer ivermectin, and recorded cases reported by individuals without conducting a physical examination. The second dataset was reported by nonendemic districts in response to the NTD Programmer's request for data to inform this review. Forty districts provided data on hydrocele and lymphedema. The districts reported 1 to 18 lymphedema cases (mean = 5) and 1-65 hydrocele cases (mean = 5). The hydrocele data collected by CDDs was excluded from the analysis due to the reliability of the data and the challenges in confirming these cases [16]. On the other hand, the lymphedema data collected by CDDs served as the primary data. However, in 22 districts where CDDs reported lower or no lymphedema cases, the data reported by the districts was used. This process resulted in lymphedema data for 88 out of the 146 nonendemic districts.

In the 88 districts, 1-32 annual lymphedema cases were reported. The mean case per district was 6.4 with a median of 5 cases. All districts reported less than 10 cases (0.1-5.3) per 10,000 adult population. Assuming 2% infection prevalence and 12.5% of infected persons developing lymphedema [12]; at least 25 lymphedema cases are expected in a 10,000-adult population.

It was unclear the minimum number of lymphedema cases in a district that would predict ongoing W. *bancrofti* infection. There are about twice (1.7 times) as many hydrocele cases as lymphedema cases in LF endemic areas [12], therefore a cut-off of ≥ 10 lymphedema cases were proposed. 18 districts met this criterion to be considered for confirmatory mapping.

Table 2
Inclusion categories and number of districts.

Inclusion category	No. of districts with prevalence ≥ 2%	No. of districts with prevalence ≥ 1%
Share boundary with hotspot; Hydrocele; Lymphedema	2	2
Share boundary with hotspot; Hydrocele; Mapping data	1	1
Share boundary with hotspot; Hydrocele;	1	1
Share boundary with hotspot; Lymphedema	2	2
Share boundary with hotspot; Mapping data	1	1
Hydrocele; Lymphedema	1	1
Hydrocele; Mapping data	6	9
Mapping data; Lymphedema	2	2
Share boundary with hotspot	5	5
Hydrocele	20	17
Lymphedema	11	11
Mapping data	18	30
Total	**70**	**82**

Only districts with hydrocele cases ≥ 20 and/or districts with lymphoedema cases≥ 10 are included in this table.

Wuchereria bancrofti vectors in Ghana

Anopheles gambiae sensu stricto (s.s.), *An. arabiensis* and *An. melas* species of *An. gambiae* sensu lato (s.l.) are the major vectors for *Wuchereria bancrofti* in West Africa [17]. In Ghana, *An. gambie* is considered the most important vector [18], although *An. melas* [19]and *Mansonia spp* [20]. have also been identified as vectors.

Data triangulation

Based on the analysis of the data from the mapping, lymphedema and hydrocele, 70-82 districts will be eligible for confirmatory mapping depending on whether districts with mapping prevalence ≥1.0% (44 districts) or ≥2.0% (28 districts) are included (Table 2, Figure 2). This includes large urban/metropolitan areas like the Kumasi Metropolitan Area (6 districts), Greater Accra Metropolitan Area (1 district), and Tema Metropolitan Area (1 district) which could be excluded from confirmatory mapping based on unstable population and low potential for LF transmission [21,22]; in which case 66-74 districts will be eligible for confirmatory mapping

A phased approach to confirmatory mapping was recommended. First, districts (28) with antigen prevalence ≥2% (2.0-5.3%) will be prioritized. Next, nonendemic districts (12) that share borders with hotspot districts were considered as the next level of priority. The priority districts include two districts with antigen prevalence ≥2% and share boundaries with hotspot districts. The morbidity data was not prioritized in selecting sites for confirmatory mapping. Thus, of the 70 districts, 38 districts with mapping antigen prevalence of ≥2% or sharing borders with a hotspot district were selected for confirmatory mapping. These included: 10 districts that reported 5.7-21.9 cases of hydrocele per 10,000 adult male population; and 6 districts that reported 1.4-5.3 lymphedema cases per 10,000 adult population. Although the morbidity data was not prioritized to include a district for confirmatory mapping, conducting confirmatory mapping in the 38 districts with antigen prevalence ≥2% will provide enough information to analyze morbidity as a possible basis for confirmatory mapping.

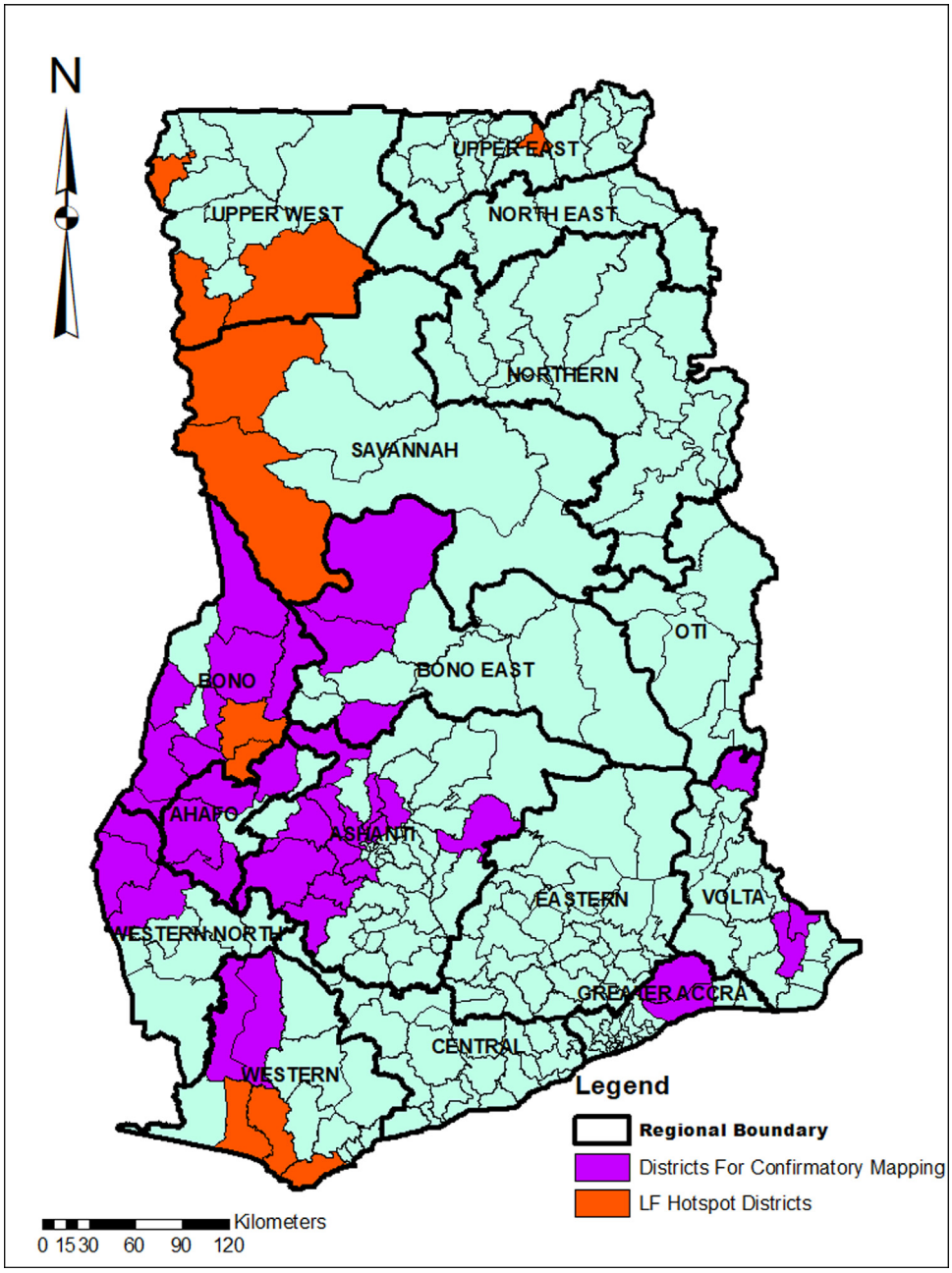

Figure 2. Priority districts for LF confirmatory mapping. Source: Ghana Neglected Tropical Diseases Programme, 2022.

Confirmatory mapping results

A total of 18,459 children were sampled in the 38 districts. 50.6% (9343/18459) were females. Following testing, 28 antigen-positive cases were detected from 17 districts (Table 3). Two districts (Nkoranza South and Wenchi) had more than 3 positive cases (4 and 5 cases respectively). Based on the confirmatory mapping cluster survey threshold, Nkoranza South and Wenchi districts are reclassified as LF endemic. In these two districts, the baseline mapping prevalence was 3% and 5% respectively, with 5.7 and 17.0 hydrocele cases per 10,000 population and 0.9 and 0.7 lymphedema cases per 10,000 populations respectively (Table 4).

The community survey in three subdistricts in the Nkoranza South and Wenchi districts revealed a prevalence of 1.68% (95% CI, 0.92-2.80; range 1.00-5.00) and 4.73% (95% CI, 3.35-6.46; range: 0.96-14.29) respectively (Table 5). In both districts, the number of positives was higher among males than females and those above 20 years. No infections were identified in children 5-9 years. The age range of the positives ranged from 12-88 years.

Discussions

Ghana has been at the forefront of LF elimination, being one of the first countries to initiate MDA through the GPELF [1]. Significant achievements have been made towards the elimination of the disease in endemic districts and communities [1,2]. However, several challenges [23–29] experienced over the last two decades have resulted in the country not being ready to submit the dossier for validation of elimination of the disease as a public health problem. The reporting of clinical cases in districts previously considered nonendemic following earlier mapping exercises further com-

Table 3
Confirmatory mapping results in districts with positive cases.

Districts	District population	No. Tested	No. Positive	Antigen Prevalence % (95% CI)	Prevalence at baseline
Ahafo-Ano South-East	77,446	480	2	0.42 (0.05-1.50)	4.0
Ahafo-Ano South-West	83,590	480	1	0.21 (0.01-1.16)	4.0
Asutifi North[a]	72,297	480	1	0.21 (0.01-1.16)	-
Atwima Nwabiagya South	103,343	480	1	0.21 (0.01-1.16)	6.0
Banda[a]	28,258	480	1	0.21 (0.01-1.16)	-
Bia East	40,560	480	1	0.21 (0.01-1.16)	5.3
Bia West	121,718	480	1	0.21 (0.01-1.16)	5.3
Dormaa East	69,106	480	2	0.42 (0.05-1.50)	3.0
Dormaa West	65,956	480	1	0.21 (0.01-1.16)	3.0
Ningo Prampram	95,379	480	1	0.21 (0.01-1.16)	4.9
Nkoranza North	91,079	480	1	0.21 (0.01-1.16)	3.0
Nkoranza South	125,613	480	4	0.83 (0.23-2.12)	3.0
Offinso North[a]	77,335	480	1	0.21 (0.01-1.16)	-
Tano North[a]	109,917	480	3	0.62 (0.13-1.82)	-
Wassa Amenfi Central[a]	98,052	480	1	0.21 (0.01-1.16)	-
Wassa Amenfi West[a]	131,870	480	1	0.21 (0.01-1.16)	-
Wenchi	122,471	480	5	1.04 (0.34-2.41)	5.0

[a] These districts had no mapping data but were included in the confirmatory mapping survey because they shared borders with LF hotspot districts.

Table 4
Characteristics of the Nkoranza South and Wenchi Districts.

Characteristics	Nkoranza South	Wenchi
Baseline mapping antigen prevalence	3%	5%
Share a border with a hotspot district	No	Yes
Oncho endemic	Yes	Yes
Ivermectin MDA[1] frequency	Bi-annual	Annual
Highest hydrocele cases reported 2014-2019	20	56
Hydrocele cases /10,000 adult male (≥15 years) 2014-2019	5.7	17.0
Highest lymphedema cases 2018-2019	6	15
Lymphedema cases /10,000 population 2018-2019	0.9	0.7

plicates the challenges. With the WHO LF elimination goal of 2030 fast approaching [4], the confirmation of transmission in these districts must be done to enable effective decision-making and implementation of interventions where required.

In this paper, we followed a process to select and evaluate the prevalence of LF in districts previously considered nonendemic. The selection of the districts was based on the baseline mapping data, sharing borders with known hotspot districts, and clinical case reports. This approach resulted in the identification of 70-82 districts for confirmatory mapping, depending on the threshold of infection. A phased approach was adopted where 38 high-risk districts were selected for confirmatory mapping in the first phase, using the methods approved by the WHO [5–7].

Generally, the prevalence of LF in the evaluated districts was low. Twenty-one districts reported no positive cases; while 15 districts reported one to three cases, and two districts reported four, and five cases respectively. These two districts (Nkoranza South and Wenchi) have therefore met the critical threshold of >3 positives and 1% infection recommended by WHO for the implementation of MDA [8,30], with the upper level of the 95% confidence interval exceeding the 2% antigen prevalence threshold. The results in these two districts were further confirmed by the

Table 5
LF antigen prevalence in Nkoranza South and Wenchi Districts.

District/Sub-district/Community	Tested	Positive	% Prevalence (95% CI)	Males	Females
Nkoranza South District	833	14	1.68 (0.92-2.80)	10	4
Ayerede Sub-district	199	2	1.01 (0.12-3.58)	1	1
Ayerede Newtown	99	1	1.01 (0.03-5.50)	1	
Dagaati line	100	1	1.00 (0.03-5.45)		1
Bonsu Sub-district	234		0 (0-1.56)		
Asunkwa	84		0 (0-4.30)		
Bonsu Town	50		0 (0-7.11)		
Koforidua	100		0 (0-3.62)		
Donkoro Nkwanta Sub-district	400	12	3.00 (1.56-5.18)	9	3
Donkro Nkwanta	100	3	3.00 (0.62-8.52)	2	1
Kyerefene	100	5	5.00 (1.64-11.28)	5	
Salam Krom	100		0 (0-3.62)		
Kyiradeso	100	4	4.00 (1.10-9.93)	2	2
Wenchi District	782	37	4.73 (3.35-6.46)	26	11
Asuogya Sub-district	209	22	10.53 (6.72-15.50)	16	6
Kanease	82	9	10.98 (5.14-19.92)	6	3
Mframaso	106	10	9.43 (4.62- 16.67)	8	2
Pokukrom	21	3	14.29 (3.05-36.34)	2	1
Nchiraa Sub-district	272	1	0.37 (0.01-2.03)	1	
Bonkro	91	1	1.10 (0.03-5.97)	1	
Botenso	91		0 (0-3.97)		
Pramaso	90		0 (0-4.02)		
Tromeso Sub-district	301	14	4.65 (2.57-7.68)	9	5
Bipotrim	101	4	3.96 (1.09-9.83)	2	2
Buoku Nkwanta/Abriefakrom	104	1	0.96 (0.02-5.24)		1
Tromeso	96	9	9.38 (4.38-17.05)	7	2

population-wide cross-sectional survey in three sub-districts, revealing widespread infections. All positive cases reported living in their districts their entire life, indicating the presence of local transmission in these settings.

These findings suggest that there may have been errors in the delineation of districts as endemic or nonendemic, following the initial mapping exercises. The selection of sites 25 km or 50 km away from each other and the use of modelling to extrapolate the distribution of LF across the country may have resulted in the endemic districts being missed [3,31]. In the mapping studies [3], there were communities with antigen prevalence 2% and above, yet the districts were not included in MDA since the overall prevalence was less than 2%. Thus, while village-level antigen prevalence may be higher than the 2% required to implement MDA [6,10], the district-level prevalence may indicate otherwise, and the modelling identified such areas as low risk. However, the validation of the mapping data in 13 sites indicated a higher prevalence (5.0-48.0%) than the initial survey (0.0-12.3%). The authors therefore concluded that the initial prevalence in these sites may have been underestimated due to the batch of ICT card used and their relative sensitivity, and the sampling bias (50-100 adults). Nonetheless, the delineation of endemic areas based on earlier studies is understandable due to the limitation of resources available at the time, and the need to rapidly map and prioritize areas for treatment at the beginning of the GPELF. The availability of funding and logistics are important factors that determine the ability to undertake control programmers.

While this study was conducted in districts previously considered nonendemic and untreated areas, the results from the districts with a low number of cases indicate that low-level transmission and prevalence may persist in the country post-MDA, with the current programme being one of elimination as a disease of public health programme and not the elimination of transmission. The GPELF treatment strategy in Africa relies on the assumption that below a certain threshold, transmission of W. *bancrofti* by anopheline vectors could be interrupted [32]. However, studies in Ghana have shown the increased efficiency of Anopheles vectors and other mosquito species in the transmission of the disease [19,20,33]. Thus, an assessment of the LF transmission indices needs to be undertaken in these districts, especially in the face of climate change and its impact on vectors.

It is important to safeguard the gains made through the GPELF. While the risks of resurgence may be low, studies indicate that this is a possibility in the long term [34–36]. Thus, this study highlights the need for confirmatory mapping in districts previously not considered endemic, but where clinical cases have been reported. Studies in districts classified as nonendemic by the national program for control of filariasis in the state of Madhya Pradesh – India, but where clinical cases were subsequently reported, revealed microfilariae prevalence between 3.8% and 11.2% [37]. This therefore reinforces the need to reevaluate districts considered nonendemic, but with clinical case reports. In this first phase of activities, only 38 districts were surveyed. There is therefore the need to undertake confirmatory mapping in the remaining districts identified through the review process. As the aim of the GPELF is to eliminate LF as a public health problem, the Ghana NTD programme has therefore initiated MDA in the Nkoranza South and Wenchi Municipal districts. The use of the triple drug regimen: ivermectin, diethylcarbamazine and albendazole (IDA) would accelerate LF elimination in the two districts, however, this is not possible due onchocerciasis co-endemicity. Implementing MDA using ivermectin and albendazole may require many years of treatment to achieve interruption of LF transmission. There is an opportunity to adopt strategies aimed at achieving high MDA coverage [28], coupled with vector control [38–40] to help accelerate elimination in these new districts. Monitoring and surveillance will be required in the remaining districts where the number of positive cases did not reach the threshold.

In conclusion, the selection of districts based on a review of baseline prevalence data, number of hydrocele and lymphedema cases, and closeness to hotspot districts for confirmatory mapping has identified districts in Ghana with sufficient cases to warrant the implementation of MDA. Confirmatory mapping will have to be completed for the remaining districts identified through the data review. Where cases have been identified but not sufficient to initiate MDA, monitoring and surveillance will be needed. The process undertaken by the Ghana Programme can serve as a guideline for the selection of sites for confirmatory mapping in other countries where there is a need for reassessment.

Declaration of competing interest

The authors have declared that no competing interests exist.

Ethical approval

Ethical approval for the study was obtained from the Ghana Health Service Ethical Review Committee (GHS-ERC: 007/06/22). Permission was obtained from the Regional and District Directors of Health, Education and the teachers. All study data were handled in compliance with GCP guidelines, and members of the study teams participated in training covering the purpose of the study. COVID-19 precautions were observed during the exercise.

Authors contributions

Scoping review: JLO, DKdS, BA, EM, EN, OA, JS, CB-D, IDD, AK, EOM; Study design: JLO, CB-D, IDD, AK, EOM; Data collection: BA, EM, EN, OA, JS; Data analysis: JLO, DKdS, BA, EM, CB-D, EOM; Writing: JLO, DKdS, BA, EM, EN, OA, JS, CB-D, IDD, AK, EOM.

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