INTERNATIONAL JOURNAL OF HEALTH & MEDICAL RESEARCH

ISSN(print): 2833-213X, ISSN(online): 2833-2148

Volume 05 Issue 01 January 2026

DOI : 10.58806/ijhmr.2026.v5i1n12

Page No. 67 - 75

Epidemiological Mapping of Male Genital Schistosomiasis Coexisting with Human Immunodeficiency Virus Infection in Wajari Community of Gombe State

Ibrahim Rabiu [1,2*], Halima Farouk Usman [3,4], Muazu Ishaqa Shuaibu [5,6], Dawa Sambo [7,8], Ahmed Muhammed Umar [9,10], Muhammed Mustapha Kura [9], Abdulmanan Yahaya [11], Kennedy Poloma Yoriyo [12].

[1]Department of Community Medicine, Gombe State University, Gombe State Nigeria
[2]Department of Community Medicine, Federal Teaching Hospital, Gombe State, Nigeria
[3]Department of Obstetrics and Gynaecology, Gombe State University, Gombe State, Nigeria
[4]Department of Obstetrics and Gynaecology, Federal Teaching Hospital, Gombe State, Nigeria
[5]Department of Family Medicine, Gombe State University, Gombe State, Nigeria
[6]Department of Family Medicine, Federal Medical Centre, Kumo, Gombe State, Nigeria
[7]Department of Ophthalmology, Gombe State University, Gombe State, Nigeria
[8]Department of Ophthalmology, Specialist Hospital, Gombe State, Nigeria
[9]Department of Surgery, Gombe State Univeristy, Gombe State, Nigeria
[10]Department of Surgery, Federal Teaching Hospital, Gombe State, Nigeria
[11]Department of Child Dental Health, Faculty of Dentistry, Bayero University Kano, Nigeria
[12]Department of Zoology, Gombe State University, Gombe State, Nigeria

ABSTRACT

Background: Male Genital Schistosomiasis (MGS), a chronic complication of *Schistosoma haematobium* infection, remains largely under-diagnosed despite its potential to facilitate HIV transmission. This study mapped the epidemiological burden of MGS and HIV in the Wajari ward of Gombe State, Nigeria.

Methods: A multi-stage cross-sectional study was conducted among 420 adult farmers (294 completed) in Wajari Ward. Data were collected via questionnaires and clinical examinations. Urine samples were analyzed for *S. haematobium* eggs using filtration and microscopy. MGS and HIV burdens were estimated based on "probable cases" due to none participant consent for semen analysis and HIV screening. Spatial mapping was utilized to correlate urogenital schistosomiasis (UGS) prevalence with clinical MGS and HIV clusters.

Results: The overall prevalence of UGS confirmed by urine microscopy was 15.99% (47/294) with Wajari Jodoma recorded the highest intensity of infection (10/35 positive; 28.57%) The prevalence of probable MGS was high, with the highest concentration in Wajari Jodoma (21.97%) and Jauro Bala (17.42%). Probable HIV cases peaked in Botso Botso (20.22%) and Kembuyel (17.42%). Wajari Jodoma emerged as a critical hotspot for co-endemicity (15.17% HIV; 21.97% MGS). Spatial mapping confirmed that areas with the highest UGS burden (16.15% - 18.73%) aligned with high clinical MGS reports, particularly in riverine communities. The mapping revealed distinct geographical clusters correlated with proximity to freshwater bodies and socio-behavioral factors.

Conclusion: The coexistence of confirmed UGS and probable MGS/HIV in Wajari Jodoma confirms the presence of a syndemic hotspot. With an overall UGS prevalence of nearly 16%, the community remains at high risk for the chronic reproductive complications of MGS. Mapping the burden has successfully identified that the southern communities require urgent, integrated interventions combining Praziquantel treatment with HIV screening and urological care.

KEYWORDS: Male Genital Schistosomiasis, HIV, Gombe State, Epidemiological Mapping, *Schistosoma haematobium*.

INTRODUCTION

Schistosomiasis is a leading neglected tropical disease (NTD), affecting over 200 million people worldwide, with more than 95% of cases concentrated in sub-Saharan Africa (SSA) [1]. Nigeria carries the highest burden of the disease globally, with approximately 29 million people infected, representing 14% of the global total [2]. While the intestinal and urinary pathologies

of *Schistosoma* species are well-documented, the chronic effects on host genitalia—specifically Male Genital Schistosomiasis (MGS)—are frequently overlooked in clinical and public health settings.

MGS is a chronic complication of urogenital schistosomiasis (UGS) caused by *Schistosoma haematobium* eggs and the resulting immune-pathological reactions in the male reproductive tract [3]. Despite being first described over a century ago [4], the epidemiology and management of MGS remain poorly understood due to limited research and a lack of diagnostic focus. The presence of schistosomal eggs in genital organs triggers granuloma formation, inflammation, and fibrosis [5]. Patients often present with pelvic or coital pain, haemospermia, and infertility, symptoms that are frequently underreported or misdiagnosed as standard sexually transmitted infections (STIs) [6, 7].

Recent global health interest has focused on Female Genital Schistosomiasis (FGS) as a significant risk factor for HIV transmission in women [8]. However, evidence suggests a similar relationship between MGS and HIV. MGS-induced genital lesions and the presence of leukocytes in semen may increase the risk of HIV transmission [8, 9]. Studies have shown that treatment with Praziquantel (PZQ) can effectively reduce HIV incidence and seminal viral loads in co-infected individuals [9]. Despite these links, HIV prevalence remains high in SSA,[10] and the specific contribution of MGS to the HIV epidemic in Nigeria is insufficiently characterized.

In Gombe State, particularly in riverine farming communities like in Wajari ward, the risk of UGS and MGS is high due to frequent water contact. This study aims to provide the first comprehensive epidemiological map of MGS and HIV coexistence in the Wajari ward. By identifying disease hotspots and assessing the spatial distribution of these infections, this research provides the evidence-based foundation required for prioritizing control strategies in line with the Nigerian National NTDs Master Plan and the Sustainable Development Goals (SDGs).

METHODS AND MATERIALS

Study Area and Population

The study was conducted in the communities in Wajari ward as shown figure 1 below, Yamaltu Deba Local Government Area (LGA), Gombe State, Nigeria. Wajari is a riverine ward consisting of nine communities and 51 settlements, with a population of approximately 21,925 people living in 6,405 households. The primary occupation is farming, which involves significant contact with infested water bodies.

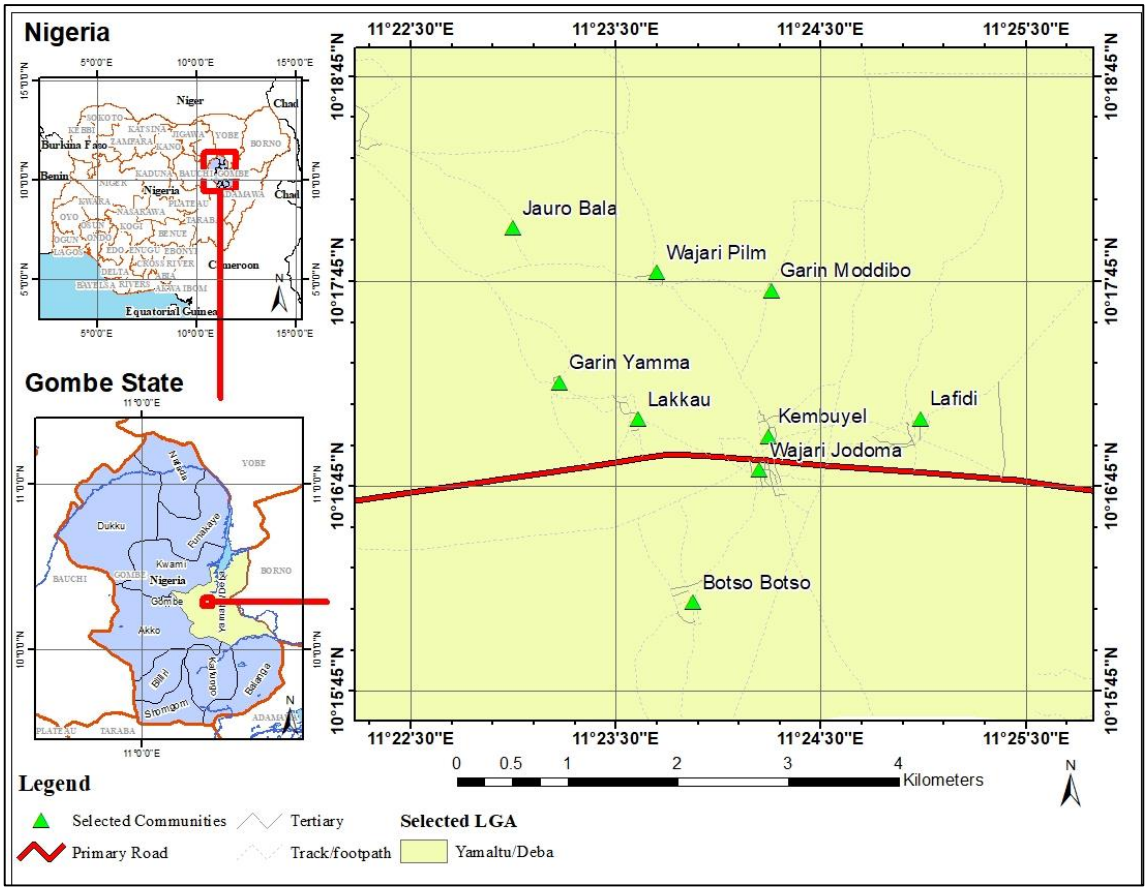

Figure 1: Study Areas in Wajari Community

Epidemiological Mapping of Male Genital Schistosomiasis Coexisting with Human Immunodeficiency Virus Infection in Wajari Community of Gombe State

Study Design and Sampling

A cross-sectional study design was utilized. A multi-stage sampling method was employed to recruit 420 participants, using the household as the primary unit of study. Inclusion criteria were adult farmers (aged 18 and above) who provided written informed consent.

Data Collection

Standardized questionnaires, adapted from previous validated studies [11], were used to collect socio-demographic information and clinical features suggestive of MGS (e.g., haemospermia, genital pain) and HIV. Physical examinations were offered at a nearby health facility.

Parasitological Analysis

Following questionnaire administration, consented participants submitted 10 ml mid-stream urine samples. Samples were analyzed for macro-hematuria and micro-hematuria using reagent strips (Siemens Multistix 10G). To confirm *S. haematobium* infection, the entire volume was filtered through a 20µm nylon mesh membrane using a Swinnex plastic holder. The membranes were examined under light microscopy at × 100 magnifications with Lugol's iodine to identify and quantify schistosomal eggs.

Case Definitions

Due to the high refusal rate for semen collection and HIV screening among participants, the study utilized "probable case" definitions:

- **Probable MGS:** Participants exhibiting clinical features of MGS (genital pain, haemospermia) without semen microscopy confirmation.
- **Probable HIV:** Participants with clinical features suggestive of HIV infection who had never been screened.

Data Analysis

Data were managed in Microsoft Excel and analyzed using R. Given the non-normal distribution of the data, non-parametric statistics were applied. Frequencies and proportions were used to define prevalence. Spatial distribution was mapped by community to identify clusters of infection.

Spatial Mapping and Data Synthesis

Spatial distribution data were analyzed to determine the prevalence of UGS across the nine communities. A Geographical Information System (GIS) was utilized to map the "Burden of Schistosomiasis," categorized by intensity ranges from 4.62% to 18.73%. This map was cross-referenced with probable clinical cases of MGS and HIV to identify zones of co-endemicity.

Ethical Consideration

Ethical clearance was obtained from the State Ministry of Ethic Committee (MOH/ADM/621/V.1/482) and written informed consent was obtained from the participants. As a Standard of care the participants were give a single dose of praziquantel.

RESULTS

Socio-demographic and Household Profiles

A total of 294 male farmers completed the study. The majority (26.0%) were aged 21–30, followed closely by the 31–40 age group (25.0%). Educational levels were low, with 71.4% having only informal education. Farming was the primary occupation (39.8%). Household data revealed that 95% of participants had lived in Wajari for over 5 years. Water sources were varied, with 34.4% using a combination of pipe-borne water and wells, while others relied heavily on rivers and boreholes. Sanitation was poor; though 94.9% reported using pit latrines, environmental exposure remained high.

Table 1: Socio-demographic Characteristics

S/N	Items	Frequency	Percentage
1	AGE		
	< 21	53	18.0
	21 to 30	75	26.0
	31 to 40	73	25.0
	41 to 50	37	12.6
	51 to 60	54	18.4
	Total	294	100
2	Gender		
	Male	294	100
4	Educational status		
	Informal	210	71.4

	Primary	39	13.3
	Secondary	45	15.3
	Total	294	100
5	Occupation status		
	Artisan	12	4.1
	Business	39	13.3
	Driving	15	5.1
	Farming	117	39.8
	Not gainfully employed	99	33.7
	Okada rider	3	1.0
	Security	3	1.0
	Tailoring	6	2.0
	Total	294	100
6	Marital status		
	Divorced	9	3
	Married	258	87.8
	Single	27	9.2
	Total	294	100
9	Tribe		
	Babarbari	18	6.1
	Bolanci	6	2.0
	Fulani	151	51.4
	Hausa	45	15.3
	Kanuri	26	9.0
	Tera	12	4.1
	Waja	36	12.1
	Total	294	100

Table 2: Household Characteristics

S/N	Items	Frequency	Percentage
1	Duration in years stay at Wajari		
	< 1	3	1.0
	1-4	12	4.0
	≥ 5	279	95.0
	Total	294	100
2	Years of marriage		
	<1	4	1.4
	1 – 4	47	15.9
	≥5	243	82.7
	Total	294	100
3	Number of children		
	None	30	10.2
	1-5	105	35.7
	6-10	117	39.8
	>10	42	14.3
	Total	294	100
4	Monthly House Income (₦)		
	<5000	27	15.0
	N5001 - N10000	36	20.0
	N10001 - N20000	60	33.3
	N20001 - N50000	39	21.7
	> N50000	18	10.0
	Total		
5	Sources of water		
	Borehole	35	11.9
	Borehole and river	45	15.3
	Pipe borne water and well	101	34.4

	Pipe borne water	8	2.7
	Stream water	3	1.0
	Well and borehole	39	13.3
	Well water	63	21.4
6	Toilet facilities		
	Open defecation	9	3.1
	Pit latrine	279	94.9
	Pit latrine/open defecations	3	1.0
	Water closet	3	1.0
	Total	294	100

Urogenital Schistosomiasis (UGS) Prevalence

Out of 294 participants, 47 (15.99%) tested positive for *S. haematobium* via urine microscopy. The distribution was highly uneven across the ward:

- **Wajari Jodoma:** Recorded the highest number of positive cases (10/35), correlating with its status as the highest MGS hotspot (21.97%).
- **Wajari Pilm:** Showed a high infection rate relative to its sample size (8/25).
- **Lakkau and Jauro Bala:** Exhibited the lowest UGS positivity rates (2 cases each).

Integrated Mapping Analysis

The mapped schistosomiasis burden (Figure 2) reveals that the highest intensity (darkest shading, (16.15% - 18.73%) is concentrated in the southern and eastern sectors of the ward, particularly around **Wajari Jodoma** and **Lafidi**.

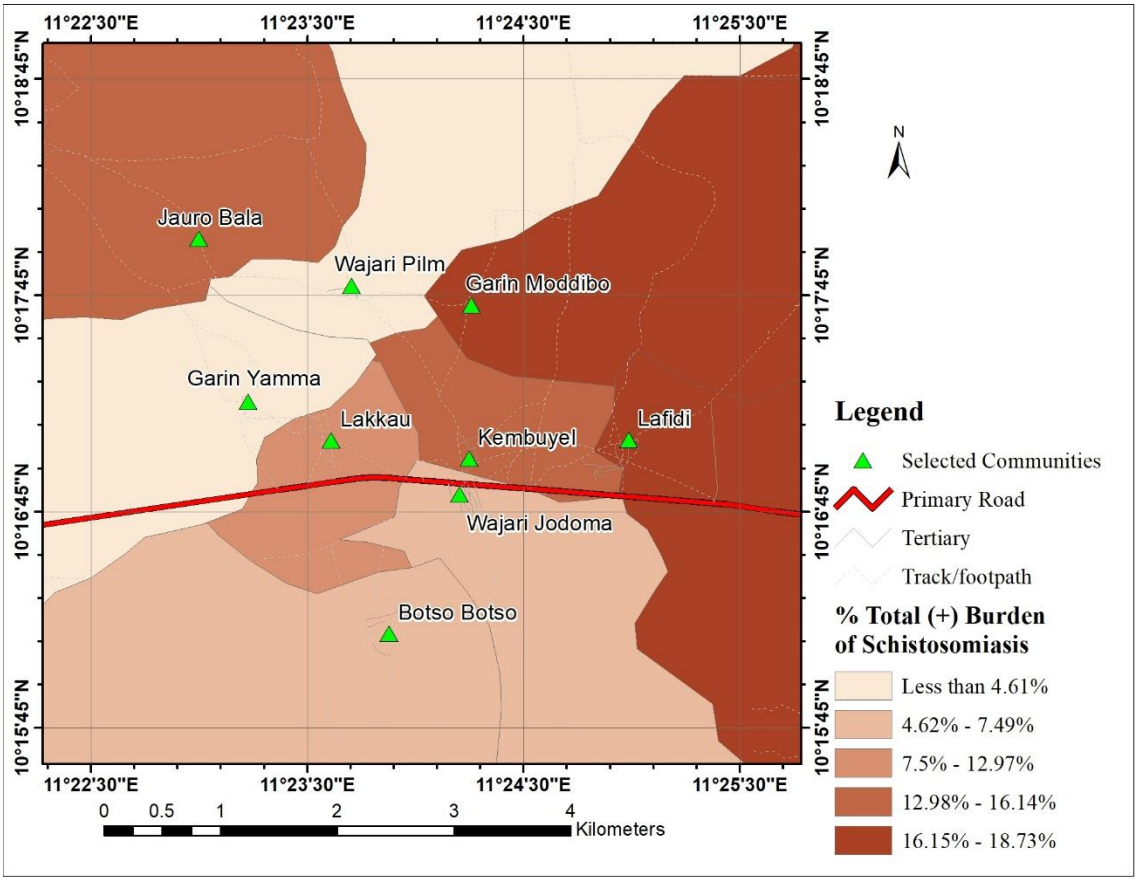

Figure 2: Mapping Hotspots of Schistosomiasis Burden across Communities in Wajari Ward

Epidemiological Mapping of Male Genital Schistosomiasis Coexisting with Human Immunodeficiency Virus Infection in Wajari Community of Gombe State

Spatial Distribution of MGS and HIV

The study identified a total of 132 probable MGS cases and 178 probable HIV cases across nine communities (Table 1).

Table 1: Spatial Distribution of Probably cases of HIV and MGS Cases across Wajari Wards

Community Name	Probable HIV (n)	Probable MGS (n)	% Total HIV	% Total MGS
Jauro Bala	25	23	14.04	17.42
Garin Yamma	10	18	5.62	13.64
Botso Botso	36	15	**20.22**	11.36
Wajari Jodoma	27	29	15.17	**21.97**
Lafidi	8	6	4.49	4.55
Garin Moddibo	20	7	11.24	5.30
Wajari Pilm	5	10	2.81	7.58
Kembuyel	31	11	17.42	8.33
Lakkau	16	13	8.99	9.85
Total	178	132	100.00	100.00

Mapping Hotspots

The spatial mapping reveals Wajari Jodoma as the primary hotspot for MGS (21.97% of cases) as in figure 3 below. Conversely, Botso Botso represents the highest burden for HIV (20.22%) (Figure 4). Crucially, Wajari Jodoma and Jauro Bala showed high prevalence for both conditions, indicating zones of significant co-endemicity. In contrast, communities like Garin Yamma showed high MGS but low HIV, while Kembuyel showed high HIV but relatively lower MGS.

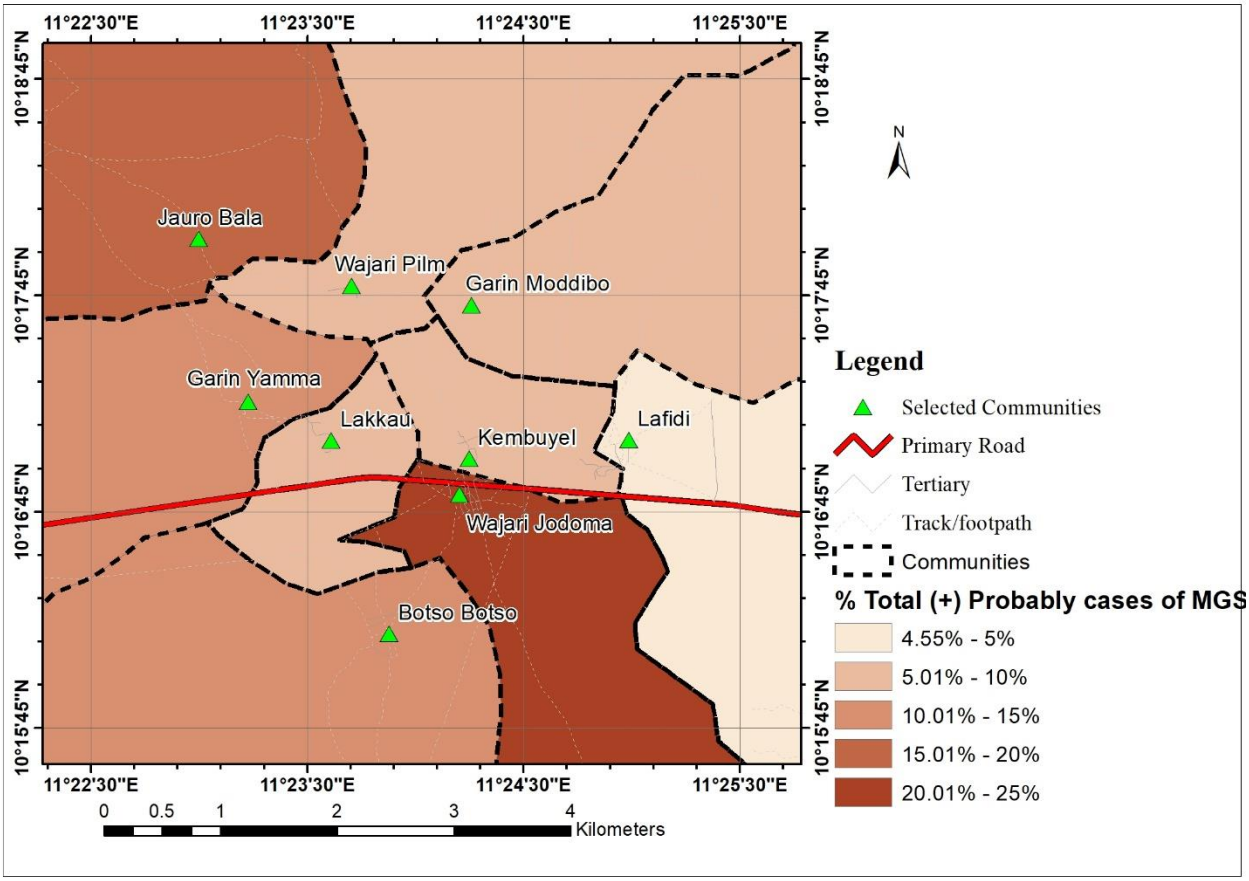

Figure 3: Mapping Hotspots of MGS Burden across Communities in Wajari Ward

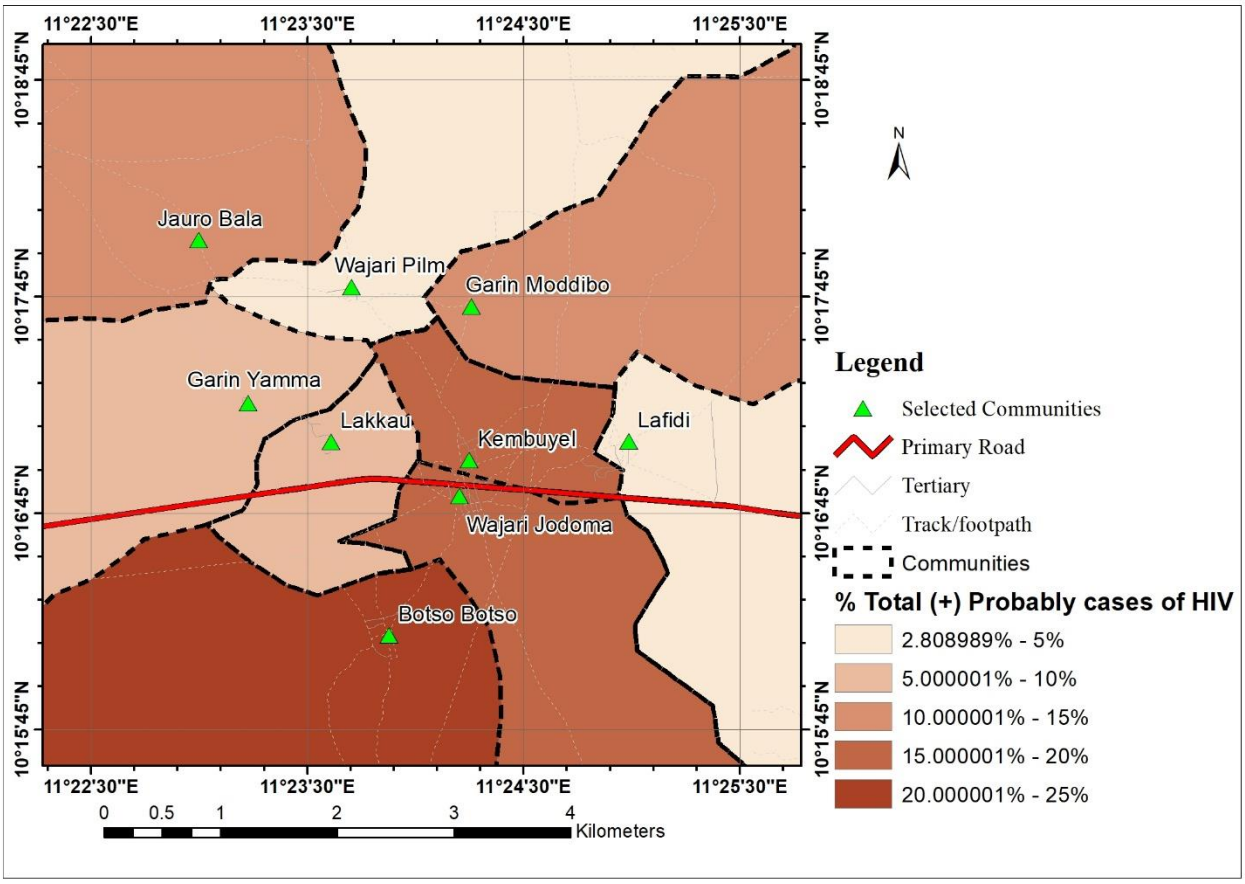

Figure 4: Mapping Hotspots of HIV Burden across Communities in Wajari Ward

DISCUSSION

This study provides epidemiological evidence on the coexistence of male genital schistosomiasis (MGS) and HIV infection in Wajari ward, Gombe State, contributing to the growing body of literature highlighting the public health significance of urogenital schistosomiasis beyond its traditional classification as a neglected tropical disease. The findings reinforce the hypothesis that *Schistosoma haematobium* infection of the male genital tract may play a critical role in enhancing susceptibility to HIV acquisition and transmission.

The epidemiological mapping of Male Genital Schistosomiasis (MGS) and Human Immunodeficiency Virus (HIV) in the Wajari community reveals a complex landscape of co-endemicity. Data from this study indicates a high prevalence of probable MGS suggesting that urogenital schistosomiasis (UGS) is a deeply entrenched public health issue in this farming community. This aligns with Nigeria's status as a high-burden country for neglected tropical diseases (NTDs).(2) However, the spatial variation across different communities highlights that transmission is highly localized, likely driven by proximity to specific freshwater contact points and irrigation tracks.

The inclusion of parasitological data confirms that Wajari Jodoma is the epicenter of urogenital and genital schistosomiasis in this region. The high positivity rate for *Schistosoma haematobium* eggs via urine microscopy in this community directly supports the high clinical reporting of MGS symptoms. The spatial mapping confirms that the burden of schistosomiasis is not uniform; the southern cluster exhibits significantly higher intensity, which correlates with local environmental risk factors and the presence of infested freshwater bodies.

Male genital schistosomiasis is increasingly recognized as an underdiagnosed manifestation of urogenital schistosomiasis, characterized by egg deposition and inflammatory lesions in the prostate, seminal vesicles, epididymis, and testes [12,13]. Inflammatory responses associated with MGS have been shown to alter cytokine profiles in semen, resulting in elevated levels of pro-inflammatory mediators that may compromise mucosal integrity and increase HIV target cell recruitment [12]. Such immunological changes provide a biologically plausible mechanism linking MGS to increased HIV transmission risk.

The identification of "hotspots" like Wajari Jodoma, where both HIV and MGS burdens are high, is perhaps the most significant finding. Existing literature suggests that MGS-induced inflammation and genital lesions may act as a biological "gateway," increasing the susceptibility to HIV and the infectivity of those already living with HIV [8, 14]. In communities like Wajari Jodoma, the dual burden likely creates a syndemic effect, where the two diseases interact to worsen the health outcomes of the population.

The observed coexistence of MGS and HIV in this study aligns with earlier epidemiological studies from sub-Saharan Africa demonstrating a positive association between urogenital schistosomiasis and HIV infection [13,15]. Mbabazi et al. reported higher HIV prevalence among individuals infected with *S. haematobium*, suggesting that schistosomiasis-associated genital pathology may facilitate HIV acquisition [13]. Similarly, systematic reviews have highlighted the potential of treating male genital schistosomiasis as a complementary HIV prevention strategy, particularly in endemic settings [15].

Interestingly, Botso Botso presents a divergent epidemiological profile. While it carries the highest probable HIV burden, it has a relatively moderate UGS positivity rate. This suggests that while MGS is a recognized biological risk factor for HIV transmission, other socio-behavioral drivers—such as patterns of mobility and proximity to the primary road network—may influence HIV distribution independently of schistosomiasis in certain settlements. Consequently, the disparity in disease distribution between communities like Botso Botso and Garin Yamma underscores the necessity of a "precision public health" approach, where interventions are tailored to the specific determinants of each sub-community.

The high infection rates UGS observed in Wajari Pilm despite its smaller sample size highlight the persistent risk of localized "micro-outbreaks." The spatial intelligence gained from mapping the burden range of UGS allows for precision mapping, ensuring that mass drug administration (MDA) and health education programs are not just ward-wide but community-specific, targeting high-intensity zones first to maximize resource efficiency.

A major challenge encountered in this study was the refusal of participants to provide semen samples or undergo HIV screening. This reflects deep-seated cultural taboos, fear of stigmatization, and lack of awareness regarding MGS. The reliance on "probable cases" based on clinical symptoms and urine microscopy, while useful for mapping, likely underestimates the true burden of MGS, as many infections may be subclinical or present without detectable eggs in urine [16]. This highlights the urgent need for better community engagement and the development of non-invasive, culturally acceptable diagnostic tools for MGS

While this study provides valuable insights, limitations include the reliance on available diagnostic tools and the cross-sectional nature of the data, which precludes causal inference. Future longitudinal and interventional studies incorporating advanced diagnostics and immunological markers are needed to further elucidate the causal pathways linking MGS and HIV.

CONCLUSION

This study provides the first detailed epidemiological map of the dual burden of MGS and HIV in the Wajari community of Gombe State. The findings demonstrate that MGS is a widespread but geographically clustered complication of schistosomiasis among adult farmers. The significant overlap between MGS and HIV in specific communities like Wajari Jodoma identifies priority areas for integrated health services. Efforts to eliminate schistosomiasis must expand beyond school-aged children to include adult men, specifically targeting MGS as a component of reproductive health and HIV prevention.

Policy Implications: The Federal and State Ministries of Health should integrate MGS screening and Praziquantel distribution into existing HIV/AIDS and reproductive health programs, particularly in co-endemic hotspots. Current Mass Drug Administration (MDA) strategies often prioritize school-aged children. Policies must be updated to include adult farmers in riverine areas to address the reservoir of MGS. Targeted health education programs are needed to de-stigmatize genital symptoms and encourage the submission of samples for diagnostic testing. Use the spatial maps generated in this study to facilitate the equitable distribution of NTD medicines and HIV prevention resources to the highest-risk settlements

REFERENCES

1) Hotez PJ, Kamath A, 2009. Neglected tropical diseases in subSaharan Africa: review of their prevalence, distribution, and disease burden. PLoS Negl Trop Dis 3, e412
2) Moné H, Ibikounlé M, Massougbodji A, Mouahid G, 2010. Human schistosomiasis in the economic community of West African states: epidemiology and control. Adv Parasitol 71, 33-91.
3) Leutscher P, Ramarokoto C-E, Reimert C, Feldmeier H, Esterre P, et al. Community-based study of genital schistosomiasis in men from Madagascar. Lancet. (2000) 355:117–8. doi: 10.1016/S0140-6736(99)04856-4
4) Madden FC. Two rare manifestations of bilharziasis. Lancet 1911; 178: 754–755.
5) Poggensee G, Feldmeier H. Female genital schistosomiasis: facts and hypotheses. Acta Tropica. (2001) 79:193– 210. doi: 10.1016/S0001-706X (01)00086-9
6) Bustinduy AL, King CH. Schistosomiasis. In: eds. Farrar J, Hotez PJ, Junghanss T, Kang G, Lalloo D, White NJ, editors. Manson's Tropical Diseases, 23rd ed. China: Elsevier Health Sciences. (2014). p. 698–725.
7) Vilana R, Corachan M, Gascon J, Valls E, Bru C. Schistosomiasis of the male genital tract: transrectal sonographic findings. J Urol. (1997) 158:1491– 3. doi: 10.1016/S0022-5347(01)64251-4
8) Leutscher PDC, Pedersen M, Raharisolo C, Jensen JS, Hoffmann S, Lisse I, et al. Increased prevalence of leukocytes and elevated cytokine levels in semen from Schistosoma haematobium-infected individuals. J Infect Dis. (2005) 191:1639–47. doi: 10.1086/429334

9) Midzi N, Mduluza T, Mudenge B, Foldager L, Leutscher PDC. Decrease in seminal HIV-1 RNA load after praziquantel treatment of urogenital schistosomiasis coinfection in HIV-positive men - an observational study. Open Forum Infect Dis. (2017) 4: ofx199. doi: 10.1093/ofid/ofx199
10) Negin, J., & Cumming, R. G. (2010). HIV infection in older adults in sub-Saharan Africa: extrapolating prevalence from existing data. Bulletin of the World Health Organization, 88(11), 847–853. https://doi.org/10.2471/BLT.10.076349
11) Leutscher, P.D.C., Pedersen, M., Raharisolo, C., Jensen, J.S., Hoffmann, S., Lisse, I., Ostrowski, S.R., Reimert, C.M., Mauclere, P., Ullum, H. Increased prevalence of leukocytes and elevated cytokine levels in semen from Schistosoma haematobium-infected individuals. J. Infect. Dis.2005; 191 (10), 1639–1647. https://doi.org/ 10.1086/429334 (Available at: bGo to ISIN://WOS:000228465000009)
12) Kjetland EF, Ndhlovu PD, Gomo E, et al. Cytokine levels in semen from Schistosoma haematobium-infected individuals. J Infect Dis. 2005;191(10):1639–1647.
13) .Mbabazi PS, Andan O, Fitzgerald DW, et al. Examining the relationship between urogenital schistosomiasis and HIV infection. PLoS Negl Trop Dis. 2011;5(12):e1396
14) Leutscher, P., Ramarokoto, C.-E., Reimert, C., Feldmeier, H., Esterre, P., Vennervald, B.J. Community-based study of genital schistosomiasis in men from Madagascar. Lancet 2000; 355 (9198), 117–118. https://doi.org/10.1016/s0140-6736(99)04856-4.
15) Stecher CW, Kallestrup P, Kjetland EF, et al. Considering treatment of male genital schistosomiasis as a tool for future HIV prevention: a systematic review. Int J Public Health. 2015;60(7):839–848.
16) Midzi, N., Mduluza, T., Mudenge, B., Foldager, L., Leutscher, P.D.C. Decrease in seminal HIV-1 RNA load after praziquantel treatment of urogenital schistosomiasis coinfection in HIV-positive men—an observational study. Open Forum Infect. Dis. 2017; 4 (4), ofx199. https://doi.org/10.1093/ofid/ofx199 Available at:. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC5695621/.