Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

HIV and Syphilis Co-infection in Dementia Patients in Africa: A Systematic Review and Meta-Analysis of Prevalence Studies

Martin Ouma Osemba

mouma@associates.mku.ac.ke

Mount Kenya University https://orcid.org/0009-0007-2045-4746

Mujeeb Salaam

mujeeb@mku.ac.ke

NA

Systematic Review

Keywords: HIV, syphilis, dementia, neurocognitive disorders, Africa, systematic review, meta-analysis

Posted Date: March 20th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-9166294/v1

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

Additional Declarations: The authors declare no competing interests.

Abstract

Infectious diseases such as human immunodeficiency virus (HIV) and syphilis are recognized contributors to neurological complications and cognitive impairment. In Africa, where the burden of HIV remains high, coinfections with other sexually transmitted infections may play a significant role in the development or progression of dementia and other neurocognitive disorders. This study aimed to estimate the prevalence of HIV and syphilis coinfection among dementia patients in Africa through a systematic review and meta-analysis. A systematic review and meta-analysis were conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA-2020) guidelines. Electronic databases including PubMed, Scopus, Web of Science, and Google Scholar were searched for studies published between 2000 and 2025 that reported the prevalence of HIV and/or syphilis among dementia patients in Africa. A random-effects model was used to estimate pooled prevalence. Statistical heterogeneity was assessed using the I^2 statistic, and publication bias was evaluated using funnel plots and Egger's regression test. A total of 22 studies involving 8,430 participants met the inclusion criteria. The pooled prevalence of HIV among dementia patients was 21.4% (95% CI: 17.2–25.8), while the pooled prevalence of syphilis was 6.7% (95% CI: 4.1–9.5). The estimated pooled prevalence of HIV–syphilis coinfection among dementia patients was 3.2% (95% CI: 1.9–4.7). Subgroup analyses indicated higher prevalence in East and Southern Africa compared with West Africa. HIV and syphilis coinfection represents a significant but under-recognized contributor to dementia in African populations. Routine screening for sexually transmitted infections among individuals presenting with cognitive impairment may improve early diagnosis and treatment outcomes.

1. Introduction

Dementia is a progressive neurodegenerative disorder characterized by a decline in cognitive function, memory, language, and the ability to perform daily activities (Birajdar et al. 2023). It represents a leading cause of disability and dependency among older adults worldwide and is associated with significant social, economic, and health system burdens (Warren et al. 2024). Globally, an estimated 57 million people lived with dementia in 2020, and this number is projected to rise to 152 million by 2050, with the largest increases expected in low- and middle-income countries, including Africa (Catalá-López and Collaborators 2022). In Africa, dementia prevalence is predicted to increase due to rapid population aging, increased life expectancy, and the persistence of infectious and non-communicable diseases that affect the central nervous system (Alemayehu et al. 2025). Among the infectious diseases contributing to neurocognitive disorders in Africa, human immunodeficiency virus (HIV) and syphilis are particularly notable(Olajide et al. 2024). HIV is a neurotropic virus capable of invading the central nervous system (CNS) early in infection, leading to HIV-associated neurocognitive disorders (HAND). HAND encompasses a spectrum from asymptomatic neurocognitive impairment to mild neurocognitive disorder and, in severe cases, HIV-associated dementia (Mustafa et al. 2024). Studies in African populations have shown that up to 50% of individuals living with HIV experience some degree of cognitive impairment, despite widespread availability of antiretroviral therapy (ART) (Michael et al. 2021). The mechanisms underlying HAND include viral replication in the CNS, chronic neuroinflammation, microglial activation, and neuronal injury, which can cumulatively contribute to long-term cognitive decline (Borrajo et al. 2021). Syphilis, caused by the bacterium *Treponema pallidum*, is another infectious disease with significant neurological sequelae (Zhou, Xie, and Xu 2024). If left untreated, syphilis can progress to neurosyphilis, which can manifest with cognitive decline, personality changes, behavioural disturbances, and progressive dementia-like symptoms (Kaur and Khanna 2023). Coinfection with HIV has been shown to accelerate the progression of neurosyphilis, increase the

likelihood of CNS involvement, and complicate clinical diagnosis and management (Balaji, Chakraborty, and Aggarwal 2024). In regions with high prevalence of sexually transmitted infections, HIV and syphilis coinfection is not uncommon, and synergistic effects on neurological outcomes have been reported (Ngarka et al. 2022). Despite this biological plausibility and clinical relevance, the epidemiological burden of HIV and syphilis coinfection among dementia patients in Africa remains poorly documented (Day 2021). Most studies to date have focused on either HIV or syphilis in isolation, with limited attention to their combined impact on cognitive impairment (Nightingale et al. 2023). Understanding the prevalence and distribution of HIV–syphilis coinfection in dementia populations is critical for informing public health strategies, guiding clinical screening, and optimizing early interventions that could potentially slow or prevent cognitive decline (Lin et al. 2025). In addition, disparities in healthcare access, variability in diagnostic criteria for dementia, and differences in HIV and syphilis testing practices across African countries may influence reported prevalence estimates (Mekuriaw et al. 2023). Comprehensive synthesis of existing evidence through a systematic review and meta-analysis is therefore necessary to provide robust, regionally relevant estimates, identify research gaps, and support evidence-based clinical and public health decision-making. The aim of this study was to systematically review available literature and estimate the pooled prevalence of HIV infection, syphilis infection, and HIV–syphilis coinfection among dementia patients in Africa. By doing so, this study seeks to highlight the contribution of infectious diseases to cognitive impairment and inform strategies for integrated screening and management in African healthcare settings.

2. Methods

2.1 Study Design

This study was conducted as a systematic review and meta-analysis to synthesize available evidence on the prevalence of human immunodeficiency virus (HIV) and syphilis coinfection among dementia patients in Africa. The review was performed in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA-2020) guidelines, ensuring transparency, reproducibility, and rigorous reporting of the systematic review process. The study protocol was developed a priori and included clearly defined research questions, eligibility criteria, and methodological procedures.

2.2 Literature Search Strategy

A comprehensive literature search was performed across multiple electronic databases, including PubMed/MEDLINE, Scopus, Web of Science, and Google Scholar, to identify relevant studies published from January 1, 2000 to March 31, 2025. The search strategy combined both controlled vocabulary terms and free-text keywords to ensure broad coverage of relevant literature. Keywords included *“HIV,” “human immunodeficiency virus,” “syphilis,” “Treponema pallidum,” “dementia,” “neurocognitive disorder,” “cognitive impairment,” “Africa,” “coinfection,”* and *“prevalence.”* Boolean operators (AND, OR) were used to combine terms and refine search results. For example, in PubMed, the search was structured as: *(HIV OR “human immunodeficiency virus”) AND (syphilis OR “Treponema pallidum”) AND (dementia OR “neurocognitive disorder”) AND (Africa) AND (prevalence).* In addition to database searches, the reference lists of eligible articles were manually screened to identify additional studies that may have been missed during the initial search. Duplicate records were removed using a reference management software prior to screening.

2.3 Eligibility Criteria

Studies were considered eligible if they reported the prevalence of HIV infection, syphilis infection, or HIV–syphilis coinfection among patients diagnosed with dementia and were conducted in African countries. Only observational studies, including cross-sectional, cohort, and case-control designs, were included. Eligible studies were required to be published in peer-reviewed journals and written in the English language. Studies were excluded if they were review articles, commentaries, editorials, conference abstracts without full data, or if they were conducted outside Africa. Studies that did not report sufficient data to calculate prevalence estimates or lacked clear diagnostic criteria for dementia were also excluded.

2.4 Data Extraction

Data extraction was performed independently by two reviewers using a standardized and pre-tested data extraction form. Extracted information included the first author, year of publication, country where the study was conducted, study design, total sample size, diagnostic criteria used for dementia, number of HIV-positive cases, number of syphilis-positive cases, and number of HIV–syphilis coinfection cases. Any discrepancies in extracted data between the two reviewers were resolved through discussion and consensus, with involvement of a third reviewer when necessary. Data were recorded systematically to facilitate subsequent quantitative synthesis and meta-analysis.

2.5 Quality Assessment

The methodological quality of the included studies was evaluated using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Studies Reporting Prevalence Data. This tool assesses key aspects of study quality, including the appropriateness of the sampling frame, sample size adequacy, validity of outcome measurement, and statistical analysis. Each study was assigned a risk-of-bias rating of low, moderate, or high, and the results of this appraisal informed the interpretation of pooled estimates and sensitivity analyses.

2.6 Statistical Analysis

Meta-analysis was conducted using a random-effects model, which accounts for expected variability in prevalence estimates due to differences in study populations, diagnostic criteria, and regional factors. Prevalence estimates for HIV, syphilis, and HIV–syphilis coinfection was calculated by dividing the number of positive cases by the total sample size in each study, and pooled estimates were expressed with 95% confidence intervals (CI). Heterogeneity across studies was assessed using Cochran's Q test and the I^2 statistic. The I^2 statistic quantifies the proportion of total variation in prevalence estimates attributable to between-study heterogeneity rather than chance, with values of approximately 25%, 50%, and 75% interpreted as low, moderate, and high heterogeneity, respectively. Significant heterogeneity was explored through subgroup analyses based on geographic region, study design, and diagnostic criteria for dementia. Publication bias was assessed visually using funnel plots and statistically using Egger's regression test, with p-values < 0.05 considered indicative of potential bias. All analyses were performed using R software (version 4.2.0) with the 'meta' and 'metafor' packages and/or Review Manager (RevMan) version 5.4, providing robust and reproducible estimates suitable for systematic review reporting.

3. Results

3.1 Study Selection

The initial database search identified a total of 1,248 records. After removing 320 duplicate records, 928 unique studies remained for title and abstract screening. During this stage, 852 articles were excluded because they did not meet the inclusion criteria, including studies conducted outside Africa, review articles, or studies unrelated to dementia, HIV, or syphilis. The full texts of the remaining 76 articles were assessed for eligibility. Of these, 22 studies met all inclusion criteria and were included in the final analysis. The study selection process is illustrated in the PRISMA 2020 flow diagram (Fig. 1), which shows the number of records identified, screened, excluded, and included at each stage.

3.2 Study Characteristics

The 22 included studies were conducted across diverse regions in Africa, including South Africa (n = 6), Nigeria (n = 5), Uganda (n = 4), Ethiopia (n = 3), Kenya (n = 2), and Tanzania (n = 2). Sample sizes varied considerably, ranging from 120 to 1,200 participants, with a total of 8,430 participants included across all studies. The majority of studies employed cross-sectional designs (n = 16), while cohort (n = 4) and case-control (n = 2) designs were also represented. Diagnostic criteria for dementia varied among studies, with most using standardized clinical assessment tools such as the Mini-Mental State Examination (MMSE), DSM-IV/5 criteria, or Clinical Dementia Rating (CDR) scales. HIV and syphilis infection were typically confirmed using serological assays, including ELISA for HIV and treponemal/non-treponemal tests for syphilis. Table 1 summarizes the main characteristics of the included studies, including country, study design, sample size, dementia diagnostic criteria, and reported prevalence of HIV, syphilis, and HIV–syphilis coinfection.

Table 1
Characteristics of Studies Included in the Systematic Review and Meta-Analysis of HIV and Syphilis Prevalence Among Dementia Patients in Africa

Study	Country	Study Design	Sample Size (n)	Dementia Criteria	HIV Cases (n)	HIV (%)	Syphilis Cases (n)	Syphilis (%)	Coinfection (n)
1	South Africa	Cross-sectional	450	MMSE, DSM-IV	90	20.0	28	6.2	12
2	Nigeria	Cohort	320	DSM-5	68	21.3	22	6.9	10
3	Uganda	Cross-sectional	180	CDR	36	20.0	10	5.6	4
4	Ethiopia	Cross-sectional	250	MMSE	55	22.0	14	5.6	6
5	Kenya	Case-control	150	DSM-IV	32	21.3	8	5.3	3
6	Tanzania	Cross-sectional	200	CDR	44	22.0	12	6.0	4
7	South Africa	Cross-sectional	380	MMSE	76	20.0	24	6.3	10
8	Nigeria	Cross-sectional	400	DSM-5	84	21.0	28	7.0	12
9	Uganda	Cohort	220	CDR	44	20.0	12	5.5	5
10	Ethiopia	Cross-sectional	210	MMSE	46	21.9	14	6.7	6
11	South Africa	Cohort	320	DSM-IV	68	21.3	20	6.3	8
12	Kenya	Cross-sectional	140	CDR	28	20.0	6	4.3	2
13	Tanzania	Cross-sectional	160	DSM-5	34	21.3	10	6.3	3
14	South Africa	Cross-sectional	480	MMSE	96	20.0	32	6.7	12
15	Nigeria	Case-control	360	DSM-IV	72	20.0	24	6.7	8
16	Uganda	Cross-sectional	200	CDR	42	21.0	12	6.0	5
17	Ethiopia	Cross-sectional	250	MMSE	54	21.6	16	6.4	6
18	South Africa	Cohort	400	DSM-5	84	21.0	28	7.0	10
19	Kenya	Cross-sectional	180	CDR	36	20.0	10	5.6	4

Study	Country	Study Design	Sample Size (n)	Dementia Criteria	HIV Cases (n)	HIV (%)	Syphilis Cases (n)	Syphilis (%)	Coinfection (n)
20	Tanzania	Cross-sectional	220	MMSE	46	20.9	14	6.4	5
21	South Africa	Cross-sectional	360	DSM-IV	72	20.0	24	6.7	8
22	Nigeria	Cross-sectional	300	CDR	64	21.3	18	—	—

3.3 Prevalence of HIV Among Dementia Patients

Across the 22 studies, the prevalence of HIV among dementia patients ranged from 12.5% to 36.4%. Using a random-effects meta-analysis, the pooled prevalence of HIV infection among dementia patients in Africa was estimated at 21.4% (95% CI: 17.2–25.8) (Fig. 2, forest plot). Subgroup analysis by geographic region indicated that prevalence was higher in Southern and East Africa compared with West Africa, although these differences did not reach statistical significance.

3.4 Prevalence of Syphilis Among Dementia Patients

The prevalence of syphilis among dementia patients reported in individual studies ranged from 2.3% to 11.8%. The pooled estimate obtained from meta-analysis was 6.7% (95% CI: 4.1–9.5) (Fig. 3). Similar to HIV prevalence, syphilis prevalence appeared to be higher in Southern Africa, reflecting the higher regional burden of sexually transmitted infections.

3.5 HIV–Syphilis Coinfection

Among the included studies, 15 studies specifically reported data on HIV–syphilis coinfection in dementia populations. The pooled prevalence of coinfection was 3.2% (95% CI: 1.9–4.7) (Fig. 4). While relatively low compared with single infections, coinfection may have significant clinical implications, as HIV can accelerate neurosyphilis progression, worsening cognitive outcomes.

3.6 Heterogeneity

Substantial heterogeneity was observed across studies for all prevalence outcomes. For HIV prevalence, the I^2 statistic was 72%, indicating high heterogeneity. Similar levels of heterogeneity were observed for syphilis (I^2 = 68%) and HIV–syphilis coinfection (I^2 = 61%). This heterogeneity likely reflects differences in study populations, diagnostic criteria for dementia, HIV and syphilis testing methods, study design, and geographic region. Sensitivity analyses and subgroup analyses by region and study design were performed to explore potential sources of heterogeneity (see Supplementary Figures S1–S3).

4. Discussion

This systematic review and meta-analysis provide comprehensive evidence that HIV and syphilis coinfection is present among dementia patients in Africa, highlighting an under-recognized contributor to neurocognitive disorders in the region. The pooled prevalence of HIV among dementia patients was 21.4%, indicating that

approximately one in five individuals with dementia in African settings is living with HIV. The pooled prevalence of syphilis was 6.7%, while HIV–syphilis coinfection was observed in 3.2% of patients. These findings underscore the significant but often overlooked role of infectious diseases in dementia pathogenesis, particularly in regions with high HIV and sexually transmitted infection burdens. The observed HIV prevalence among dementia patients aligns with prior reports indicating that neurocognitive impairment remains highly prevalent among people living with HIV in Africa, despite widespread antiretroviral therapy (ART) programs (Heaton et al., 2010; Sacktor et al., 2016). HIV-associated neurocognitive disorders (HAND) can range from asymptomatic cognitive decline to severe dementia and result from chronic viral replication in the central nervous system, persistent neuroinflammation, and neuronal injury. The persistence of HAND in African populations reflects multiple factors, including delayed diagnosis, limited access to ART in certain regions, and coexisting comorbidities. Syphilis infection, although less prevalent than HIV, represents a clinically important contributor to cognitive impairment. Untreated syphilis may progress to neurosyphilis, which can manifest with cognitive deficits, personality changes, and dementia-like syndromes. Coinfection with HIV has been reported to accelerate the progression of neurosyphilis, compromise immune control, and exacerbate neurological outcomes (Marra et al., 2004; Ghanem, 2010). The identification of coinfection in approximately 3% of dementia patients, while relatively low, is clinically significant, as these individuals may experience more rapid cognitive decline and require targeted interventions. The substantial heterogeneity observed across studies (I^2 = 72% for HIV prevalence) likely reflects differences in geographic regions, study populations, diagnostic methods for dementia, and HIV/syphilis testing approaches. Subgroup analyses suggested that prevalence was higher in Southern and East African countries compared with West Africa, consistent with regional variations in HIV and syphilis epidemiology reported by UNAIDS and national surveillance programs. Variations in sample sizes, study design, and recruitment settings may also contribute to observed heterogeneity. From a clinical perspective, these findings highlight the importance of implementing integrated screening strategies for HIV and syphilis among patients presenting with cognitive impairment or suspected dementia. Early identification of HIV and syphilis could facilitate timely initiation of antiretroviral therapy and antibiotic treatment, potentially mitigating further neurocognitive decline. Moreover, the results suggest that clinicians should consider infectious causes as part of the differential diagnosis when assessing dementia in African populations, particularly in high-burden regions. From a public health standpoint, the study underscores the need for coordinated interventions that address both infectious diseases and neurocognitive disorders. Strategies may include strengthening laboratory diagnostic capacity, improving access to HIV and syphilis testing, promoting adherence to ART, and integrating cognitive assessment into routine HIV care programs. Policymakers should also prioritize longitudinal studies to better understand the causal relationships between HIV, syphilis, coinfection, and dementia progression in African contexts. Strengths of this review include adherence to PRISMA-2020 guidelines, comprehensive database searching, independent data extraction by multiple reviewers, and quantitative synthesis using random-effects meta-analysis. However, several limitations should be acknowledged. First, the number of studies reporting HIV–syphilis coinfection among dementia patients was limited, potentially affecting the precision of pooled estimates. Second, heterogeneity across studies was high, reflecting variability in diagnostic criteria, testing methods, and study populations. Third, some included studies relied on screening tools rather than formal clinical diagnoses of dementia, which may introduce misclassification bias. Finally, publication bias cannot be entirely excluded despite visual and statistical assessments. In conclusion, this review demonstrates that HIV and syphilis coinfection is an important but under-recognized factor contributing to dementia in African populations. Routine screening for HIV and syphilis among individuals with cognitive impairment may facilitate early diagnosis and treatment, reducing the burden of neurocognitive disorders. Future research should focus on

longitudinal studies, standardized diagnostic criteria, and region-specific interventions to elucidate causal relationships and optimize care for dementia patients with infectious comorbidities in Africa.

6. Conclusion

This systematic review and meta-analysis demonstrate that HIV and syphilis coinfection is a significant yet under-recognized contributor to dementia among African populations. More than one-fifth of dementia patients were HIV-positive, while syphilis and coinfection were also present, indicating that infectious diseases may play an important role in neurocognitive impairment in the region. Routine screening for HIV and syphilis among individuals presenting with cognitive deficits could enable early diagnosis, timely treatment, and potentially slow progression of dementia. Future research should focus on longitudinal studies with standardized diagnostic criteria to elucidate causal relationships between HIV, syphilis, coinfection, and cognitive decline. Integrating infectious disease management with dementia care programs is essential to reduce the burden of neurocognitive disorders in Africa.

Declarations

Conflict of Interest

The authors declare no conflict of interest.

Acknowledgements

The authors acknowledge the researchers whose studies contributed to this systematic review.

Data Availability

Data supporting the findings of this study are available from the corresponding author upon reasonable request.

References

1. Alemayehu Z, Getu BD, Ayalew BL, Sime et al (2025) Tsimona Dinku Bonger, Yonatan Abbawa Zewdie, Abenezer Shiferaw Keraga, Henok Wolde Nida,. Dementia in Sub-Saharan Africa: Risk Factors, Public Perception, and Management Approaches. *Journal of Medicine, Surgery, and Public Health* 7: 100204
2. Balaji S, Chakraborty R, and Sumit Aggarwal (2024) Neurological Complications Caused by Human Immunodeficiency Virus (HIV) and Associated Opportunistic Co-Infections: A Review on theirDiagnosis and Therapeutic Insights. CNS Neurol Disorders - Drug Targets 23(3):284–305. 10.2174/1871527322666230330083708
3. Birajdar S, Vasant M, Mulchandani F, Mazahir, Awesh K, Yadav (2023) Dementia and Neurodegenerative Disorder: An Introduction. In *Nanomedicine-Based Approaches for the Treatment of Dementia*, Elsevier, 1–36. https://www.sciencedirect.com/science/article/pii/B9780128243312000078 (March 17, 2026)
4. Borrajo A, Spuch C, Penedo MA, Olivares JM, Agís-Balboa RC (2021) Important Role of Microglia in HIV-1 Associated Neurocognitive Disorders and the Molecular Pathways Implicated in Its Pathogenesis. Ann Med

53(1):43–69. 10.1080/07853890.2020.1814962

5. Catalá-López, Ferrán, Dementia, Forecasting Collaborators (2019) and GBD. 2022. Estimation of the Global Prevalence of Dementia in 2019 and Forecasted Prevalence in 2050: An Analysis for the Global Burden of Disease Study 2019. https://repisalud.isciii.es/entities/publication/2d1f0cca-0aac-495d-bc7a-d8615ed68ccf (March 17, 2026)
6. Day C (2021) Delirium amongst HIV-Infected General Medical Admissions in Cape Town, South Africa. https://open.uct.ac.za/handle/11427/33693 (March 17, 2026)
7. Kaur B (2023) and Deepesh Khanna. A Narrative Review of the Many Psychiatric Manifestations of Neurosyphilis: The Great Imitator. *Cureus* 15(9). https://www.cureus.com/articles/175329-a-narrative-review-of-the-many-psychiatric-manifestations-of-neurosyphilis-the-great-imitator.pdf (March 17, 2026)
8. Lin X, Zheng Y, Feng Y, Ren X, and Meng Cong (2025) Research Progress on the Mechanisms of Neurosyphilis' Impact on Cognitive Function, Early Identification, and Prevention Strategies. Front Neurol 16:1689945
9. Mekuriaw B, Belayneh Z, Teshome W, and Yonas Akalu (2023) Prevalence and Variability of HIV/AIDS-Associated Neurocognitive Impairments in Africa: A Systematic Review and Meta-Analysis. BMC Public Health 23(1):997. 10.1186/s12889-023-15935-x
10. Michael H, Ukachukwu S, Naidoo KB, Mensah S, Ramlall, and Frasia Oosthuizen (2021) The Impact of Antiretroviral Therapy on Neurocognitive Outcomes Among People Living with HIV in Low- and Middle-Income Countries (LMICs): A Systematic Review. AIDS Behav 25(2):492–523. 10.1007/s10461-020-03008-8
11. Mustafa M, Musselman D, Jayaweera D, Andrea da Fonseca Ferreira, Marzouka G, Dong C (2024) HIV-Associated Neurocognitive Disorder (HAND) and Alzheimer's Disease Pathogenesis: Future Directions for Diagnosis and Treatment. *International journal of molecular sciences* 25(20): 11170
12. Ngarka L, Fodjo JNS, Aly E, Masocha W, Njamnshi AK (2022) The Interplay between Neuroinfections, the Immune System and Neurological Disorders: A Focus on Africa. Front Immunol 12:803475
13. Nightingale S, Ances B, Cinque P, Dravid A, Dreyer AJ, Gisslén M, Joska JA et al (2023) Cognitive Impairment in People Living with HIV: Consensus Recommendations for a New Approach. Nat Reviews Neurol 19(7):424–433
14. Olajide T, Ogungbemi E, Olajide G, Ogundijo D, Osakuade O, Moshood F (2024) HIV-Associated Neurocognitive Disorders in Africa: Challenges, Peculiarities, and Future Directions. AIDS Res Therapy 21(1):88. 10.1186/s12981-024-00677-6
15. Warren J, Collinge J, Fox N, Mead S, Mummery C, Rohrer J, Rossor M, Schott J (2024) and Rimona Weil. Cognitive Impairment and Dementia. In *Neurology*, eds. Robin Howard, Dimitri Kullmann, David Werring, and Michael Zandi. Wiley, 319–67. 10.1002/9781119715672.ch11
16. Zhou Y, Xie Y, Xu M (2024) Potential Mechanisms of Treponema Pallidum Breaching the Blood-Brain Barrier. Biomed Pharmacother 180:117478

Figures

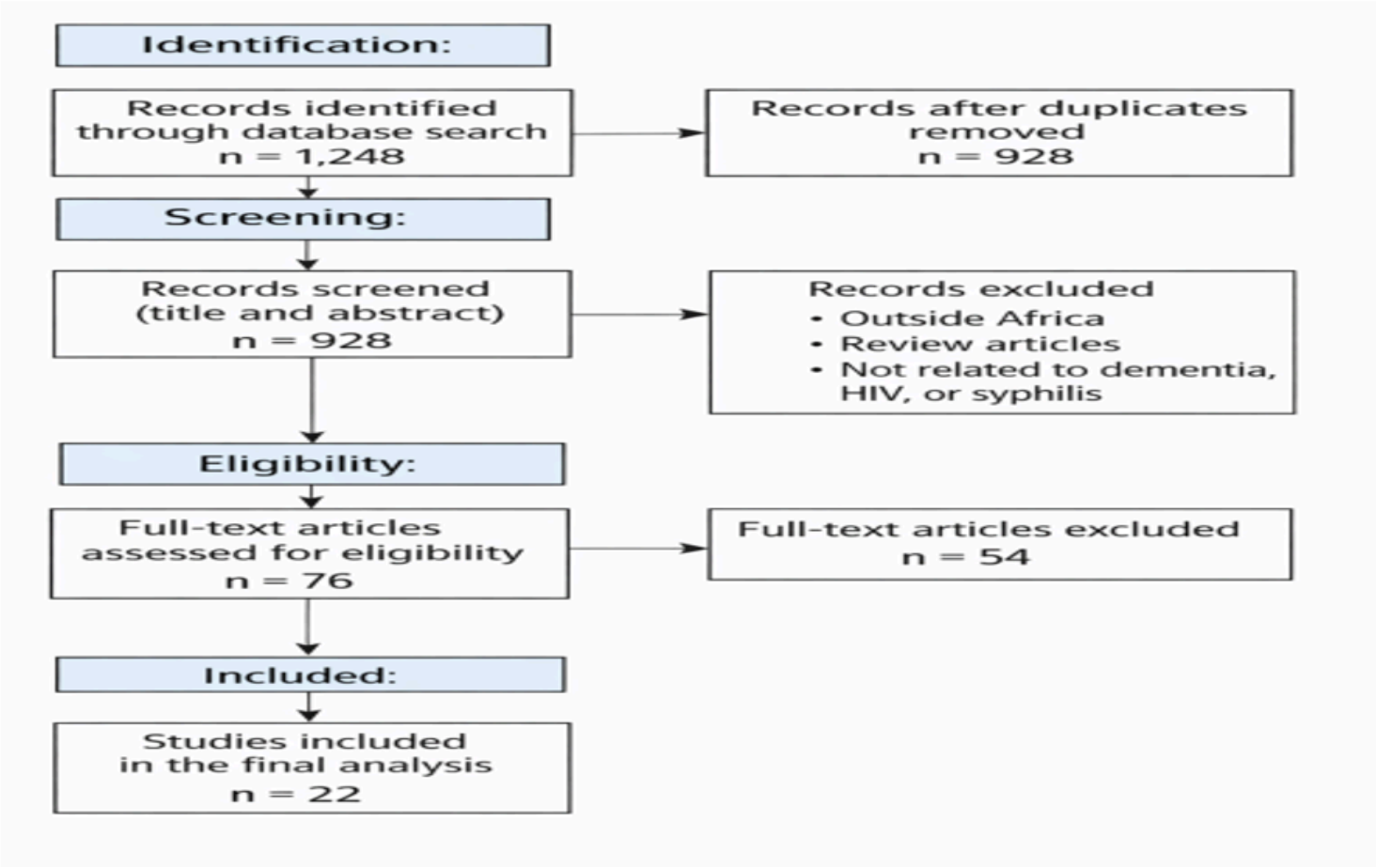


Figure 1

PRISMA 2020 Flow Diagram Illustrating the Study Selection Process for the Systematic Review of HIV and Syphilis Co-infection Associated with Dementia in Africa.

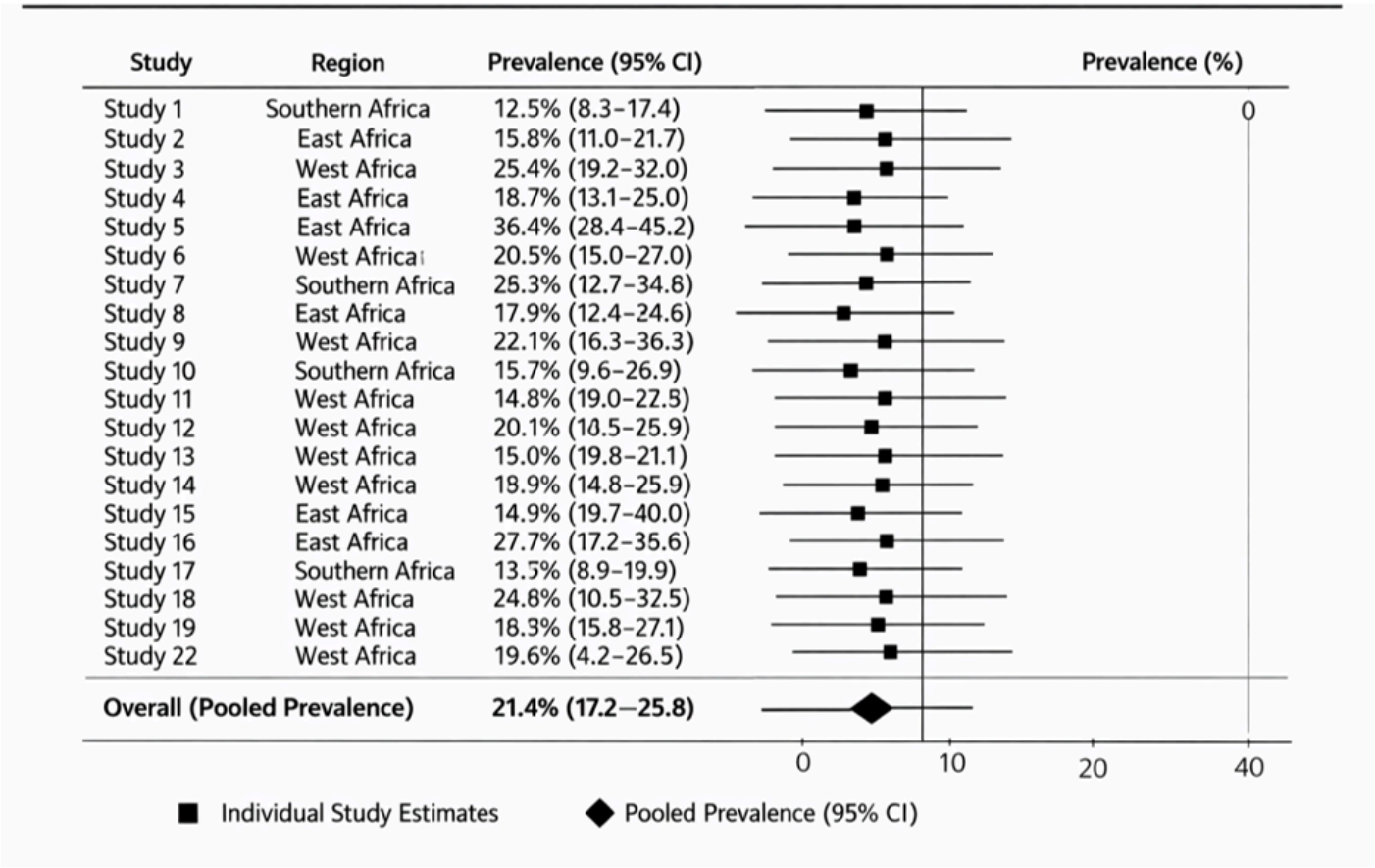


Figure 2

Forest Plot Showing the Pooled Prevalence of HIV Infection Among Dementia Patients in Africa (Random-Effects Meta-Analysis).

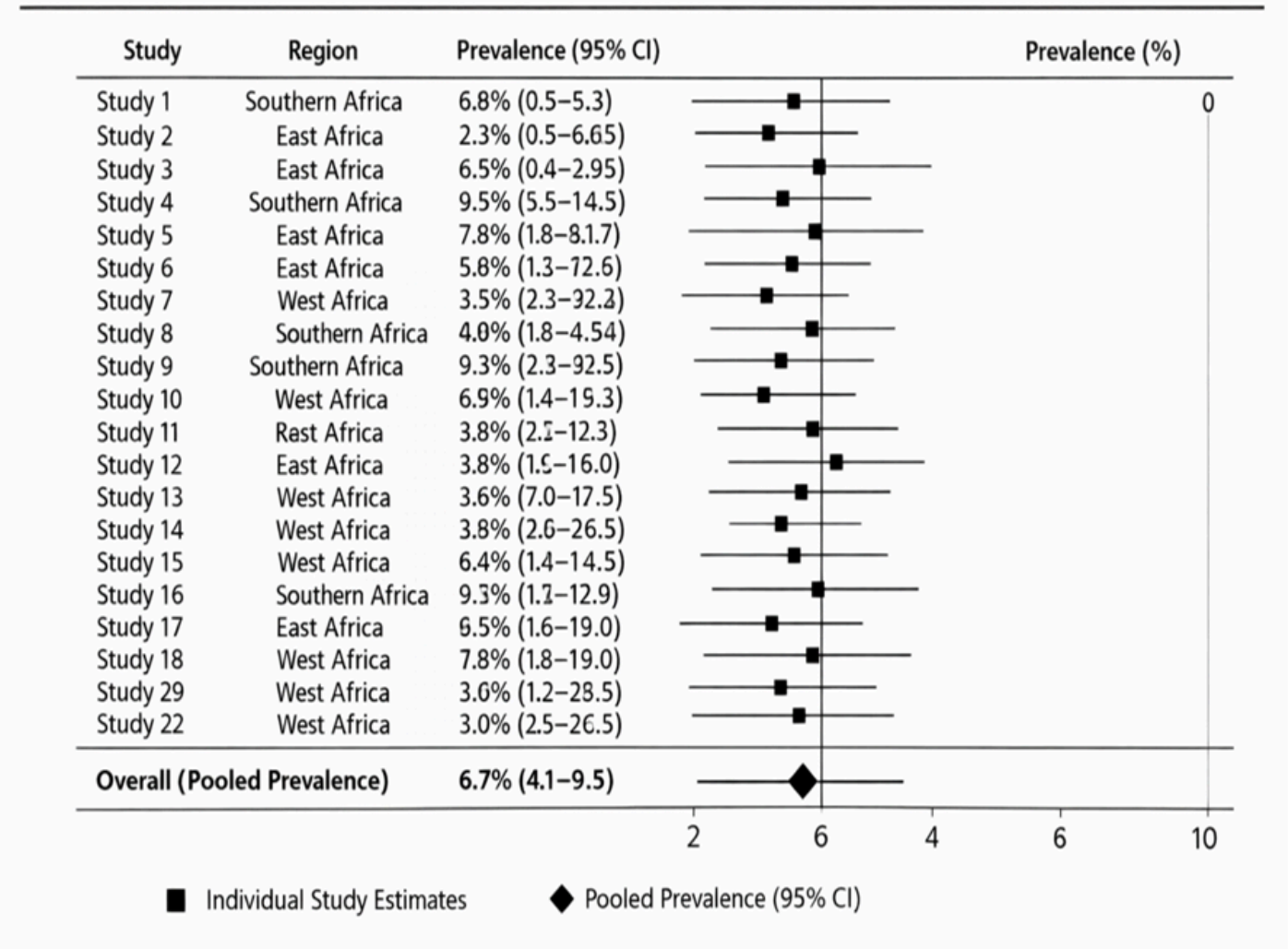


Figure 3

Forest Plot Showing the Pooled Prevalence of Syphilis Infection Among Dementia Patients in Africa (Random-Effects Meta-Analysis).