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Review Article

A Systematic Review and Meta-Analysis of the Prevalence of Human Immunodeficiency Virus in Plateau State, Nigeria

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Abstract

Introduction: The Human Immunodeficiency Virus (HIV) infection is now in its fifth decade and remains a devastating public health challenge. However, limited local evidence on the prevalence pattern remains a major gap. This systematic review synthesized existing data to provide evidence-based insights into the HIV situation and to support bottom-up sustainable health strategies. The study collated relevant studies to estimate the prevalence of HIV in Plateau State, Nigeria.

Methods: This systematic review was reported in accordance with the PRISMA guidelines. The literature was searched in PubMed, Scopus, EMBASE, Global Health, HINARI, among other databases, using search terms and keywords combined with Boolean operators to retrieve primary published studies between January 1, 1990, and December 31, 2023. R-version 4.0.2 was used to estimate the pooled overall and gender-based HIV prevalence with 95% confidence interval (CI) under a random-effects model. Heterogeneity analysis indicated substantial variation across studies, with an I^2 value > 90% among 26 studies involving 655,060 participants. Egger's regression showed evidence of publication bias, although the funnel plot appeared symmetrical, with studies distributed around the pooled effect size.

Results: The pooled HIV prevalence was 6.32% (95% CI: 4.29-9.21), I2 = 100%, $P < 0.001$. Subgroup analysis revealed the highest HIV prevalence among females, at 5.73% (95% CI: 3.69 – 8.80), I2 = 98.8%, $P < 0.001$, and among males, at 1.35% (95% CI: 0.64-2.82), I2 = 94.4%, $P < 0.001$.

Conclusion: The high variability observed among the studies demonstrated substantial heterogeneity, likely due to gender-related vulnerability to HIV infection. A gender-based HIV prevention strategy, with priority given to the most at-risk women, should be designed and implemented to halt both vertical and horizontal transmission of HIV.

Keywords: HIV prevalence, General population, Plateau state, Nigeria

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Introduction

The Human Immunodeficiency Virus (HIV)/Acquired Immunodeficiency Syndrome (AIDS) epidemic has entered its fifth decade and remains one of the major public health challenges, impacting millions of individuals globally. Low- and middle-income countries are the most affected.[1] Worldwide, efforts in HIV/AIDS research and interventions over the last four decades have led to significant improvements in reducing the burden of the infection on development.[1-3] The core values that have boosted the HIV response during this period align with the Sustainable Development Goals (SDGs) principle that "no one should be left behind," which has guided campaigns against social inequalities, discrimination, and human rights violations linked to the spread of HIV. These principles have shaped the global HIV response and contributed substantially to progress toward SDG target 3.3, which aims to end the AIDS pandemic, although its impacts extend beyond the public health realm.[1,4,5]

Consequently, new HIV infections have decreased by 39% since 2010 and by 60.0% in 2023 since the epidemic peaked in 1995.[1] Similarly, the rate of new infections in Sub-Saharan Africa declined by 56.0% between 2010 and 2023, in a region that initially accounted for the highest burden of infection worldwide.[6,7] For the first time, for instance, the number of people testing HIV-positive dropped by 47.0% between 2015 and 2020.[8,9] Uganda, Zimbabwe, Tanzania, Zambia, and Nigeria, which

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previously contributed to the global HIV burden, have experienced substantial declines.[6,10]

In Nigeria, the dynamics of the epidemic are not different. Since the first two cases were diagnosed and reported in 1986, the prevalence declined to 1.4% in 2018 from a peak of 5.8% in 2001.[10] In Plateau state, the prevalence peaked at 11.0% in 1996 and declined to 1.5% in 2025.[11] Despite the development gains achieved through investment in the fight against HIV/AIDS, several challenges in prevention, diagnosis, and treatment remain unresolved.[12] Stigma and discrimination, resistance to antiretroviral drugs, donor fatigue, and inadequate health care services in resource-limited settings continue to hinder the achievement of sustainable health outcomes.[6,13] Reaching key populations such as pregnant women, female sex workers, and long- and short-distance drivers remains a priority; however, achieving this has been difficult in local settings in Nigeria.[10,14] Understanding these patterns is necessary for determining the true burden of infection and providing stakeholders with the evidence needed to guide HIV/AIDS policy discussions, design a comprehensive and robust response, evaluate the impact of prevention and treatment efforts, and measure progress in controlling the disease toward sustainable health development. Therefore, this study was designed as a systematic review and meta-analysis to pool data from HIV/AIDS epidemiological and public health studies to determine the prevalence of HIV/AIDS infection in Plateau State, Nigeria.

Methods

This systematic review and meta-analysis explored the evidence of HIV/AIDS prevalence in Plateau State, Nigeria, between January 1990 and December 2025. The study aimed to delineate trends and patterns of HIV prevalence to inform evidence-based policy directions and strategic interventions for achieving a sustained reduction in HIV/AIDS prevalence. Hence, the study adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines and the Cochrane Handbook for Systematic Reviews of Interventions.[15,16]

Search Strategy

Searches for relevant articles were independently carried out by team members in July 2023. We searched electronic databases, including PubMed, Scopus, EMBASE, Global Health, HINARI, and Google Scholar, using MeSH terms and keywords combined with Boolean operators as follows: ("HIV prevalence" OR "HIV estimate" OR "HIV transmission" OR "HIV decline") AND ("Plateau State" OR "Nigeria") AND("Northcentral Nigeria"). The last literature search was on the 31st of December, 2025, and the selection process is illustrated in the PRISMA flowchart (Figure 1).

Inclusion Criteria

The inclusion criteria for this systematic review and meta-analysis focused on HIV in humans; studies had to be peer-reviewed, published in English, and released

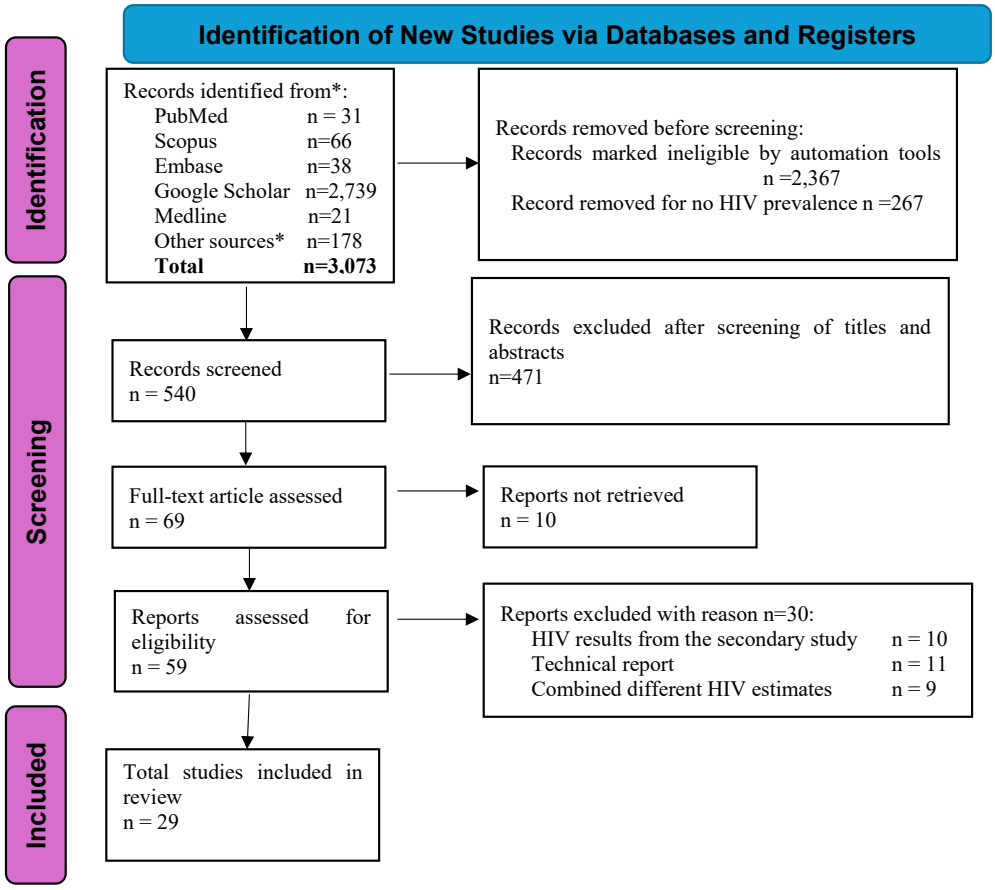

Figure 1. PRISMA Flowchart of the Process of the Study Search, Screened, and Selection

between 1990 and 2025. Articles were included if they directly reported observed HIV prevalence as determined through cross-sectional or cohort studies involving blood sample testing with standardized laboratory screening kits. Eligible participants included men and women, regardless of age, who were residents of Plateau State at the time of the study. To ensure a comprehensive scope, the selected studies included diverse groups, including female sex workers, men who have sex with men, pregnant women attending antenatal care, patients in healthcare facilities, and both in-school and out-of-school youth.

Exclusion Criteria

We excluded animal-based studies, articles that reported HIV prevalence only in the abstract without describing detailed methodologies, and original full-text articles that were inaccessible. Additionally, articles written in other Languages (with no English version available) and HIV estimates specifically targeting people living with AIDS (PLWHA) were excluded. In cases of duplicate HIV estimates from the same study, only the most relevant version was selected for inclusion.Review papers, researcher discussions, or opinion articles, individual case reports, and grey literature were also excluded. The systematic review was exploratory, aiming to provide broad access to the HIV prevalence landscape in Plateau State and to understand local dynamics. To ascertain relevance and eligibility, the authors, titles, and abstracts of articles were first screened, followed by a thorough scrutiny of studies meeting the inclusion criteria. A third reviewer was consulted to resolve any discrepancies during the data extraction process. We also contacted corresponding authors regarding studies that were inaccessible or contained unclear data.

Quality Assessment

The quality of the included articles was assessed by two reviewers using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Studies Reporting Prevalence Data.[17] This checklist assesses the methodological quality of prevalence studies using nine items, with 'yes', 'no', 'unclear', or 'not applicable' as possible responses. A score of 1 was allocated to each appropriate response, with a minimum possible score of 0 and a maximum of 9. All included studies met the minimum quality threshold, and no articles were excluded due to poor methodological quality, as all met the review criteria (Table 1).

Statistical Analysis

The study team screened and extracted relevant data from the published studies, and the outcomes were collated in a Microsoft Excel spreadsheet. Extracted data included the authors' names, year of publication, specific study locations, and descriptions of the study designs. Additionally, the population sampled and screened for HIV, the number of individuals diagnosed HIV-positive, and the HIV estimates were recorded (Table 1).

Two reviewers performed a random-effect meta-analysis to estimate the crude prevalence of HIV in Plateau State, Nigeria. Data analysis was conducted using R software (version 4.0.2). HIV prevalence rates were determined as percentages and pooled within a random-effects model. A test for heterogeneity was used to assess the percentage of variation across studies attributable to true between-study differences rather than chance. A computed I^2 test $P<0.01$ identified evidence of very high heterogeneity, implying significant diversity among the studies. This degree of heterogeneity necessitated the use of a random-effects model for estimating the pooled HIV prevalence at a 95% CI, as an alternative to a fixed-effects model. Subgroup analyses were conducted using gender (male and female) as a grouping variable to assess sources of variation among studies. Furthermore, stratified HIV Prevalence was computed based on different diagnostic screening methods (RDT, RDT + ELISA, PCR/ELISA, and unreported) to provide insights for scientific research, policy, and practice. Publication bias was assessed using a funnel plot and temporal trend analysis of HIV estimates. The meta-analysis results are presented in Figures 1 to 5, respectively.

Results

Figure 1 presents the PRISMA flowchart detailing the process of study search, identification, screening, exclusion, and final inclusion. A total of 3,074 peer-reviewed and published studies were initially identified through 10 databases and a manual search process to ensure the inclusion of relevant evidence-based studies. Before the screening, 2,367 studies were deemed ineligible, and 267 were excluded because they were irrelevant or lacked HIV prevalence estimates. The titles and abstracts of 540 articles were screened, of which 471 articles were excluded because they focused on people living with HIV/AIDS without specifying the sampled population. Out of the 69 full-text articles retrieved and assessed for eligibility, 40 were found unsuitable due to lack of full-text access, HIV data derived from secondary sources, technical reports, and unclear estimates of HIV cases. In the end, 29 articles were included, reviewed, and used for meta-analysis (Figure 1).

Synthesis of Articles Reviewed and Participants' Characteristics

The articles reviewed in Table 1 indicate the primary sources of the study and helped identify the key articles selected for review. The studies show that authors who presented multiple HIV prevalence results included references 18-21 for the period between 2014 and 2016, reference 22 for the period between 2010 and 2014, and references 23 and 24 for the period between 2012 and 2016, respectively. In all articles, some of which reported multiple estimates, HIV prevalence was reported between 2005 and 2018. In 2006, two articles and in 2007, one article were reported.[25-27] In 2010, one article[28], one in 2012 and two articles in 2013 [29-31], four articles in 2014 [32-35], five articles in 2015 [36-38], two in 2016 [39,40], four articles in 2017

Table 1. Results of the Systematic Literature Review on HIV Prevalence in the General Population of Plateau State, Nigeria

Author(s)	Specific Study Location(s)	Study Year of Recruitment	Study Setting	Study Design	Screening Method/ Test	Target Population	HIV Tested (n)	HIV +	HIV + (%)	Quality (%)
Adelekan et al, 2017[18]	Shendam and Jos North LGAs	2016-2017	Urban and Rural	Retrospective chart review	RDT, Ag/Ab	General population (15-49 years)	3,466	124	3.6% (2014)	60
Adelekan et al, 2017[18]	Shendam and Jos North LGAs	2016-2017	Urban and Rural	Retrospective chart review	RDT, Ag/Ab	General population (15-49 years)	57,019	203	0.4% (2015)	60
Adelekan et al, 2017[18]	Shendam and Jos North LGAs	2016-2017	Urban and Rural	Retrospective chart review	RDT, Ag/Ab	General population (15-49 years)	32	0	0.0% (2016)	60
*Adelekan et al, 2017b[19]	Jos North, Jos South, and Mangu LGAs	2016-2017	Urban and Rural	Retrospective chart review	RDT, Ag/Ab	Female sex workers ≥ 15 years	32	5	15.6% (2014)	70
*Adelekan et al, 2017b[19]	Jos North, Jos South, and Mangu LGAs	2016-2017	Urban and Rural	Retrospective chart review	RDT, Ag/Ab	Female sex workers ≥ 15 years	545	10	1.8% (2015)	70
*Adelekan et al, 2017b[19]	Jos North, Jos South, and Mangu LGAs	2016-2017	Urban and Rural	Retrospective chart review	RDT, Ag/Ab	Female sex workers ≥ 15 years	65	0	0.0% (2016)	70
*Adelekan et al, 2017c[21]	Shendam, Pankshin, Jos North, Langtang North, Jos South, Mangu, and Barkin Ladi LGAs	2016-2017	Urban and Rural	Retrospective chart review	RDT, Ag/Ab	Short distance drivers	947	4	0.4% (2014)	50
*Adelekan et al, 2017c[21]	Shendam, Pankshin, Jos North, Langtang North, Jos South, Mangu, and Barkin Ladi LGAs	2016-2017	Urban and Rural	Retrospective chart review	RDT, Ag/Ab	Short distance drivers	14,209	86	0.6% (2015)	50
*Adelekan et al, 2017c[21]	Shendam, Pankshin, Jos North, Langtang North, Jos South, Mangu, and Barkin Ladi LGAs	2016-2017	Urban and Rural	Retrospective chart review	RDT, Ag/Ab	Short distance drivers	332	3	0.9% (2016)	50
*Adelekan et al, 2017c[21]	Shendam, Pankshin, Jos North, Langtang North, Jos South, Mangu, Barkin Ladi LGAs	2016-2017	Urban and Rural	Retrospective chart review	RDT, Ag/Ab	Short distance drivers	332	3	0.9% (2016)	50
*Ayanka et al, 2016[22]	Faith Alive Foundation Hospital, Jos city	Jan 2010 – Dec 2014	Urban	Cross-sectional, facility-based	RDT, Ag/Ab	Antenatal clinic patients	168	18	10.7% (2010)	80
*Ayanka et al, 2016[22]	Faith Alive Foundation Hospital, Jos city	Same	Urban	Cross-sectional, facility-based	RDT, Ag/Ab	Antenatal clinic patients	216	19	8.8% (2011)	80
*Ayanka et al, 2016[22]	Faith Alive Foundation Hospital, Jos city	Same	Urban	Cross-sectional, facility-based	RDT, Ag/Ab	Antenatal clinic patients	365	25	6.8% (2012)	80
*Ayanka et al, 2016[22]	Faith Alive Foundation Hospital, Jos city	Same	Urban	Cross-sectional, facility-based	RDT, Ag/Ab	Antenatal clinic patients	455	28	6.2% (2013)	80
*Ayanka et al, 2016[22]	Faith Alive Foundation Hospital, Jos city	Same	Urban	Cross-sectional, facility-based	RDT, Ag/Ab	Antenatal clinic patients	516	30	5.8% (2014)	80
*Magaji et al, 2018a[23]	17 LGAs (health facilities & outreaches)	Jan 2012 – Dec 2015	Urban and Rural	Retrospective chart review	RDT and ELISA, Ag/Ab	General population (excl. pregnant women)	45,366	5,943	13.1% (2012)	70
*Magaji et al, 2018a[23]	17 LGAs (health facilities & outreaches)	Same	Urban and Rural	Retrospective chart review	RDT and ELISA, Ag/Ab	General population (excl. pregnant women)	54,314	6,498	12.0% (2013)	70
*Magaji et al, 2018a[23]	17 LGAs (health facilities & outreaches)	Same	Urban and Rural	Retrospective chart review	RDT and ELISA, Ag/Ab	General population (excl. pregnant women)	115,798	9,053	7.8% (2014)	70

Table 1. Continued.

Author(s)	Specific Study Location(s)	Study Year of Recruitment	Study Setting	Study Design	Screening Method/ Test	Target Population	HIV Tested (n)		HIV + (%)	Quality (%)
*Magaji et al, 2018a[23]	17 LGAs (health facilities & outreaches)	Same	Urban and Rural	Retrospective chart review	RDT and ELISA, Ag/Ab	General population (excl. pregnant women)	280,240	8,956	3.2% (2015)	70
*Magaji et al, 2018b[24]	17 Local Government Areas of Plateau State	Jan 2012 – Dec 2015	Urban and Rural	Retrospective chart review	RDT and ELISA, Ag/Ab	Pregnant women and partners	648	188	29.0%	70
*Magaji et al, 2018b[24]	17 Local Government Areas of Plateau State	Jan 2012 – Dec 2016	Urban and Rural	Retrospective chart review	RDT and ELISA, Ag/Ab	Pregnant women and partners	2,588	561	21.7%	70
*Magaji et al, 2018b[24]	17 Local Government Areas of Plateau State	Jan 2012 – Dec 2016	Urban and Rural	Retrospective chart review	RDT and ELISA, Ag/Ab	Pregnant women and partners	2,150	956	44.5%	70
*Magaji et al, 2018b[24]	17 Local Government Areas of Plateau State	Jan 2012 – Dec 2016	Urban and Rural	Retrospective chart review	RDT and ELISA, Ag/Ab	Pregnant women and partners	1,819	222	12.2%	70
*Magaji et al, 2018b[24]	17 Local Government Areas of Plateau State	Jan 2012 – Dec 2016	Urban and Rural	Retrospective chart review	RDT and ELISA, Ag/Ab	Pregnant women and partners	646	129	20.0%	70
Lum et al, 2007[25]	Faith Alive Foundation Hospital, Jos city	Jan–Dec 2005	Urban	Cross-sectional, facility-based	PCR, viral load	Patients on medical care	7,672	3,869	50.4%	60
Jombo et al, 2006[26]	Zawan, Jos South LGA	2005	Rural	Cross-sectional, community testing	RDT, Ag/Ab	General population	300	25	8.3%	70
Sagay et al, 2005[27]	JUTH Antenatal Clinic	April 2002 – Nov 2003	Urban	Cross-sectional, facility-based	RDT and ELISA, Ag/Ab	Antenatal clinic attendees	2,657	217	8.2%	80
*Chirdan et al, 2010[28]	11 LGAs	Dec 2008 – July 2009	Urban and Rural	Retrospective chart review	NR	Community members	4,915	424	8.6%	70
Imade et al, 2013[29]	Jos city	March 2010 – Jan 2012	Urban	Cross-sectional, facility-based	RDT and ELISA, Ag/Ab	Pregnant women (antenatal)	217	4	1.8%	100
Ajoge et al, 2013[30]	Panyan, Mangu LGA	Aug–Nov 2007	Rural	Cross-sectional, facility-based	RDT, Ag/Ab	Pregnant women (antenatal)	1,011	104	10.3%	80
John et al, 2014[33]	Jos town	NR	Urban	Cross-sectional, community-based	RDT, Ag/Ab	Secondary school adolescents	883	9	1.0%	80
Imade et al, 2014[34]	JUTH, OLA, and SOLAT Hospitals	May 2010 – March 2012	Urban	Cross-sectional, facility-based	PCR and ELISA, viral load and Ag/Ab	Pregnant women (antenatal)	8,357	364	4.4%	90
Envuladu et al, 2014[35]	Plateau State	NR	Urban and Rural	Cross-sectional, facility-based	NR	Antenatal clinic attendees	32,987	1,866	5.7%	70
Onoja et al, 2015[36]	NBTS & Plateau Specialist Hospital, Jos	May 2011 – Oct 2014	Urban	Cross-sectional, facility-based	RDT and ELISA, Ag/Ab	Blood donors	510	16	3.1%	60
Isichei et al, 2015a[37]	Mangu LGA	June–July 2008	Rural	Cross-sectional, facility-based	ELISA, Ag/Ab	Rural pregnant women (antenatal)	248	8	3.2%	80
Isichei et al, 2015b[37]	Faith Alive Foundation Hospital, Jos city	16–20 Dec 2013	Urban	Cross-sectional, facility-based	RDT, Ab	Pre-surgical patients	57	7	12.3%	60
*Ogbe et al, 2014[38]	Brothel-based FSWs, Jos	Jan–May 2012	Urban	Cross-sectional, facility-based	RDT and ELISA, Ag/Ab	Female sex workers	200	47	23.5% (2012)	60
*Ogbe et al, 2014[38]	Brothel-based FSWs, Jos	Jan–May 2012	Urban	Cross-sectional, facility-based	RDT and ELISA, Ag/Ab	Female sex workers	200	193	48.5% (2006)	60

Table 1. Continued.

Author(s)	Specific Study Location(s)	Study Year of Recruitment	Study Setting	Study Design	Screening Method/ Test	Target Population	HIV Tested (n)		HIV + (%)	Quality (%)
Charles et al, 2016[39]	Faith Alive Foundation Hospital, Jos city	Jan 2010 – Dec 2014	Urban	Cross-sectional, facility-based	RDT, Ag/Ab	Antenatal clinic attendees	216	18	8.3%	60
Agaba et al, 2016[40]	17 LGAs	2006–2009	Urban and Rural	Cross-sectional, facility-based	RDT, Ag/Ab	Young people aged 15–24 years	4,302	78	1.8%	80
Abok et al, 2015[32]	Jos South, Jos North, Jos East LGAs	NR	Urban and Rural	Cross-sectional, facility-based	RDT, Ag/Ab	Vulnerable children (household/ orphanage)	237	9	3.8%	60
Imade et al, 2008[42]	Jos Metropolis	NR	Urban and Rural	Cross-sectional, facility-based	RDT and ELISA, Ag/Ab	Female sex workers	398	193	48.5%	100
Isichei et al, 2015c[43]	Jos East and Bassa LGAs	April 2013 – March 2015	Urban and Rural	Cross-sectional, facility-based	NR	Vulnerable pregnant women	2,136	97	4.5%	70
Sagay et al, 2006[44]	JUTH	April & Aug 2005	Urban	Cross-sectional, facility-based	RDT and ELISA, Ag/Ab	Antenatal clinic attendees	402	22	5.5%	80
Gomwalk et al, 2012[31]	All 17 LGAs	Aug–Oct 2008	Urban and Rural	Cross-sectional, facility-based	RDT and ELISA, Ag/Ab	HIV low/high risk groups>15 years	5,021	245	4.9%	80
Ramyil et al, 2014[45]	Mabudi Rural Community	NR	Rural	Cross-sectional, facility-based	RDT and ELISA, Ag/Ab	General population	250	6	2.4%	80
Ali et al, 2025[46]	Jos North and Jos South LGAs	Sept–Dec 2020	Urban	Cross-sectional, facility-based	PCR, viral load, and Ag/Ab	Female sex workers	175	39	22.3%	90

Note. Ab: Antibody; Ag: Antigen; Ag/Ab: Antigen/Antibody combination test; CI: Confidence interval; ELISA: Enzyme-linked immunosorbent assay; FSW: Female sex worker; HIV: Human immunodeficiency virus; JUTH: Jos university teaching hospital; LGA: Local government area; NBTS: National blood transfusion service; NR: Not reported; OLA: Our lady of apostles hospital; PCR: Polymerase chain reaction; RDT: Rapid diagnostic test; SOLAT: Solat medical center. *Studies that present multiple reviewed HIV prevalence results.

[18-21], and two in 2018.[22-23] Regarding geographical spread, four articles covered the entire 17 Local Government Areas (LGAs) in Plateau State[23,24,35,40], while two articles covered between eight and eleven (8-11) LGAs.[21,28]

Generally, among the 27 articles, three were conducted in three LGAs [18,19,37] and 12 were conducted in urban settings[22,25,27,29,32-34,36-39], three in a rural settings[26,30,33], and 11 in both urban and rural areas.[18,19,21,23,24,28,30,31,33,35,37,40-43,42] Eighteen studies used cross-sectional and facility-based laboratory test designs[22,27,28,30-33,35-40]; two combined cross-sectional and community-based testing[26,34,37]; and six used retrospective chart reviews.[18,19,21,23,24,28] Eleven articles targeted pregnant women tested for HIV [22-24,27,29,30,32,33,35,37,39]; six studies focused on the general population[18,23,26,28,31,40]; three on female sex workers.[19,29,43] Two articles examined adolescents and young people,[34,37] while two focused on patients receiving medical care.[25,37] Only one study each investigated blood donors[36] and short-distance drivers[21] for HIV infection. Over 46.0% of the studies used Rapid Diagnostic Test (RDT), Enzyme-Linked Immunosorbent Assay (ELISA), and Antigen (Ag)/Antibody (Ab) methods.[10] RDT and Ag/ Ab represented 38.5%[8] of the approaches used. In four studies (15.3%), ELISA and Ag/ Ab [33], Polymerase Chain Reaction (PCR) and ELISA, Viral Load and Ag/Ab,[35] PCR and viral load[25], and RDT and Ab [37] were used to determine HIV prevalence rates.

Methodological Quality of Included Studies

Generally, the quality ratings of the studies reflect the reliability and robustness of the data obtained, which varied across studies. The screened articles were graded as good (≥75%), fair (50%-74%), and poor (<50%). The study had a median score of 70% (range 50%-100%) on the nine JBI risk-of-bias items. Eleven (42.3%) studies were of good quality,[18,19,21,23,24,28,30,31,33,35,37,40,43,44] with only two (18.2%) rated 100%.[29,43] Out of the fifteen studies (57.7%) with fair ratings (50%-75%), only one (6.6%) rated 50%[21]; seven (46.7%) were rated 60%,[22,25,36-38,42] and six studies were graded 70%.[19,23,24,26,29,35]

Meta-Analysis Outcomes

A total of 29 studies provided appropriate data used for statistical analysis, and the results presented in Tables 1, Figures 2 to 5, and the details are discussed below:

Overall Crude Human Immunodeficiency Virus Prevalence

Figure 2 represents the pooled studies and the total HIV prevalence in a forest plot. In the 27 studies reviewed and synthesized through meta-analysis, 655,486 individuals underwent HIV diagnostic screening, yielding an overall prevalence of 6.32% (95% CI: 4.29-9.21). The HIV situation in Plateau State indicates a low-level epidemic, with more than six individuals infected per100 people, while the

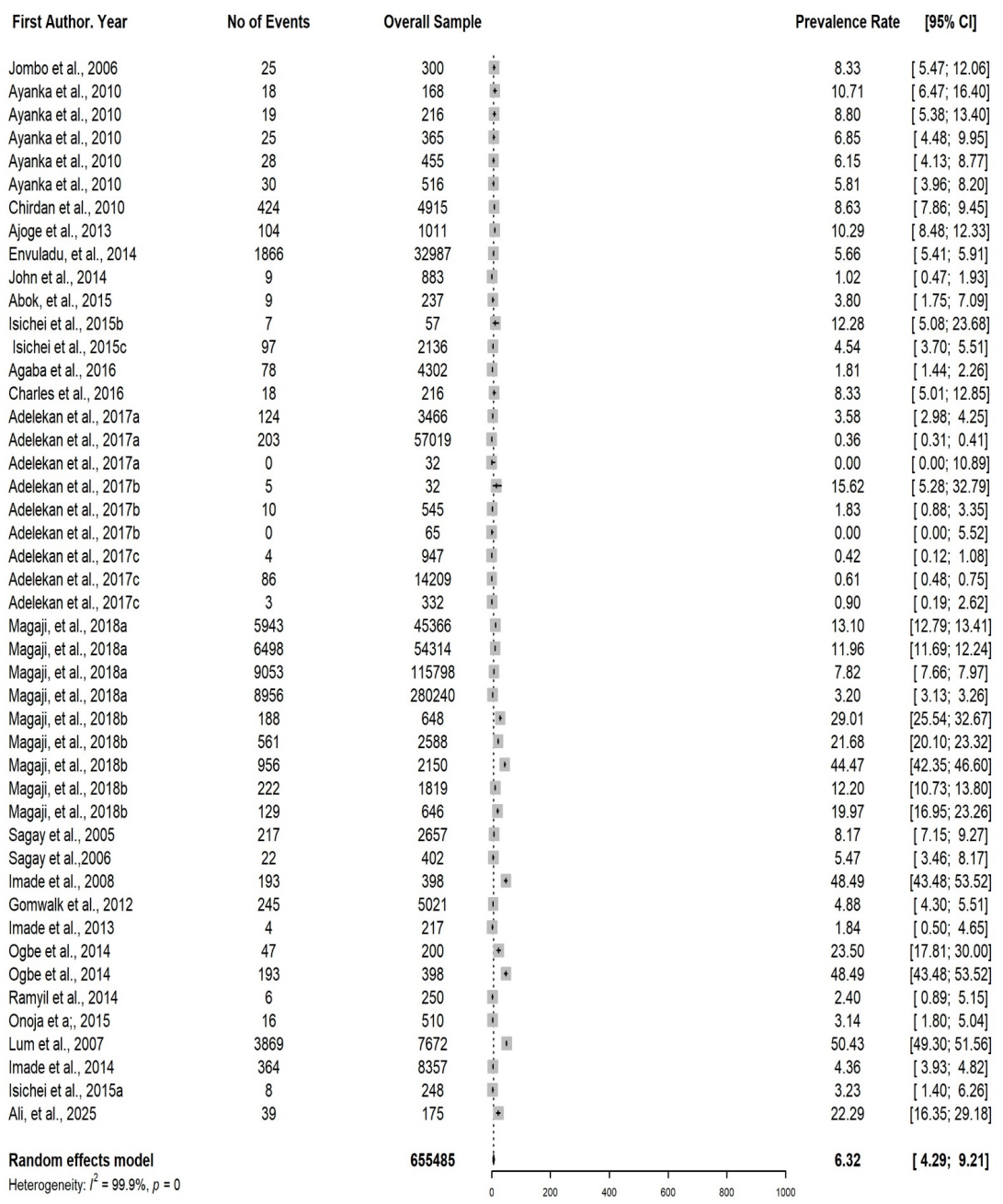

Figure 2. Forest Plot on the Pooled Crude HIV Prevalence in Plateau State, Nigeria
Note. HIV: Human immunodeficiency virus

generalized epidemic threshold is typically > 1.0% with a $I^2 = 100\%$, $P < 0.001$, indicating high heterogeneity across the included studies.

Two studies reported HIV prevalence rates of 0.00 (95% CI: 0.00-5.57 and 0.00-10.89), representing 4.5% of the total sample.[18,19] Low-level prevalence rates included 0.36 (95% CI: 0.31-0.41) in 2015 [18], 0.42% (95% CI: 0.12-1.08)[19], 0.61% (95% CI: 0.48-0.75), and 0.90% (95% CI: 0.19-2.62)[21], respectively. Generalized prevalence rates of < 1.0% were reported in several studies[18,19,21,23,24,28,29,31,33-35,37,40,42], while prevalence ≥ 1.0% was observed in others.[24,25,30,37,38,43,45] The highest recorded HIV rates were 50.43% (95% CI: 51.56) [38], 48.49% (95% CI: 43.48-53.52) [38,43], 44.47% (95% CI: 42.35-46.60) [24], 29.01 (95% CI: 25.54-32.67) [38], 23.50% (95% CI: 17.81-30.00)[38], and 22.29% (95% CI: 16.35-29.18).[47] Overall, the pooled annual data indicate a declining trend in the HIV epidemic, falling from 50.43% in 2007 to 0.36% in 2017 (Figure 2).

Subgroup Human Immunodeficiency Virus Prevalence

Eleven studies reported HIV prevalence within the male population of Plateau State (Figure 3a). These results yielded an overall pooled prevalence of 1.55% (95% CI: 0.64-2-83) out of a sampled population of 24,864. The findings indicated a prevalence of 6.25% (95% CI: 0.77-20.81) in 2016 [37], 4.35% (95% CI: 1.20-10.76) in 2015 [37], followed by 4.15% (95% CI: 1.81-8.00).[26] Conversely, some studies reported an absence of infection 0.00% (95% CI: 0.00-17.65)[20], with the lowest positive rate recorded at 0.09% (95% CI: 0.01- 0.32)[21] among the male population. Analysis of 84,555 women across nineteen studies revealed a pooled HIV prevalence of 5.73% (95% CI: 3.69-8.80), as illustrated in Figure 3b. High prevalence rates were

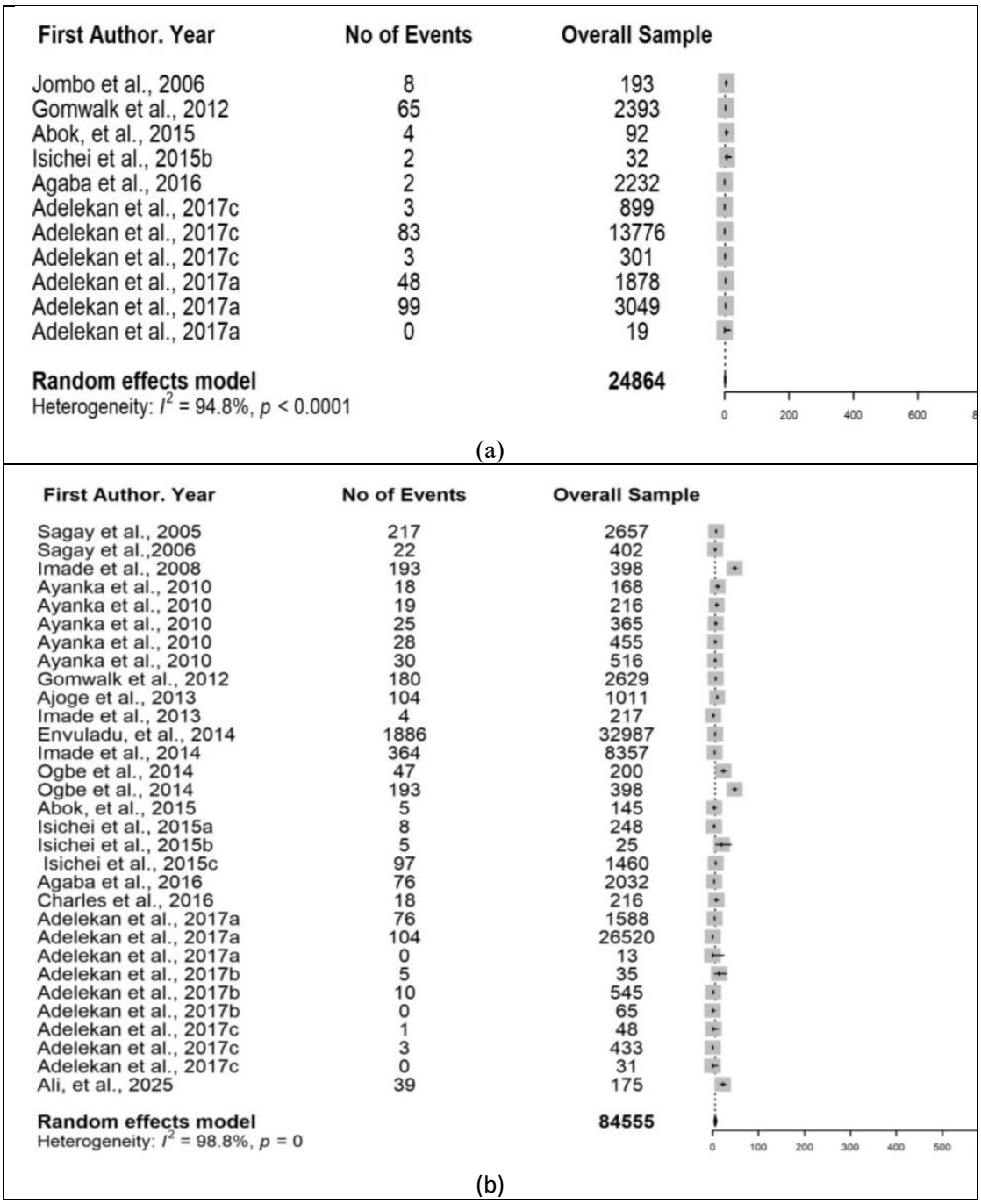

Figure 3. Forest Plot on the Pooled Crude HIV Prevalence for (a) Males and (b) Female Population in Plateau State, Nigeria
Note. HIV: Human immunodeficiency virus

reported in three studies: 48.49% (95% CI: 43.48-53.52) [38,43], 23.50% (95% CI: 17.81-30.00),[38] and 22.29% (95% CI: 16.35-29.16). In contrast, two studies found no evidence of HIV.[18,21] On average, the female HIV prevalence is more than four times higher than that observed in the male population 1.55% (95% CI: 0.64-2-83).

Stratified Human Immunodeficiency Virus Prevalence Estimates

HIV prevalence categorized by diagnostic method showed significant subgroup variation: $x_3^2 = 16.90$, df = 3; $P < 0.001$ (Figure 4). Four studies utilizing PCR + ELISA[25,34,37,46] reported the highest prevalence rates, ranging from 3.23% (95% CI: 31.40-6.26) to 50.43% (95% CI: 49.30–51.56), with a pooled prevalence of 12.72% (95% CI: 3.54-36.68). RDT + ELISA methods revealed intermediate HIV estimates across 10 studies,[27,31,36,38,47] ranging from 1.84% (95% CI: 0.50-4.65) to 48.49% (95% CI: 43.48–53.52), with a pooled rate of 9.24% (95% CI: 3.83-20.01).

Conversely, studies that used only RDTs reported the lowest HIV estimates,[18,19,21,26,30,33,39,40,42] with a pooled prevalence of 3.02% (95% CI: 1.77-5.11). Within this subgroup, individual study rates peaked at 15.62% (95% CI: 5.28-32.79) and 12.28% (95% CI: 5.06-2379), while the lowest recorded rate was 0.36% (95% CI: 0.39-0.41). Studies with unreported diagnostic methods used in four studies exhibited high variability,[23,24,28,35,44] with prevalences reaching 44.47% (95% CI: 42.35-46.60) and 29.01% (95%

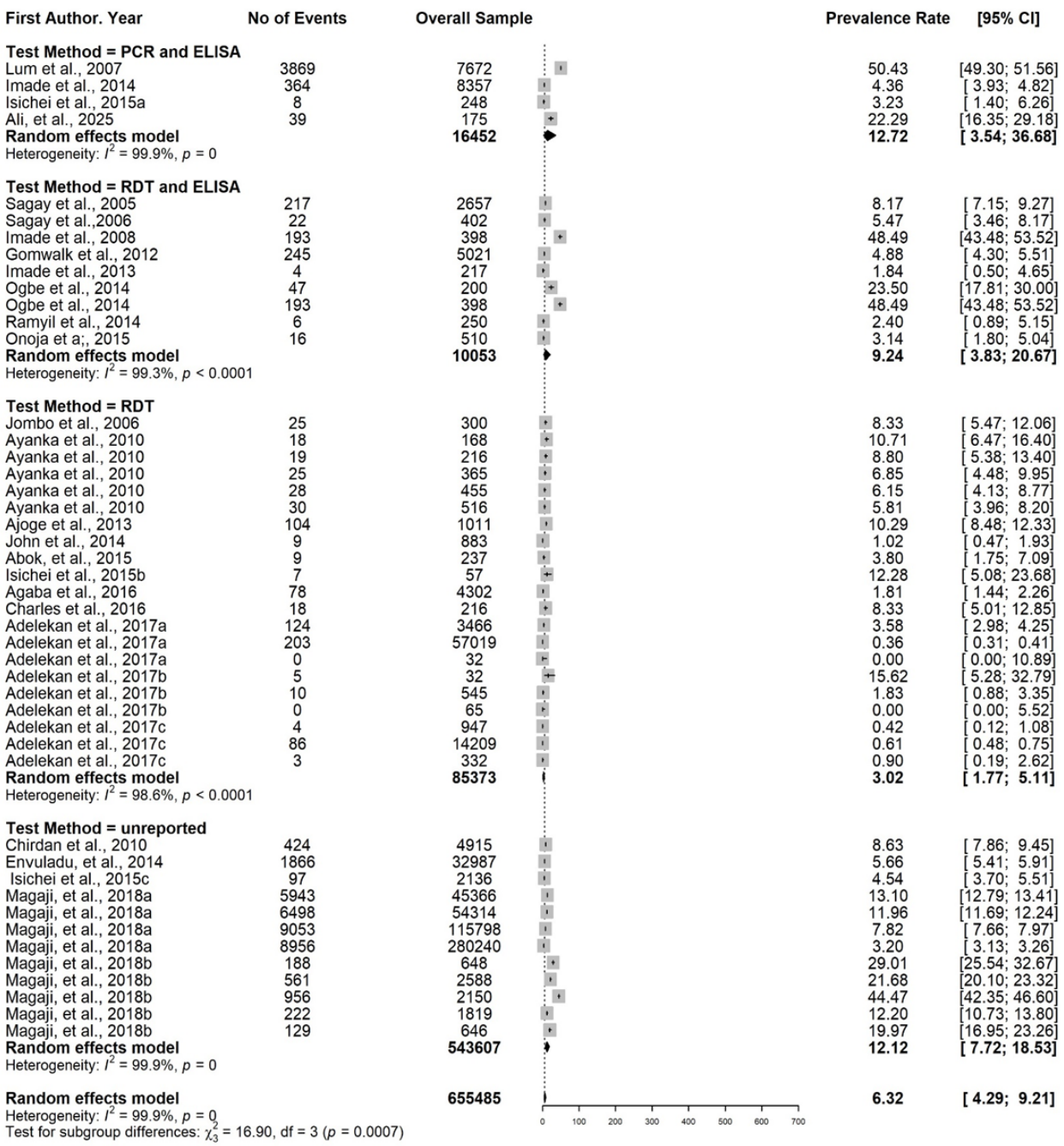

Figure 4. Stratified HIV Prevalence Rates by Diagnostic Methods Employed
Note. HIV: Human immunodeficiency virus

CI: 25.54-32.26), while the lowest prevalence was 3.20% % (95%CI: 3.13-3.26). The pooled HIV prevalence for studies with unnamed laboratory diagnostic methods and study design was 12.12% (95% CI: 7.72-18.53). Overall, the stratified analysis of the 655,485 participants across all reviewed studies revealed a total pooled HIV prevalence of 6.32% (95% CI: 4.29-9.21).

A closer examination of HIV epidemiology in Plateau State revealed a substantial decline in prevalence over time. Significant changes were noted from a peak of 50.43% (95% CI: 49.30-5.56) in 2007 [25] to 0.36% (95% CI: 0.31-0.1)[18] in 2017 (Figure 2). Regarding gender, male prevalence decreased from 6.25% (95% CI: 0.77-20.81)[26] in 20215 to 0.33% (95% CI: 0.07-0.97)[18,19,21] in 2017 (Figure 3). Female prevalence similarly declined from 48.49% (95% CI: 43.84-53.52)[43] to 0.39% (0.32-0.47) [18] in 2017 (Figure 3b). A similar trend was observed in Figure 4, where the stratified analysis results indicated that HIV prevalence declined from 50.43% (95% CI: 49.30-51-56)[25] in 2007 to 3.23 (1.40-6.23) [37] in 2015 among studies using PCR and ELISA for HIV diagnosis. Similarly, studies using a combination of RDT and ELISA showed a decrease in HIV rate from 48.49% (95% CI: 43.48-53.52)[43] in 2006 to 1.84% (95% CI: 0.50-4.85)[36] in 2015. The same HIV decline occurred in studies that used only RDTs and those whose in which the diagnostic methodology was not reported.

Publication Bias

The funnel plot (Figure 5a) was symmetric, suggesting no evidence of publication bias. Furthermore, the

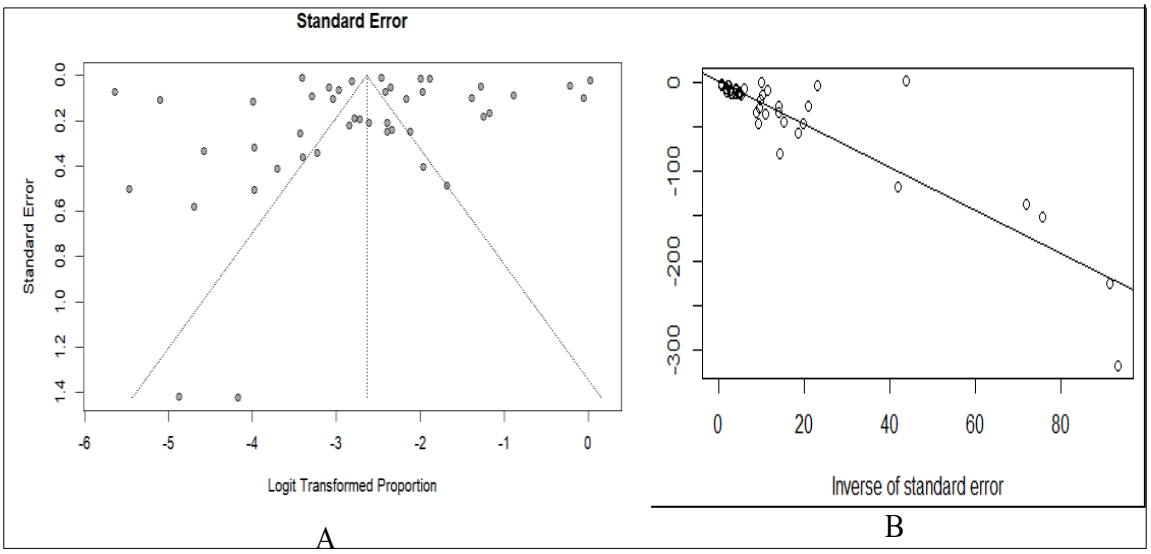

Figure 5. Funnel Plot for Publication Bias (A) and Regression Line of Egger Test (B)

Egger regression test (Figure 5b) showed no evidence of asymmetry (intercept: -2.42; 95% CI: -2.76 - 2.09; $P > 0.05$). Altogether, these findings suggest no evidence of small-study effects or publication bias in the current meta-analysis.

Discussion

The results reveal a substantial overall pooled HIV prevalence of 6.32% in Plateau State. Although this HIV situation indicates a generalized HIV epidemic, the rate exceeds the recent national estimates of 1.3% and 0.2% reported in 2024.[47,48] Nevertheless, Plateau State remains among the top three regions in recent HIV surveillance data (6.0%), followed by Bayelsa (4.3%) and Lagos (3.4%).[47] Compared to other African settings, the 6.32% prevalence in Plateau State is lower than the rates reported in KwaZulu-Natal, South Africa (16.0%) [49], Matabeleland South, Zimbabwe (17.3%), and Kalangala, Uganda (18.8%).[50] This variance may be attributed to historical prevention efforts that have mitigated the endemic situation in Platea State.

The risky HIV situations in Plateau State, compared to other States in Nigeria, may be influenced by its proximity to high-prevalence HIV locations, including Benue State and the Federal Capital Territory (Abuja). Spatial analyses have demonstrated a linear relationship between high-prevalence hot-spots and transmission patterns that influenced spread along major transportation routes.[51] Furthermore, for nearly two decades, recurrent ethno-religious conflicts in Plateau State have posed significant security threats. These findings align with literature that violent conflict increases vulnerability to HIV transmission[47,52-54] due to forced displacement and disrupted livelihoods, which induce financial distress and consequently heighten the risk of contracting or spreading HIV through transactional sex.[55] Additionally, peacekeeping missions often introduce power dynamics that play a significant role in HIV infection[56] and influence risky behaviours that facilitate the spread of HIV in developing countries.[57]

Our results indicate that the pooled female HIV prevalence 5.7% (95% CI: 3.69-8.80)[33,58] was more than four times higher than that of males 1.4% (95% CI: 0.64-2.83). The rates were higher than the national average of 1.3% for females and 0.9% for males[59], though they remain lower than the rates reported in Nigeria's five highest-burden States: Benue, Akwa-Ibom, Cross River, Rivers, and Taraba.[58] The pooled HIV prevalence rate among females in Plateau State was lower than the 2023 rates (22.6%) reported in South Africa, Mozambique (14.5%), Zimbabwe (13.0%), and Uganda (6.6%).[6,59-61] The higher prevalence rates among women in this study are likely due to the diverse cultural practices shaped by gender dynamics that play a role in the spread of HIV. In many traditional societies, men are considered superior and are accorded dominance over women, which has been shown to limit women's access to education, employment, and financial autonomy, and sexual and reproductive health agency.[62-64] Hence, women and girls become vulnerable to sexual risk, underscoring the need to empower them to make informed and independent decisions about their personal health and well-being.[65]

The study can also support best practice by demonstrating that the diagnostic method determines HIV prevalence estimates. PCR/ELISA-based studies captured higher prevalence estimates, consistent with their superior sensitivity in detecting acute infections that may be missed by RDTs.[66,67] In contrast, reliance on RDTs alone risks underestimating the true burden, as reported in previous evaluations of test performance in resource-limited settings.[68,69] From a surveillance and policy perspective, standardized diagnostic protocols, ideally beginning with RDT screening followed by ELISA or PCR confirmation, are essential for obtaining accurate prevalence estimates and informing intervention planning.[70,71] The significant heterogeneity observed in the study further underscores the role of local contextual factors such as geographical location, conflict-related violence, displacement, and HIV

risk patterns on the epidemic patterns.[72,73] Moreover, the literature indicates that the presence of studies without specified diagnostic methods highlights a significant methodological limitation[74-76], underscoring the need for standardised reporting in HIV research to strengthen comparability and reliability across studies.

The observed decline in HIV prevalence in Plateau State reflects a broader global trend, where new HIV infections declined by 60.6% from 3.3 million in 1995 to 1.3 million in 2023.[3,59] Sub-Saharan Africa, which accounts for about 70.0% of the global HIV infection rate[59], also experienced a 54.0% decline in HIV prevalence and a 38.0% decline in new infections between 2010 and 2023. Notably, Eastern and Southern Africa, known as an HIV hot-spot, recorded an epidemiological decline from 1.1 million to 450,000 new infections, representing a 59.0% reduction. Western and Central Africa also experienced a 46.0% HIV decline over the last 13 years.[1,59,60] Nigeria reported a 68.3% decline from 4.1% in 2010 to 1.3 in 2023 [3,77],

These changes in HIV prevalence may reflect progress associated with advancements in the HIV/AIDS policy environment, such as the HIV/AIDS- and health-related Millennium Development Goals before 2015 and the subsequent Sustainable Development Goals, which emphasized global-to-local investment and collaboration.[60,79] This networking synergy has strengthened international cooperation and strategic actions aimed at addressing threats to global health interests in delivering sustainable health solutions to end the HIV/AIDS epidemic and ensuring that 'no one is left behind'.[59,79]

Limitations of the Study

Despite the rigorous systematic review and meta-analysis, this study has several limitations. Restricting inclusion to English-language, peer-reviewed articles may have introduced publication bias, although a comprehensive search strategy was employed to minimize this risk. Substantial heterogeneity persisted across included studies, even after subgroup and stratified analyses, likely reflecting inconsistencies in study populations, time periods, geographic locations, and diagnostic methods. The inclusion of studies with unreported diagnostic methodologies further limited the standardization of prevalence estimates. Although the funnel plot and Egger's test suggested no significant publication bias, the potential influence of unreported HIV screening methods in some articles cannot be entirely excluded. Lastly, the observational nature of the included studies prevents causal inference regarding the observed trends and associated factors.

Conclusion

This systematic review found significant variability in HIV prevalence across different studies and settings in Plateau State, Nigeria. Generally, the temporal trends indicate fluctuating but declining HIV prevalence. Women had a higher pooled prevalence than men, reflecting the dynamic and gendered nature of the epidemic. PCR and ELISA tests detect higher viral loads, especially in early HIV cases. Therefore, HIV monitoring should rely on standardized diagnostic methods, with RDT results confirmed by ELISA or PCR to ensure accurate HIV prevalence results. The use of RDT alone and the inclusion of studies with unreported diagnostic methods highlight important methodological issues and warrant caution in interpreting prevalence estimates. Therefore, continuous HIV surveillance remains essential for evaluating the effect of past, current, and future interventions and for informing evidence-based public health policy, resource allocation, and targeted action among high-risk populations. These efforts are essential for achieving sustainable health outcomes and well-being across Plateau State and similar settings in Africa.

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Competing Interests

The authors declare no conflict of interests.

Ethical Approval

Not applicable. However, the protocol for this systematic review was registered in the International Prospective Register for Systematic Reviews (PROSPERO), Registration No. 337071, and is available at: https://www.crd.york.ac.uk/PROSPERO/view/CRD42022337071

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