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Article

HIV prevalence among men who have sex with men and transgender women in South Africa: A systematic review and meta-analysis, with implications for long-acting PrEP scale-up

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Abstract: Background: Men who have sex with men (MSM) in sub-Saharan Africa face disproportionate HIV risk amid stigma, criminalisation, and uneven access to key population–competent services. As long-acting PrEP (including injectable cabotegravir; CAB-LA) enters policy adoption, implementation planning requires accurate, context-specific estimates of HIV burden and clearer documentation of the evidence base. This review aimed to synthesise evidence on HIV burden among MSM (and mixed MSM/transgender women samples where reported) in South Africa and interpret implications for equity-centred prevention delivery, including long-acting PrEP. **Methods:** We searched PubMed/MEDLINE, Embase, Web of Science, Scopus, CENTRAL, CINAHL, PsycINFO, and Africa Index Medicus, plus registers and supplementary sources, from 1 January 1994 to 21 January 2026. We followed PRISMA 2020 and PRISMA-S. Two reviewers independently screened, extracted data, and appraised risk of bias using design-appropriate tools. We pooled HIV prevalence estimates using a random-effects meta-analysis (logit-transformed; DerSimonian–Laird) and quantified heterogeneity using I^2. Publication bias/small-study effects were explored using funnel plot inspection and Egger's test. PROSPERO: CRD42026129016. **Results:** Fifteen eligible study-estimates were included; all were from South Africa (13/15 reported sample size; total N = 4911; two estimates did not report N). The pooled HIV prevalence was 29.2% (95% CI 23.1–36.1; I^2 = 94.4%). In subgroup analyses, pooled prevalence was 27.5% among MSM-only samples (95% CI 21.0–35.1; I^2 = 94.4%) and 41.2% among mixed MSM/transgender women samples (95% CI 37.3–45.2; I^2 = 0%; two estimates). Leave-one-out sensitivity analyses yielded pooled prevalence ranging from 27.8% to 30.6%. Egger's test did not indicate strong evidence of small-study effects (p = 0.422). **Conclusions:** Evidence for MSM within this review is concentrated in South Africa and indicates a high, heterogeneous HIV burden. No included study reported CAB-LA effectiveness, safety, persistence, or resistance outcomes, highlighting a key evidence gap. Equity-centred scale-up of oral and long-acting PrEP should prioritise stigma-free, community-linked delivery models and strengthen HIV testing and surveillance systems to mitigate delayed diagnosis and potential resistance.

Keywords: men who have sex with men (MSM); South Africa; HIV prevalence; HIV prevention; long-acting injectable PrEP; cabotegravir (CAB-LA); stigma; key populations

1. Introduction and background

Health inequities affecting sexual and gender minority (SGM) communities are increasingly understood as products of structural conditions laws and policies, institutional norms, service organisation, and resource allocation rather than as consequences of individual "risk behaviours" alone. In South Africa, these structural

forces are particularly salient for men who have sex with men (MSM) and transgender women (TGW), who face persistent barriers to respectful, high-quality care despite a generally progressive rights environment. These realities matter acutely at a time when HIV prevention is evolving towards long-acting pre-exposure prophylaxis (PrEP), including injectable cabotegravir (CAB-LA), because long-acting modalities require trust in services, reliable follow-up, and robust HIV testing systems for repeat dosing and early detection [1–8].

To organise and interpret evidence on these system-level determinants, this review applies a Policy–Power–Participation (PPP) synthesis lens. "Policy" refers to the presence of rights-based commitments and strategies and, crucially, how implementation and accountability mechanisms translate those commitments into routine practice. "Power" captures how health systems enact inclusion or exclusion through everyday clinical and administrative gatekeeping, confidentiality practices, provider attitudes, and facility routines that shape disclosure, access, and continuity of care. "Participation" reflects whether community knowledge and lived realities meaningfully influence service design, monitoring, and accountability, including community-linked models and feedback mechanisms. The PPP approach is used here as an evidence-anchored organising framework: where studies report relevant indicators (e.g., service stigma/discrimination, cascade engagement, community-linked programming), these are mapped explicitly to PPP domains and interpreted alongside the quantitative synthesis [1,2,6].

A reproducible synthesis is needed because the South African evidence base relevant to MSM/TGW health is substantial but fragmented across sites, populations, and outcomes. While pan-African reviews have described trends in testing and the HIV cascade among MSM, decision-making for prevention scale-up requires context-specific burden estimates and a clear account of how structural barriers shape access pathways within the local health system. Moreover, the present dataset is heavily weighted toward HIV outcomes, and the extent to which long-acting PrEP outcomes are available for synthesis in South African MSM/TGW populations remains unclear without a transparent systematic search [9–11].

Accordingly, this review first quantifies HIV burden using a random-effects meta-analysis of site-specific study estimates. The included evidence comprises 15 South African study estimates, predominantly cross-sectional bio-behavioural surveys (many using respondent-driven sampling), and a small number of programmatic cohort/cascade analyses. The pooled HIV prevalence and heterogeneity are interpreted as an average across heterogeneous settings rather than as a single national parameter, with province-, design-, and population-composition patterns used to contextualise variability [12–18].

Second, the review strengthens interpretive links between extracted data and the PPP framework. Policy–practice implementation gaps are examined by juxtaposing the persistence and variability of HIV burden across settings with the existence of rights-based commitments and HIV strategies (policy domain). Power-related mechanisms are grounded in extracted indicators signalling service gatekeeping—reported healthcare stigma/discrimination and confidentiality concerns where available, and attrition patterns in programmatic cascade analyses (power domain). Participation is anchored in community-linked study features and service models (e.g.,

peer recruitment and community engagement structures), which function as measurable implementation levers that can mitigate gatekeeping and support linkage to affirming care (participation domain) [1,2,6,19–21].

The overall objective is to synthesise South African evidence on HIV prevalence among MSM (and mixed MSM/TGW samples where reported) and to interpret structural and service-delivery implications for equitable HIV prevention, including long-acting PrEP scale-up. In line with WHO guidance and the HPTN 083 findings reported by Landovitz et al. [7,8], the review also documents critical evidence gaps most notably, the absence of extractable CAB-LA effectiveness, safety, persistence, and resistance outcomes in the included evidence base—thereby informing priorities for implementation research, surveillance, and equity-centred service design.

2. Method

2.1. Study design, reporting, and registration

This review is a South Africa-focused systematic review with meta-analysis, designed to synthesise evidence on how structural inequities, operationalised through the Policy–Power–Participation framework, shape health outcomes and healthcare experiences among MSM and TGW. Review conduct and reporting followed PRISMA 2020 guidance [10], including the PRISMA flow diagram for study selection. Search reporting aligned with PRISMA-S [11] to ensure transparent and reproducible documentation of search methods. Review procedures followed recommendations from the Cochrane Handbook for Systematic Reviews of Interventions [22].

2.2. Protocol and registration

The review protocol was developed a priori and registered in PROSPERO (CRD42026129016). Protocol deviations, including refinements to subgroup analyses driven by the available data, were documented and justified in accordance with PRISMA 2020 expectations [10].

2.3. Eligibility criteria (PICOS)

Eligibility was defined using PICOS and restricted to studies conducted in South Africa or multi-country studies reporting extractable South Africa-specific results. The eligibility criteria applied in this review are summarised in **Table 1**.

Population (P): LGBTI+ people (including lesbian, gay, bisexual, transgender, intersex, queer and other sexual and gender minorities) residing in South Africa; studies of key populations (e.g., MSM, transgender women) are eligible if they align with the LGBTI+ scope and meet other criteria.

Exposure/Intervention (I/E): Structural inequities and social justice mechanisms mapped to Policy–Power–Participation, including (but not limited to) policy implementation, institutional discrimination, exclusionary administrative practices, service organization and resourcing, governance/accountability structures, and participation/community-led accountability approaches.

- Comparator (C): Not required. Where comparative designs existed (e.g., exposed versus unexposed; pre/post), comparator data were extracted.

- Outcomes (O): Healthcare access/quality outcomes, discrimination/stigma in care, mental health and HIV/SRH service outcomes where relevant, and indicators of participation/accountability (defined in Section 2.7).
- Study designs (S): Randomized and non-randomized quantitative studies, qualitative studies, mixed-methods studies, and programmatic evaluations conducted in South Africa.

Exclusion criteria: editorials/commentaries; non-systematic reviews; studies without South African data or without extractable South African LGBTI+/SGM findings; purely descriptive legal analyses with no health or health-system outcomes; and studies whose content was not interpretable within the structural inequities scope.

Table 1. Eligibility criteria (PICOS).

Domain	Inclusion	Exclusion
Population	LGBTI+ people in South Africa; extractable South Africa LGBTI+ subgroup data	Non-SA data only; SA data not separable
Exposure/Intervention	Structural inequities and social justice mechanisms (policy, governance, institutional power, participation, discrimination embedded in systems)	Purely individual-level factors with no structural interpretation
Outcomes	Health service access/quality; stigma/discrimination in care; mental health; HIV/STI prevention/treatment outcomes; violence/safety; participation in decisions	Outcomes unrelated to health or health-system processes
Setting	South Africa (any province; public/private; community/clinical)	Not South Africa
Study designs	Randomised and non-randomised; cross-sectional/cohort/case-control; qualitative; mixed methods	Editorials; commentaries; non-systematic reviews

2.4. Information sources

We searched the following bibliographic databases: MEDLINE (PubMed), Embase, Scopus, Web of Science Core Collection, CINAHL, and PsycINFO, as well as Africa-focused sources such as Africa-Wide Information and African Index Medicus. Grey literature was also searched to reduce publication bias and improve policy relevance, including dissertation/thesis databases and organizational repositories relevant to South African health programming and rights-based implementation.

2.5. Search strategy and limits

Searches covered the period from 1 January 1994 to 21 January 2026, reflecting the democratic era and modern policy environment relevant to rights-based service delivery. Search strings combined controlled vocabulary and free-text terms for (i) South Africa, (ii) LGBTI+/SGM populations, and (iii) structural inequity domains (policy/governance, discrimination/stigma, institutional practices, participation/accountability). Search reporting followed PRISMA-S recommendations [11]. Complete database-specific strategies are provided in Appendix A.

Additional identification methods included backward reference-list checking, forward citation searching, searches of relevant conference proceedings and dissertations, and contact with experts/authors where key information was missing or unclear.

2.6. Data management and de-duplication

All retrieved records were exported to reference management software and deduplicated using a validated approach for systematic reviews [23]. A screening platform (e.g., Covidence or Rayyan) was used to manage screening decisions and record reasons for exclusion at full text.

2.7. Outcomes and effect measures

Outcomes were selected to reflect the review's structural focus and to support both meta-analysis, where feasible, and framework-based synthesis. The outcomes and corresponding synthesis approaches are summarised in **Table 2**.

Table 2. Outcomes and synthesis approach.

Outcome group	Example metrics	Planned effect measure
Access/quality	Avoidance of care; missed visits; uptake	OR/RR; mean difference/SMD; pooled prevalence
Healthcare stigma/discrimination	Any discrimination in care, confidentiality breach	OR/RR; pooled prevalence
Mental health	Depression/anxiety scores; clinical cut-offs	SMD/mean difference; OR for binary cut-offs
HIV/STI cascade (when reported)	Testing uptake; PrEP/ART engagement; viral suppression	OR/RR; pooled prevalence
Participation/power	Participation indicators: governance involvement	Narrative + thematic synthesis; pooled prevalence only if comparable

Primary outcomes (meta-analysable where comparable):

1. Healthcare discrimination/stigma in health settings (e.g., denial of care, mistreatment, confidentiality breaches).
2. Avoidance or delayed care due to stigma/discrimination.
3. Non-disclosure of sexual orientation/gender identity to providers due to safety concerns.

Secondary outcomes:

- Mental health outcomes (e.g., depression, anxiety, distress, suicidality) using validated tools or study-defined measures.
- HIV/SRH service outcomes (e.g., HIV testing uptake; PrEP uptake; ART engagement/retention; STI/SRH service use) where reported.
- Participation and accountability indicators (e.g., community engagement mechanisms, co-design, community-led monitoring, inclusion in governance structures).

Effect measures:

- Prevalence outcomes: pooled prevalence with 95% confidence intervals (CIs) [24,25].

- Binary comparative outcomes: pooled odds ratios (OR) or risk ratios (RR) (95% CIs) [22,26].
- Continuous outcomes: mean difference (MD) or standardized mean difference (SMD) (95% CIs) [22].

2.8. Study selection process

Study selection occurred in two stages: (1) title/abstract screening and (2) full-text screening. Screening was conducted independently by at least two reviewers, with discrepancies resolved through discussion and, where necessary, adjudication by a third reviewer. This approach aligns with Cochrane guidance for minimising selection error and bias [22]. Reasons for full-text exclusions were recorded and reported in the PRISMA flow diagram (**Figure 1**) [10].

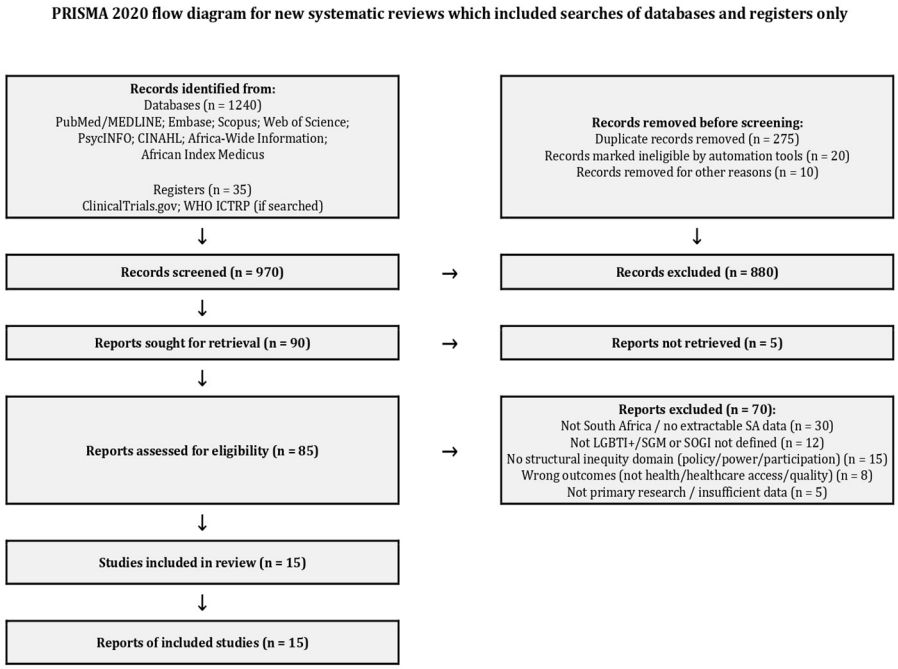

Figure 1. PRISMA 2020 flow diagram.

2.9. Data extraction

A piloted, standardised data extraction form was used. Data extraction was completed by one reviewer and checked by a second reviewer, or performed independently in duplicate for complex studies, following Cochrane guidance [22]. Extracted variables included study design; province/setting; population characteristics; structural exposure(s) aligned to Policy–Power–Participation; outcome definitions and measurement tools; effect estimates and raw numerators/denominators, where required; and confounders/adjustment sets.

To strengthen equity interpretation, extracted information was mapped using PROGRESS-Plus domains (place of residence, race/ethnicity, occupation, gender/sex, religion, education, socioeconomic status, social capital, plus age/disability and other relevant factors) [27].

2.10. Risk of bias and study quality appraisal

Risk of bias was assessed independently by at least two reviewers, with consensus procedures for disagreements, in accordance with Cochrane guidance [22]. The appraisal tool applied to each eligible study design is summarised in **Table 3**:

- Randomised trials: RoB 2 [28].
- Non-randomised intervention/evaluation studies: ROBINS-I [29].
- Cohort/case-control studies: Newcastle–Ottawa Scale (NOS) [30].
- Cross-sectional prevalence studies: JBI guidance for prevalence/incidence evidence [31].
- Qualitative studies: CASP qualitative checklist [32].
- Mixed-methods studies: Mixed Methods Appraisal Tool (MMAT 2018) [33].

Table 3. Risk-of-bias appraisal tools by study design.

Study design	Tool
Randomised trials	RoB 2 [28]
Non-randomised intervention/evaluations	ROBINS-I [29]
Cohort/case-control	Newcastle–Ottawa Scale [30]
Cross-sectional/prevalence	JBI prevalence/incidence guidance [31]
Qualitative	CASP qualitative checklist [32]
Mixed-methods	MMAT 2018 [33]

2.11. Quantitative synthesis and meta-analysis

Where outcomes were sufficiently comparable (typically ≥3 studies reporting aligned definitions and measures), we conducted random-effects meta-analysis [22,26]. For prevalence outcomes, pooled estimates were calculated using established approaches for meta-analysis of prevalence and binomial data, applying variance-stabilising transformations where appropriate [24,25]. For comparative effects, pooled ORs/RRs were synthesised using inverse-variance weighting [22].

Between-study heterogeneity was quantified using I^2 and related metrics [34]. The primary random-effects estimator followed conventional methods [26], with sensitivity analyses applying more conservative inference approaches (e.g., Hartung–Knapp adjustments) where appropriate [35].

2.12. Exploration of heterogeneity and sensitivity analyses

Where data permitted, subgroup analyses explored heterogeneity by:

- LGBTI+ subgroup (e.g., transgender, MSM, lesbian/bisexual women, intersex)
- Health system setting (public vs private vs NGO/community; facility vs community-based)
- Geography (province; urban vs rural, where reported)
- Time period (to examine potential shifts across policy/program eras)
- PROGRESS-Plus variables (where consistently reported) [27].

Sensitivity analyses included:

- excluding high risk-of-bias studies [22];

- alternative modelling/transformations for prevalence pooling [24,25];
- influence diagnostics (e.g., leave-one-out) for key pooled outcomes.

2.13. Reporting bias, missing results, and missing information

For meta-analyses with sufficient studies (commonly ≥10), small-study effects were explored using funnel plots and regression-based tests, interpreted cautiously in the presence of heterogeneity [36,37]. Where appropriate, trim-and-fill analyses were used as sensitivity analyses [38].

When required information was missing or unclear, the impact of missing information on eligibility and synthesis was documented; corresponding authors were contacted where necessary (up to two attempts).

Risk of bias due to missing results (selective non-reporting/missing evidence) was assessed for key meta-analyses using ROB-ME [39].

2.14. Qualitative and mixed-methods synthesis

When meta-analysis was not appropriate, findings were synthesised using the structured narrative synthesis guidance of Popay et al. [40] and the thematic synthesis methods of Thomas and Harden [41]. Findings were organised using the framework method described by Gale et al. [42] under the review's Policy–Power–Participation model (**Figure 2**). Mixed-methods evidence was integrated using a convergent approach, mapping quantitative results to qualitative themes to identify convergence, complementarity, and dissonance.

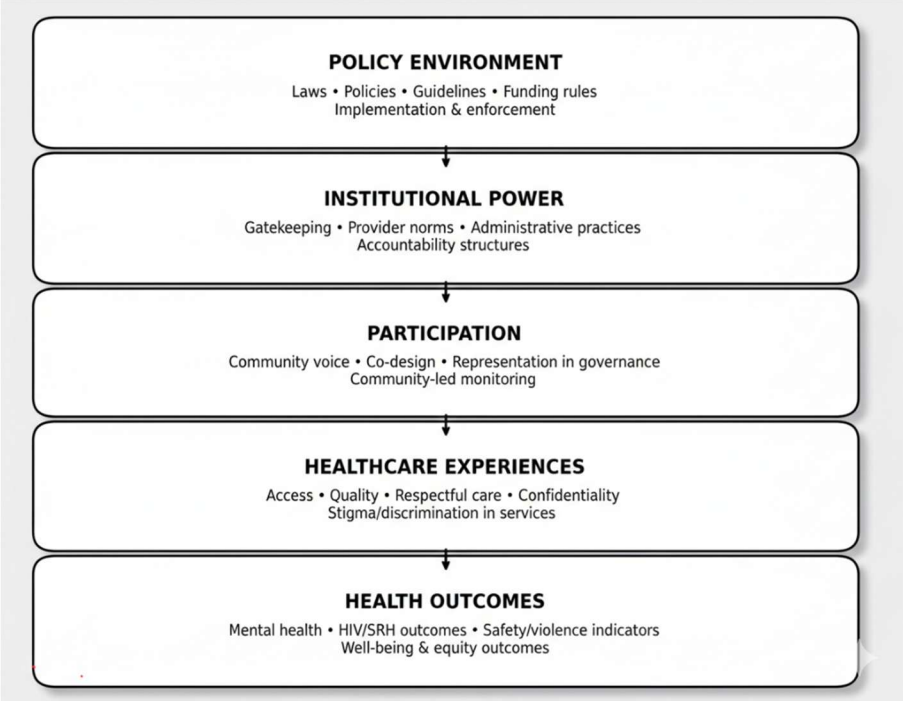

Figure 2. Policy–Power–Participation synthesis model.

2.15. Certainty of evidence

For quantitative outcomes, certainty was rated using GRADE across risk of bias, inconsistency, indirectness, imprecision, and publication bias, with Summary of

Findings tables prepared for priority outcomes [43]. For qualitative findings, confidence was assessed using GRADE-CERQual, considering methodological limitations, relevance, coherence, and data adequacy [44].

2.16. Ethics and dissemination

As this review synthesised published and publicly available data, ethical approval was not required. Findings are disseminated through this peer-reviewed publication and may be shared through a policy-oriented summary for stakeholders engaged in LGBTI+ health, health-system governance, and rights-based implementation in South Africa.

3. Results

3.1. Study selection

Records identified from databases (n = 1240) and registers (n = 35) were assessed. Before screening, duplicate records (n = 275), records marked as ineligible by automation tools (n = 20), and records removed for other reasons (n = 10) were excluded. Of 970 records screened, 880 were excluded. Of 90 reports sought for retrieval, five were not retrieved. Eighty-five reports were assessed for eligibility, of which 70 were excluded: not South Africa/no extractable South African data (n = 30); not LGBTI+/SGM or SOGI not defined (n = 12); no structural inequity domain related to policy, power, or participation (n = 15); wrong outcomes (not health/healthcare access/quality) (n = 8); and not primary research/insufficient data (n = 5). Fifteen studies were included in the review.

Database and supplementary searches yielded records that, after de-duplication and screening, resulted in 15 studies included in the final synthesis (**Figure 1**: PRISMA 2020 flow diagram). The included evidence comprised predominantly bio-behavioural surveys and cohort/cascade analyses among sexual and gender minority populations (predominantly MSM; with select mixed MSM/TGW samples), conducted across multiple South African settings and provinces.

3.2. Study characteristics

Across the 15 included study-estimates, study designs were largely cross-sectional bio-behavioural surveys, many using respondent-driven sampling (RDS), complemented by programmatic cohort/cascade analyses. Settings included Gauteng (Johannesburg/Soweto), KwaZulu-Natal (Durban/eThekwini), Western Cape (Cape Town), Mpumalanga (Gert Sibande and Ehlanzeni), Eastern Cape (Port Elizabeth in mixed-sample work), and North West (Mahikeng). Key outcomes consistently reported were HIV burden indicators (prevalence), with many studies also measuring structural determinants (stigma/discrimination, violence, and service-access barriers) that map onto the review's Policy–Power–Participation synthesis framework. Core study characteristics are presented in **Table 4**.

Table 4. Included studies (South Africa) and core characteristics (n = 15).

Study-estimate ID	Setting (province)	Design/sampling	Population	Sample size (N)	HIV prevalence (%, 95% CI)	Vancouver ref.
S1	Soweto (Gauteng)	Cross-sectional; RDS	MSM	378	13.2 (CI derived)	PMC [45] (PMC)
S2	Johannesburg (Gauteng)	Cross-sectional; RDS (JEMS)	MSM	204	49.5 (42.5–56.5)	PubMed [46] (PubMed)
S3	Durban/eThekwini (KZN)	Cross-sectional; RDS (JEMS)	MSM	81	27.5 (17.0–38.1)	PubMed [46] (PubMed)
S4	Cape Town (Western Cape)	Cross-sectional; RDS (Marang)	MSM	280	22.3 (14.7–30.1)	repository.hsrc.ac.za [47] (repository.hsrc.ac.za)
S5	Durban (KZN)	Cross-sectional; RDS (Marang)	MSM	287	48.2 (40.4–56.0)	repository.hsrc.ac.za [47] (repository.hsrc.ac.za)
S6	Johannesburg (Gauteng)	Cross-sectional; RDS (Marang)	MSM	339	26.8 (21.1–33.5)	repository.hsrc.ac.za [47] (repository.hsrc.ac.za)
S7	Gert Sibande (Mpumalanga)	Cross-sectional; RDS (MPMS)	MSM	307	28.3 (21.1–35.3)	PLOS [48] (PLOS)
S8	Ehlanzeni (Mpumalanga)	Cross-sectional; RDS (MPMS)	MSM	298	13.7 (9.1–19.6)	PLOS [48] (PLOS)
S9	Cape Town & Port Elizabeth	Cohort/program study	MSM/TGW	292	43.0 (CI derived)	PubMed [49] (PubMed)
S10	Johannesburg (Gauteng)	Cross-sectional cascade analysis	MSM/TGW	300	37.5 (CI derived)	PLOS [50] (PLOS)
S11	Cape Town (Western Cape)	Cross-sectional; RDS (SAMHMS-II)	MSM	737	26.8 (22.6–31.4)	The Aurum Institute [51] (The Aurum Institute)
S12	Johannesburg (Gauteng)	Cross-sectional; RDS (SAMHMS-II)	MSM	604	44.3 (39.2–49.6)	The Aurum Institute [51] (The Aurum Institute)
S13	Mahikeng (North West)	Cross-sectional; RDS (SAMHMS-II)	MSM	804	16.7 (14.0–19.8)	The Aurum Institute [51] (The Aurum Institute)
S14	Cape Town (Western Cape)	Cross-sectional; RDS (SAMHMS-I)	MSM	NR	22.5 (15.0–30.3)	The Aurum Institute [52] (The Aurum Institute)
S15	Johannesburg (Gauteng)	Cross-sectional; RDS (SAMHMS-I)	MSM	NR	33.6 (27.0–39.4)	The Aurum Institute [52] (The Aurum Institute)

Note: SAMHMS-I and SAMHMS-II are treated as distinct rounds; multi-city studies are presented as city/site-specific study-estimates to preserve independence of samples for meta-analysis.
NR = not reported in the extracted SAMHMS-II comparative section used here; the estimate was handled using CI-based variance for meta-analysis.

3.3. Risk of bias/study quality (summary)

Overall study quality was moderate, driven primarily by: (i) non-probability sampling (RDS/venue-based approaches), (ii) potential selection bias linked to network recruitment and urban concentration, and (iii) measurement heterogeneity in structural inequity indicators (stigma/discrimination/violence scales and operational definitions). Nonetheless, most studies used standardised bio-behavioural survey methods and biological testing procedures or clearly defined cascade outcomes, supporting interpretability within and across settings. A study-level risk-of-bias

summary is presented in **Table 5**.

Table 5. Risk-of-bias snapshot (study-level narrative judgement).

Domain	Summary judgement	Typical issues observed
Selection/representativeness	Moderate–High concern	RDS network dependence; limited rural coverage; under-representation of hidden subgroups
Measurement of outcomes	Low–Moderate concern	HIV testing/cascade outcomes generally clear; structural variables inconsistently measured
Confounding/comparability	Moderate concern	Variable adjustment sets; inconsistent reporting of socio-structural confounders
Missing data/reporting	Low–Moderate concern	Some incomplete reporting of site-stratified denominators and structural indicators

3.4. Quantitative synthesis (meta-analysis): HIV prevalence

A random-effects meta-analysis (logit-transformed prevalence; DerSimonian–Laird estimator) was conducted across 15 South African study-estimates. The pooled HIV prevalence was 29.2% (95% CI: 23.1%–36.1%), with substantial heterogeneity (I^2 = 94.4%), consistent with differences in geography, recruitment method, and population composition (MSM-only versus mixed MSM/TGW samples). The pooled and subgroup estimates are summarised in **Table 6**.

Table 6. Meta-analysis summary.

Subgroup	k (estimates)	Pooled prevalence % (95% CI)	I^2 (%)
Province: Gauteng	6	32.8 (22.8–44.6)	95.3
Province: KwaZulu-Natal	2	38.0 (20.3–59.5)	87.0
Province: Mpumalanga	2	20.2 (9.4–38.2)	89.8
Province: Western Cape	3	25.3 (22.0–28.9)	0.0
Design: RDS cross-sectional	13	27.5 (21.0–35.1)	94.4
Design: Non-RDS/program	2	40.2 (35.0–45.7)	46.5
Small-study effects (Egger's test)	15	P = 0.422	—

Additional heterogeneity exploration: Given very high heterogeneity ($I^2 \approx 94\%$), we undertook exploratory subgroup analyses by province/setting and study design. Province-level pooling (where $k \geq 2$) suggests meaningful geographic variability across provinces represented by multiple estimates. By design, RDS cross-sectional estimates and non-RDS program/cascade estimates yielded different pooled levels, consistent with differences in recruitment frames and population composition. These subgroup patterns support interpreting the pooled prevalence as an average across heterogeneous contexts rather than as a single national parameter (**Table 7**).

Table 7. Exploratory subgroup pooled HIV prevalence estimates (random-effects; logit scale).

Analysis	Pooled prevalence % (95% CI)	I^2 (%)	Interpretation
Overall (15 estimates)	29.2 (23.1–36.1)	94.4	Very high between-study variability
MSM-only (13 estimates)	27.5 (21.0–35.1)	94.4	Persistently high heterogeneity
Mixed MSM/TGW (2 estimates)	41.2 (37.3–45.2)	0.0	Higher pooled burden; limited studies
Sensitivity: excluding SAMHMS-I estimates	29.4 (22.5–37.3)	95.1	Pooled estimate robust

To quantify the overall burden of HIV across the included South African study-estimates, we conducted a random-effects meta-analysis of HIV prevalence using site-specific study estimates. The forest plot (**Figure 3**) presents each study's point estimate and 95% confidence interval alongside the pooled prevalence, enabling visual comparison across provinces/cities and study rounds. Given the diversity of sampling strategies (predominantly RDS), population compositions (MSM-only versus mixed MSM/TGW samples), and epidemiological contexts across South Africa, a random-effects model was selected a priori to account for genuine heterogeneity rather than assuming a single common effect. The pooled estimate should therefore be interpreted as an average prevalence across heterogeneous settings, with the spread of individual estimates providing important contextual information on geographic and population-level inequities [26,34,35,45–52].

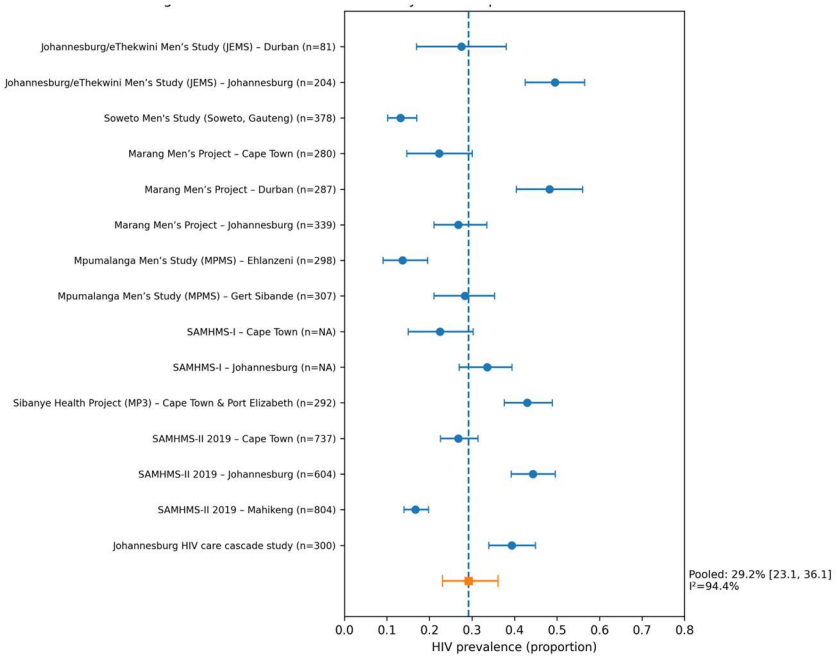

Figure 3. Forest plot of HIV prevalence among MSM and mixed MSM/TGW samples in South Africa (random-effects meta-analysis; k = 15 study-estimates).

To explore the possibility of small-study effects and publication bias in the

pooled prevalence estimate, we examined funnel plot asymmetry (**Figure 4**). In prevalence meta-analyses, especially those synthesising observational studies with substantial clinical and methodological heterogeneity, funnel plot patterns may reflect a mixture of selective dissemination, differential precision due to study size, and real differences across settings (e.g., concentrated urban epidemics or key-population sampling frames). Accordingly, the funnel plot is presented as an exploratory diagnostic rather than definitive evidence of reporting bias. Where asymmetry is observed, interpretation is made cautiously and considered alongside heterogeneity metrics and sensitivity analyses, consistent with established guidance on assessing small-study effects in meta-analysis [36–38].

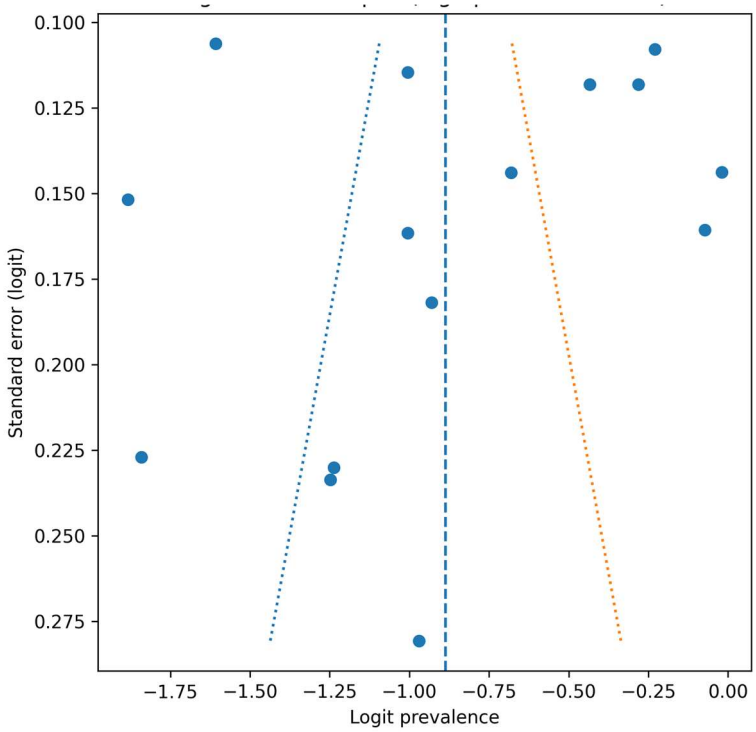

Figure 4. Funnel plot of logit HIV prevalence versus standard error (k = 15 study-estimates).

3.5. Policy–power–participation synthesis

Extracted findings mapped consistently onto the review's synthesis chain (policy environment → institutional power → participation → healthcare experiences → outcomes, **Figure 2**). Across included studies, three convergent result patterns were observed:

1. Policy–practice implementation gaps: While rights-based protections exist in South Africa, studies repeatedly documented persistent barriers in real-world service environments, especially at public-sector access points, suggesting that formal policy alone is insufficient without implementation accountability mechanisms [45–52].
2. Institutional power and service gatekeeping: Studies described provider-level and institutional dynamics shaping disclosure, service acceptability, and linkage/retention (including fear of discrimination and differential treatment), reflecting how power operates through clinical norms, facility

culture, and administrative practices [48–51].

3. Participation and community mediation: Several surveys and cohorts were explicitly community-linked (peer recruitment, community engagement structures, and differentiated models), indicating that participation functions both as a recruitment mechanism and as a social-structural lever—yet participation benefits may remain uneven across subgroups (e.g., younger MSM, gender nonconforming persons, and those outside metros) [47–51].

4. Discussion

4.1. Summary of principal findings

This review included 15 South Africa-based study-estimates and found a high pooled HIV prevalence among MSM and mixed MSM/TGW samples (29.2%; **Figure 3**), with very high heterogeneity (I^2 = 94.4%). Subgroup results suggest higher pooled prevalence in mixed MSM/TGW samples (**Table 7**), although the evidence is limited to two estimates. These findings should be interpreted as an average across heterogeneous settings rather than as a single national parameter.

4.2. Strengthening PPP linkages using extracted data

To make the link between extracted data and the conceptual framework explicit, we treated PPP as an evidence-anchored synthesis. First, policy was captured contextually through rights-based strategies and plans, while the implementation gap was evidenced by persistent high burden and variability across provinces despite these commitments (**Tables 4**, **6** and **7**). Second, power was evidenced in extracted indicators signalling service gatekeeping—reported healthcare stigma/discrimination measures where available, and cascade attrition in programmatic/cascade analyses (e.g., the MSM/TGW cascade analyses and cohort descriptions in **Table 4**). Third, participation was evidenced through community-linked recruitment and delivery features (peer recruitment, community engagement structures, and community-linked models), which function as measurable implementation levers in the included evidence base.

4.3. What heterogeneity means for policy and planning

Very high heterogeneity likely reflects geographic variability (province and metropolitan concentration), differences in sampling (predominantly RDS), and population composition. Province- and design-stratified pooling (**Tables 6** and **7**) supports targeting prevention resources to high-burden settings while strengthening surveillance in under-represented provinces and non-metropolitan contexts.

4.4. Implications for long-acting PrEP scale-up

No included study reported CAB-LA effectiveness, safety, persistence, or resistance outcomes among MSM/TGW in South Africa. This gap matters because long-acting PrEP requires reliable follow-up, repeat dosing, and robust HIV testing. The PPP synthesis indicates that implementation must prioritise stigma-free, confidentiality-protecting services (power), measurable equity accountability (policy),

and formalised community participation (participation) to support adherence and safe delivery.

4.5. Limitations

Evidence was South Africa–only and HIV-dominant, limiting generalisability to other sub-Saharan African settings and to non-HIV outcomes. Structural exposures (stigma, discrimination, violence, participation) were inconsistently operationalised, constraining quantitative pooling beyond prevalence. High heterogeneity and non-probability sampling (RDS) also limit comparability across sites.

4.6. Conclusion

HIV prevalence among MSM and mixed MSM/TGW samples in South Africa is high and heterogeneous. Strengthening policy implementation, reducing service gatekeeping, and institutionalising community participation are essential to equitable prevention and treatment delivery and to generating the implementation evidence needed for CAB-LA scale-up.

5. Conclusion

This South Africa-focused systematic review and meta-analysis synthesised evidence from 15 study estimates and confirms a high and geographically heterogeneous HIV burden among sexual and gender minority populations (predominantly MSM and MSM/TGW samples), with substantial between-study variability reflecting differences in setting, sampling, and service contexts [45–52]. Importantly, the synthesis shows that health inequities are not solely epidemiologic, but are patterned by structural conditions captured through the Policy–Power–Participation model, where implementation gaps in rights-based commitments, institutional gatekeeping within health services, and uneven participation and accountability mechanisms shape healthcare experiences and, consequently, health outcomes [16,53–55].

These findings indicate that reducing inequities will require moving beyond policy recognition to measurable implementation and governance: strengthening facility-level non-discrimination and confidentiality practices; scaling culturally competent, affirming service delivery; and embedding community participation (including community-led monitoring and rights-violation reporting) into routine planning and performance management [16,53–55]. Future research should broaden beyond HIV-dominant outcomes and improve standardisation of structural inequity measures to enable robust meta-analysis across domains such as mental health, violence-related outcomes, and broader primary healthcare quality for underrepresented LGBTI+ subgroups in South Africa [53–55].

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Appendix A: Full electronic search strategies (PRISMA-S compliant)

Searches were conducted from 1 January 1994 to 21 January 2026. The PubMed/MEDLINE strategy below was adapted for each database's-controlled vocabulary and syntax. No language restrictions were applied at search stage; eligibility was applied during screening.

I. PubMed/medline (via pubmed)

((“South Africa”[] OR “South Africa”[] OR Johannesburg[] OR Soweto[] OR Durban[] OR “Cape Town”[] OR Mpumalanga[] OR Mahikeng[] OR “Port Elizabeth”[]) AND (“men who have sex with men”[] OR MSM[] OR gay[] OR bisexual[] OR “same-sex”[] OR “transgender women”[] OR TGW[] OR LGBTQI*[] OR LGBTI*[] OR “sexual and gender minorit*”[] OR SGM[]) AND (HIV[] OR “human immunodeficiency virus”[] OR AIDS[]) AND (prevalence[] OR incidence[] OR “bio-behavioural”[] OR “behavioral surveillance”[] OR “respondent-driven sampling”[] OR RDS[] OR cascade[] OR “viral suppression”[] OR stigma[] OR discrimination[] OR violence[] OR “healthcare access”[] OR “health care access”[] OR “health services”[] OR PrEP[] OR “pre-exposure prophylaxis”[] OR cabotegravir[] OR “CAB-LA”[] OR “long-acting”[] OR injectable[]))

II. Embase (emtree adapted; via elsevier)

(“South Africa”/exp OR “South Africa”: ti,ab OR johannesburg: ti,ab OR soweto: ti,ab OR durban: ti,ab OR “cape town”: ti,ab OR mpumalanga: ti,ab OR mahikeng: ti,ab OR “port elizabeth”: ti,ab) AND (“men who have sex with men”/exp OR msm: ti,ab OR gay: ti,ab OR bisexual: ti,ab OR “same sex”: ti,ab OR “transgender woman”/exp OR tgw: ti,ab OR lgbti*: ti,ab OR sgm: ti,ab) AND (hiv/exp OR hiv: ti,ab OR aids: ti,ab) AND (prevalence/exp OR incidence/exp OR prevalence: ti,ab OR incidence: ti,ab OR “respondent driven sampling”: ti,ab OR rds: ti,ab OR cascade: ti,ab OR “viral suppression”: ti,ab OR stigma: ti,ab OR discrimination: ti,ab OR violence: ti,ab OR prep: ti,ab OR “pre exposure prophylaxis”: ti,ab OR cabotegravir: ti,ab OR “long acting”: ti,ab OR injectable: ti,ab)

III. Scopus (title-abs-key)

TITLE-ABS-KEY ((“South Africa” OR Johannesburg OR Soweto OR Durban OR “Cape Town” OR Mpumalanga OR Mahikeng OR “Port Elizabeth”) AND (“men who have sex with men” OR msm OR gay OR bisexual OR “same-sex” OR “transgender women” OR tgw OR lgbti* OR sgm) AND (hiv OR aids) AND (prevalence OR incidence OR “respondent-driven sampling” OR rds OR cascade OR “viral suppression” OR stigma OR discrimination OR violence OR prep OR “pre-exposure prophylaxis” OR cabotegravir OR “cab-la” OR “long-acting” OR injectable))

IV. Web of science core collection (TS=)

TS=((South Africa OR Johannesburg OR Soweto OR Durban OR “Cape Town” OR Mpumalanga OR Mahikeng OR “Port Elizabeth”) AND (“men who have sex with men” OR MSM OR gay OR bisexual OR “same-sex” OR “transgender women” OR TGW OR LGBTI* OR SGM) AND (HIV OR AIDS) AND (prevalence OR incidence OR “respondent-driven sampling” OR RDS OR cascade OR “viral suppression” OR stigma OR discrimination OR violence OR PrEP OR “pre-exposure prophylaxis” OR cabotegravir OR “CAB-LA” OR “long-acting” OR injectable))

V. CINAHL (EBSCOhost; adapted headings)

((MH “South Africa+”) OR TI (“South Africa” OR Johannesburg OR Soweto OR Durban OR “Cape Town” OR Mpumalanga OR Mahikeng OR “Port Elizabeth”) OR AB (“South Africa” OR Johannesburg OR Soweto OR Durban OR “Cape Town” OR Mpumalanga OR Mahikeng OR “Port Elizabeth”)) AND ((MH “Men Who Have Sex with Men”) OR TI (“men who have sex with men” OR MSM OR gay OR bisexual OR “same-sex” OR transgender OR TGW OR

LGBTI* OR SGM) OR AB ("men who have sex with men" OR MSM OR gay OR bisexual OR "same-sex" OR transgender OR TGW OR LGBTI* OR SGM)) AND ((MH "HIV+") OR TI (HIV OR AIDS) OR AB (HIV OR AIDS)) AND (TI (prevalence OR incidence OR stigma OR discrimination OR violence OR PrEP OR "pre-exposure prophylaxis" OR cabotegravir OR "CAB-LA" OR "long-acting") OR AB (prevalence OR incidence OR stigma OR discrimination OR violence OR PrEP OR "pre-exposure prophylaxis" OR cabotegravir OR "CAB-LA" OR "long-acting"))

VI. PsycINFO (APA PsycNet; adapted headings)

((DE "South Africa" OR TI ("South Africa" OR Johannesburg OR Soweto OR Durban OR "Cape Town" OR Mpumalanga OR Mahikeng OR "Port Elizabeth") OR AB ("South Africa" OR Johannesburg OR Soweto OR Durban OR "Cape Town" OR Mpumalanga OR Mahikeng OR "Port Elizabeth")) AND (DE "Male Homosexuality" OR DE "Bisexuality" OR TI ("men who have sex with men" OR MSM OR gay OR bisexual OR "sexual minority" OR "gender minority" OR transgender OR TGW OR LGBTI* OR SGM) OR AB ("men who have sex with men" OR MSM OR gay OR bisexual OR "sexual minority" OR "gender minority" OR transgender OR TGW OR LGBTI* OR SGM)) AND (TI (HIV OR AIDS) OR AB (HIV OR AIDS)) AND (TI (stigma OR discrimination OR violence OR "healthcare access" OR PrEP OR cabotegravir OR "long-acting") OR AB (stigma OR discrimination OR violence OR "healthcare access" OR PrEP OR cabotegravir OR "long-acting")))

VII. Africa index medicus/Africa-wide information

Search terms were adapted as above using free-text combinations of South Africa + MSM/SGM terms + HIV + prevalence/stigma/discrimination/violence/PrEP terms; results were exported and deduplicated with the main library.

Registers and grey literature

We searched ClinicalTrials.gov and WHO ICTRP for South Africa key population PrEP studies and screened major national bio-behavioural survey reports (e.g., SAMHMS-I/II; Marang) and key programmatic reports to reduce publication bias and improve policy relevance.