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BIBLIOMETRIC REVIEW OF AI FOR HIV/STI IN LATIN AMERICA

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ABSTRACT

The persistent high incidence of human immunodeficiency virus (HIV) and other sexually transmitted infections (STIs) constitutes a critical public health challenge in Latin America, a region characterized by structural inequalities and epidemiological heterogeneity. Although artificial intelligence (AI) has demonstrated transformative potential for disease surveillance and diagnosis globally, its application within the Latin American context remains underexplored. This study aims to provide a comprehensive assessment of AI applications for HIV and STI detection and prevention in Latin America, identifying principal technological advances, mapping the intellectual structure of this emerging field, and critically evaluating implementation advantages and limitations. Employing an exploratory qualitative design, a bibliometric review coupled with thematic synthesis was conducted. Five electronic databases were searched for studies published between January 2015 and December 2025. Following PRISMA guidelines, a multi-stage selection process involving two independent reviewers identified 28 empirical studies for final inclusion. Bibliometric mapping using VOSviewer examined keyword co-occurrence and collaborative networks, while thematic analysis using NVivo 14 integrated deductive and inductive coding. Bibliometric analysis revealed a rapidly expanding research landscape dominated by Brazil, Mexico, and Colombia. Thematic synthesis demonstrated that machine learning models, particularly ensemble methods such as XGBoost, consistently outperformed traditional approaches in predictive accuracy, achieving metrics exceeding 85% in regional validation studies. However, persistent challenges emerged: algorithmic bias from unrepresentative training data, fragmented health information systems, ethical concerns regarding data privacy, and a significant implementation gap between technical validation and public health impact. Artificial intelligence offers substantial promise for enhancing HIV and STI prevention in Latin America through improved diagnostic precision and targeted interventions. Realizing this potential requires sustained investment in digital infrastructure, interdisciplinary collaboration, and robust ethical governance frameworks to ensure equity and protect vulnerable populations.

Keywords
Artificial Intelligence; Machine Learning; Sexually Transmitted Diseases.

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1. Introduction

Human immunodeficiency virus (HIV) and other sexually transmitted infections (STIs) continue to pose significant public health challenges in Latin America, a region characterized by epidemiological heterogeneity and structural inequalities. Between 2010 and 2021, the Pan American Health Organization (PAHO) reported a 21% increase in the number of new HIV cases in the region, resulting in an annual average of 120,000 new infections. The imperative need for innovative, targeted interventions is underscored by the fact that key populations—including transgender individuals, men who have sex with men (MSM), and sex workers—account for more than half of all new cases.

Machine learning (ML) and artificial intelligence (AI) possess transformative potential for disease surveillance, diagnosis, and prevention. In contrast to traditional statistical methods, machine learning algorithms are capable of identifying intricate, non-linear patterns in extensive datasets. This capability facilitates enhanced risk stratification, personalized intervention planning, and optimized resource allocation. AI models have shown potential in the identification of candidates for pre-exposure prophylaxis (PrEP), the prediction of HIV acquisition risk, and the support of clinical decision-making on a global scale.

Despite this global progress, the utilization of AI for the treatment of HIV and STIs remains insufficiently investigated in Latin America. Implementing these technologies in the region necessitates meticulous consideration of context-specific obstacles, including disjointed health information systems, algorithmic bias stemming from unrepresentative data, insufficient ethical and regulatory frameworks, and structural health determinants such as poverty, stigma, and violence.

Research question: In what ways may artificial intelligence technology improve the detection, diagnosis, and prevention of HIV and other sexually transmitted illnesses within the distinct socio-cultural, economic, and health system contexts of Latin America?

The objectives of this study are to (1) identify and characterize the AI and ML technologies currently being developed or implemented for HIV and STI detection in Latin American countries; (2) delineate the intellectual structure of this emerging field through bibliometric analysis of publication trends, collaborative networks, and thematic clusters; and (3) critically assess the reported advantages, methodological limitations, implementation challenges, and ethical implications related to the deployment of these technologies in the region.

2. Theoretical Framework

Despite significant global progress in combating HIV and other sexually transmitted infections (STIs), Latin America continues to face persistent epidemiological challenges characterized by concentrated epidemics among key populations and notable disparities in access to prevention and treatment services (Elendu et al., 2024).

The region's epidemiological profile, shaped by structural factors such as poverty, stigma, and fragmented healthcare systems, demands innovative approaches that transcend traditional public health interventions.

AI, particularly machine learning (ML), offers unprecedented capabilities for analyzing complex, high-dimensional datasets that integrate clinical, demographic, behavioral, and genomic information. Unlike conventional statistical methods, ML algorithms can autonomously detect non-linear patterns and hidden interactions that may signal disease risk or treatment response (Suleimenov et al., 2020). This capacity is especially relevant for HIV and STI research, where risk determination involves intricate combinations of biological, behavioral, and social factors.

Internationally, research has demonstrated the versatility of AI across the HIV care continuum. In East Africa, Mutai et al. (2021) applied random forests and gradient boosting algorithms to demographic and health survey data, identifying predictors such as age, marital status, and number of sexual partners with greater accuracy than traditional regression models. Similarly, Xiang et al. (2022) documented the efficacy of ML approaches for predicting HIV acquisition risk and optimizing pre-exposure prophylaxis allocation. Marcus et al. (2020) explored AI applications for personalized HIV prevention, while raising critical concerns about algorithmic transparency, data privacy, and potential perpetuation of health disparities through biased training data.

Beyond risk prediction, AI has demonstrated utility in clinical decision support and patient engagement. Jaiteh et al. (2024) systematically reviewed ML applications for strengthening HIV testing services, highlighting the potential to identify individuals most likely to benefit from targeted testing campaigns. Araujo et al. (2022) employed association rules and ML techniques to analyze clinical data, identifying factors affecting antiretroviral therapy adherence. In resource-limited settings, Seboka et al. (2023) developed predictive models for viral load and CD4 count, demonstrating how AI could support treatment monitoring where laboratory infrastructure is scarce. Additionally, AI-powered chatbots have shown promise for expanding access to sexual health education and counselling among marginalized populations (Ciecierski-Holmes et al., 2022).

Despite global promise, translating these advances to Latin America requires careful consideration of region-specific challenges. First, algorithmic bias poses a significant threat: models trained on unrepresentative datasets may produce inequitable predictions, potentially exacerbating health disparities (Ratwani et al., 2024). Second, the region's health information systems are often fragmented, with limited interoperability compromising data quality. Third, structural determinants of health—including poverty, gender-based violence, migration, and stigma—create complex realities difficult to quantify in data-driven models (Cabrera et al., 2021). Fourth, ethical frameworks governing data privacy and algorithmic accountability remain underdeveloped in many Latin American countries (Bellucci, 2022). Finally, the digital divide limits the reach of AI-enabled interventions among rural and marginalized communities.

3. Methodology

This study employed an exploratory qualitative design grounded in a pragmatist philosophical orientation. This approach was selected because it enables the integration of quantitative bibliometric mapping with in-depth qualitative thematic synthesis without being constrained by rigid paradigmatic divisions (Creswell & Poth, 2018; Morgan, 2014). Pragmatism prioritizes the practical utility of knowledge in addressing real-world problems (Kaushik & Walsh, 2019), making it particularly suitable for investigating how AI technologies can be applied to improve HIV and STI detection in the complex Latin American public health context. Pragmatism prioritizes the practical utility of knowledge in addressing real-world problems, making it particularly suitable for investigating how AI technologies can be applied to improve HIV and STI detection in the complex Latin American public health context.

A comprehensive search was implemented across five electronic databases: Scopus, Web of Science, IEEE Xplore, PubMed/MEDLINE, and EBSCOhost. This multi-database approach ensured exhaustive coverage.

The search strategy integrated Boolean operators, keywords, and MeSH terms across three conceptual blocks: (a) AI technologies ("artificial intelligence," "machine learning," "deep learning"); (b) sexually transmitted infections ("HIV," "STI," "syphilis," "gonorrhea"); and (c) geographic focus ("Latin America" and all 20 constituent countries"). In order to encompass the most recent advancements in this discipline that is swiftly evolving, the search was restricted to publications published between January 2015 and December 2025.

Studies were included if they met the following criteria: (a) original research articles or systematic reviews presenting empirical data on the development, validation, or application of AI or ML models; (b) investigations specifically addressing the detection, diagnosis, prediction, prevention, or surveillance of HIV and/or other STIs; (c) studies conducted in Latin American countries or with study populations predominantly drawn from the region; and (d) articles published in English, Spanish, or Portuguese.

Exclusion criteria comprised: (a) opinion pieces, editorials, conference abstracts, and theoretical or conceptual papers lacking empirical support; (b) studies focusing exclusively on other infectious or non-infectious diseases; (c) research conducted solely in non-Latin American settings without implications for the region; and (d) duplicate publications using the same dataset without novel analytical insights.

The selection process followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyzes (PRISMA) 2020 guidelines to ensure transparency and replicability (Page et al., 2021). All retrieved records were imported into Mendeley reference management software for duplicate removal. Two independent reviewers, each with expertise in public health and qualitative synthesis, screened titles and abstracts against the eligibility criteria. Studies considered potentially relevant by either reviewer proceeded to full-text retrieval.

The same two reviewers independently assessed full-text articles, documenting reasons for exclusion. Disagreements during the selection process were resolved through discussion and consensus, or through consultation with a third senior reviewer specializing in bibliometric studies when necessary. This rigorous, multi-step process minimized selection bias and enhanced the reliability of the final corpus.

For the 28 studies that definitively met all inclusion criteria, comprehensive data were extracted using a standardized Microsoft Excel form previously piloted for consistency. The extraction tool captured: (a) bibliometric details (authors, year, journal, institutional affiliations, funding sources, corresponding author's country); (b) study characteristics (objective, design, setting, population, sample size); (c) AI intervention (algorithm type, application purpose, comparative models); (d) data sources and characteristics (clinical records, surveys, administrative databases, sample size, dimensionality, temporal coverage); (e) methodological quality indicators (validation strategies, performance metrics, bias management, ethical considerations); (f) main findings related to HIV/STI detection or prevention; and (g) reported challenges, limitations, and implementation barriers specific to Latin America.

The study employed a dual analytical strategy combining quantitative bibliometric mapping with qualitative thematic synthesis to obtain a comprehensive view of the field (Hong et al., 2017; Noyons et al., 1999; Szrajber & Alon, 2025).

Bibliometric Analysis: Bibliometric data—including titles, abstracts, author keywords, and reference lists—were exported and analyzed using VOSviewer software version 1.6.20. A co-occurrence analysis of author keywords was conducted using the full counting method. To capture emerging yet significant terms, each keyword was required to appear at least twice (van Eck & Waltman, 2010). The analysis revealed the intellectual structure of the field, identifying dominant research clusters, thematic linkages between applications (e.g., "risk prediction," "XGBoost," "classification algorithms") and populations or settings (e.g., "Brazil," "Mexico," "MSM," "key populations"). Additionally, co-authorship networks at institutional and country levels were mapped to visualize scientific collaboration patterns and interdisciplinary research dynamics.

Qualitative Thematic Synthesis: Thematic synthesis was conducted using NVivo 14 software, employing both deductive and inductive coding approaches. Deductive codes were initially developed based on the research objectives and conceptual framework, focusing on four dimensions: "application area" (e.g., risk stratification, diagnosis, surveillance); "algorithm type" (e.g., ensemble methods, neural networks, regression-based ML); "data source typology" (e.g., electronic health records, survey data, geospatial data); "reported performance"; and "explicitly identified challenges" (e.g., algorithmic bias, data privacy, infrastructure limitations, ethical concerns). This a priori coding structure ensured alignment with the study's core questions.

Simultaneously, inductive coding allowed the analysis to remain responsive to the emergent and context-dependent nature of qualitative inquiry.

Through iterative reading and reflection on the included studies, new codes were developed to capture unexpected yet significant themes, including "structural stigma as a modeling challenge," "community participation in AI development," "fragmentation of health information systems," and "discourses of technological solutionism versus pragmatic implementation."

The integration of bibliometric mapping and thematic synthesis follows established recommendations for mixed-methods systematic reviews in emerging fields (Hong et al., 2018). This design assumes that quantitative co-occurrence structures provide empirically grounded hypotheses about a field's intellectual architecture, while qualitative synthesis offers the interpretive depth necessary to contextualize, refine, and challenge those structures (Noyons et al., 1999). Unlike sequential or purely parallel designs, the present integration operated iteratively: bibliometric clusters informed deductive coding categories, and inductive themes from full-text reading identified concepts with low keyword frequency but high substantive importance.

The five-step analytical process was designed to guarantee transparency and replicability, from the extraction of raw data to the final development of thematic themes.

Step 1: Data Extraction to Codes: NVivo 14 was utilized to integrate the 28 studies that were incorporated into the analysis. Initially, a pre-established deductive classification framework was employed by two independent examiners to classify three randomly selected studies. For instance, disagreements regarding the application of code—such as whether a discovery constituted "algorithmic bias" or "data representativeness limitation"—were resolved through consensus.

Step 2 – Code Development: Each reviewer independently coded the remaining 25 studies after the initial calibration. The evaluators convened to identify new patterns after classifying ten studies, and inductive codes were devised iteratively (Saldaña, 2021). The code "structural stigma as a modeling challenge" was developed as a result of three Brazilian studies that demonstrated how the fear of discrimination resulted in the underreporting of sexual behaviors that were not able to be captured in the training data. The "fragmentation of health information systems" code was developed as a result of numerous studies conducted in Mexico and Colombia, which demonstrated the incompatibility of electronic health record systems between public and private providers.

Step 3 – Theme Aggregation: Codes were aggregated into broader analytical themes through an iterative process of abstraction and comparison. Initially, descriptive identifiers (e.g., "XGBoost accuracy 0.89," "privacy concerns raised," "Brazilian national database") were summarized. These were subsequently categorized into explanatory constructs through the process of axial coding (Strauss & Corbin, 1998).

Step 4 – Dispute Resolution: The two evaluators meticulously documented discrepancies that occurred in approximately 12% of classification determinations. Reviewers engaged in structured discussions when disagreements arose, referencing the original extracted data.

The final determination was made by a third senior reviewer who specialized in bibliometric studies if consensus could not be reached after discussion (Belur et al., 2021).

Step 5 – Synthesis: The final analytical themes presented in the Empirical Analysis section were produced by methodically comparing, abstracting, and synthesizing the collected data following coding. This process transitioned from descriptive codes to explanatory constructs, guaranteeing that the results were based on both the theoretical frameworks and the lived realities of AI implementation research in Latin America.

Several strategies were employed to enhance the credibility and trustworthiness of the findings. Credibility was established through investigator triangulation (involvement of multiple researchers in data collection, coding, and analysis), regular peer debriefing on emerging findings with colleagues not involved in the original analysis, and persistent engagement with the dataset. Transferability was addressed through thick description of the context, the included studies, and the research processes, enabling readers to assess the applicability of findings to other settings. Dependability and confirmability were ensured through a comprehensive audit trail documenting all research decisions, search strategies, selection records, coding frameworks, and analytical memos generated throughout the study.

4. Empirical Analysis

The bibliometric and thematic synthesis of the 28 included studies revealed a rapidly evolving research landscape at the intersection of AI, HIV, and sexually transmitted infections in Latin America. This section presents the findings organized into three analytical dimensions: (a) the intellectual structure and collaborative patterns of the field; (b) AI applications for risk prediction and diagnosis; and (c) AI applications for clinical management and public health surveillance. Within each dimension, the analysis addresses both technological advances and persistent challenges, including algorithmic bias, implementation barriers, and ethical considerations.

Bibliometric analysis using VOSviewer revealed that research on AI for HIV and STI detection in Latin America has expanded considerably since 2020, though with significant geographical concentration. Brazil emerged as the dominant contributor, accounting for approximately 40% of the included publications, followed by Mexico (25%) and Colombia (15%). Other Latin American countries, including Argentina, Chile, Peru, and Costa Rica, contributed the remaining 20%, often through collaborative partnerships with the region's research leaders or with institutions in North America and Europe.

Co-authorship network analysis identified three primary research clusters. The first, centered in Brazilian universities (Universidade de São Paulo, Fundação Oswaldo Cruz), focuses on machine learning applications for epidemiological surveillance and predictive modeling using national health databases. The second cluster, based in Mexican institutions (Universidad Nacional Autónoma de México, Instituto Nacional de Salud Pública), emphasizes clinical decision support systems and the integration of AI into primary care settings.

The third, more diffuse cluster involves cross-regional collaborations addressing key populations, particularly men who have sex with men (MSM) and transgender women, often in partnership with North American research centers.

Keyword co-occurrence analysis revealed the predominant thematic focus on machine learning techniques, with "machine learning," "random forest," and "XGBoost" appearing as high-frequency terms. These were closely linked to application-oriented keywords such as "risk prediction," "HIV incidence," "screening," and "early diagnosis." Geographic keywords ("Brazil," "Mexico") frequently co-occurred with population-specific terms ("MSM," "key populations," "pregnant women"), indicating attention to the region's concentrated epidemic patterns. Notably, terms related to implementation challenges—"data privacy," "algorithmic bias," "health disparities"—appeared with lower frequency but increased notably in publications after 2022, suggesting growing awareness of ethical and practical considerations.

The thematic synthesis demonstrated that machine learning models for HIV and STI risk prediction constitute the most extensively developed application area within the Latin American literature, consistently outperformed traditional approaches. Reported performance metrics included area under the receiver operating characteristic curve (AUC-ROC) values ranging from 0.82 to 0.91, sensitivity between 78% and 89%, and specificity between 81% and 93% in regional validation studies.

Key predictors identified across studies included sociodemographic characteristics (age, educational attainment, income level), behavioral factors (age at sexual debut, consistent condom use, number of sexual partners, history of transactional sex), and membership in key populations (MSM, transgender women, sex workers). Several Brazilian studies utilizing national survey data highlighted the predictive importance of geographic variables, with urban residence and specific neighborhoods associated with elevated risk profiles. Mexican research incorporating clinical records from public health clinics identified previous STI diagnoses and inconsistent healthcare utilization as significant predictors of HIV acquisition.

Despite these promising accuracy metrics, the qualitative synthesis revealed important limitations. First, most predictive models were developed using data from clinical or survey sources that systematically underrepresent marginalized populations with limited healthcare access. This sampling bias may compromise model generalizability and potentially perpetuate health disparities if deployed without careful validation across diverse subgroups. Second, several studies acknowledged challenges in capturing contextual factors such as stigma, discrimination, and violence, which are known to influence HIV risk but are difficult to quantify and integrate into predictive algorithms. Third, the temporal scope of most studies was limited to cross-sectional or short-term longitudinal data, constraining their ability to capture dynamic changes in risky behavior over time.

A smaller but growing body of literature addressed AI applications beyond initial risk prediction, encompassing clinical decision support, treatment optimization, and public health surveillance. In the clinical domain, Colombian researchers developed a natural language processing system to extract relevant clinical information from electronic health records, facilitating the identification of patients eligible for pre-exposure prophylaxis (PrEP) initiation. Brazilian studies explored the use of machine learning to predict antiretroviral therapy (ART) adherence and virologic failure, demonstrating the potential for AI to support personalized treatment monitoring in resource-constrained settings.

In the surveillance domain, Mexican investigators applied spatiotemporal analysis combined with ML techniques to identify geographic clusters of HIV and STI incidence, enabling targeted deployment of mobile testing units and community outreach services. Peruvian research utilized social media data and search engine queries to develop real-time syndromic surveillance systems for STI outbreak detection, though concerns regarding data representativeness and privacy were noted.

The thematic synthesis also identified emerging applications of AI-powered chatbots and virtual assistants for sexual health education and counselling. A pilot study in Costa Rica demonstrated the feasibility of a WhatsApp-based chatbot delivering tailored HIV prevention information to young adults, with high user engagement and acceptability. However, the study noted challenges in ensuring content accuracy, maintaining user privacy, and reaching populations with limited digital literacy.

Across all analytical dimensions, three cross-cutting challenges emerged consistently. First, algorithmic bias resulting from unrepresentative training data was identified as a critical concern. Several studies acknowledged that models developed using data from urban, clinic-based populations may not perform adequately for rural, indigenous, or other marginalized groups. Ratwani et al. (2024) argue that such biases can perpetuate and even amplify existing health disparities, underscoring the importance of diverse, community-engaged data collection and rigorous bias testing prior to deployment.

Second, a significant implementation gap exists between technical model validation and real-world public health impact. Few studies provided evidence of how AI-based predictions translated into improved health outcomes, such as reduced HIV incidence, increased PrEP uptake, or enhanced treatment adherence. This gap reflects broader health system challenges in the region, including fragmented information systems, limited interoperability between public and private providers, and insufficient training of healthcare workers in digital health tools. Without concurrent investment in health system strengthening, even the most accurate predictive models may fail to achieve their intended public health benefits.

Third, ethical and regulatory frameworks governing AI in health remain underdeveloped across most Latin American countries. Concerns regarding data privacy, informed consent, algorithmic transparency, and accountability for automated decisions were raised in multiple studies but rarely addressed systematically. Bellucci (2022) emphasizes that the absence of clear governance mechanisms may undermine public trust and impede the responsible adoption of AI technologies, particularly among vulnerable populations with historical experiences of discrimination and exploitation in healthcare settings.

5. Methodological Reflection

The research was based on a pragmatic philosophical perspective, which asserts that knowledge assertions are justified by their practical effectiveness in solving real-world issues. This framework facilitated the amalgamation of quantitative bibliometric mapping with qualitative theme synthesis, unencumbered by strict dichotomies between positivist and interpretivist paradigms. According to Takona (2024), pragmatism emphasizes the research topic above methodological adherence, making it particularly appropriate for mixed-methods strategies in addressing intricate health issues. This position enabled the research to go beyond just cataloging existing AI technologies to comprehending their development and implementation within the unique circumstances of Latin America.

This research uniquely combines quantitative bibliometric mapping (utilizing VOSviewer) with qualitative theme synthesis (employing NVivo). This integration provides substantial benefits for mapping emerging, interdisciplinary disciplines, although it also introduces epistemological conflicts, necessitates clear standards for translation, and has certain constraints that need examination.

Epistemological Conflicts and Their Resolution: Bibliometric mapping, based on co-occurrence and network analysis, embodies positivist principles on the objective assessment of intellectual frameworks. It regards keyword frequencies and citation linkages as measurable indications of conceptual relationships. Thematic synthesis, however, functions within an interpretivist framework, seeing knowledge as generated via the researcher's interaction with textual significance. The possible conflict between seeing themes as "measurable entities" and "interpretive constructions" was addressed using the pragmatic approach of this research. Instead of favoring one paradigm over another, the study regarded bibliometric outputs as tentative frameworks that produced ideas on topic structures, which were then analyzed and refined qualitatively. The co-occurrence cluster surrounding "XGBoost" and "risk prediction" indicated a predominant technical emphasis; however, qualitative synthesis uncovered significant yet infrequent terms like "algorithmic bias," which bibliometric analysis would have overlooked. Pragmatism enabled us to maintain both ideas in a constructive tension.

Standards for Transitioning from Bibliometric Outputs to Analytical Categories: The transition from quantitative mapping to qualitative categories adhered to specific criteria: (a) frequency threshold – keywords that appeared a minimum of twice were included to ensure statistical reliability; (b) relevance assessment – bibliometric clusters were qualitatively evaluated for their substantive alignment with the research question; (c) data triangulation – each bibliometric observation (e.g., "Brazil dominates research output") was corroborated with the extracted country affiliation data; (d) qualitative enhancement – thematic labels derived from clusters (e.g., "machine learning techniques") were refined through meticulous examination of the underlying articles to capture subtleties (e.g., differentiating between ensemble methods and neural networks).

The bibliometric cluster designated "risk prediction" by VOSviewer was divided into three qualitatively distinct categories: clinical risk stratification (utilizing electronic health records), behavioral risk prediction (employing survey data), and geospatial risk mapping (leveraging epidemiological surveillance data). This disaggregation could not have been achieved only by bibliometric analysis.

Particular Constraints of This Integration: Notwithstanding its advantages, the integration of bibliometric mapping and theme synthesis has several constraints. Initially, bibliometric maps may solidify prevailing publishing trends, thereby perpetuate the supremacy of well-financed research teams while neglect creative but infrequent contributions. The research mitigated this by complementing keyword analysis with full-text reading of all 28 included studies, ensuring that marginalized terms received qualitative attention. Secondly, the unit of analysis varies across methodologies: bibliometric analysis functions at the level of document aggregates (keywords, citations), while theme synthesis works at the level of interpretative significance. Integrating these units required meticulous decision-making, recorded in our audit chain. The temporal delay inherent in published literature indicates that bibliometric frameworks represent previous research priorities, perhaps overlooking current trends. Our inductive coding identified emerging topics (e.g., "AI-powered chatbots") that had not yet attained significant keyword frequency. The integration procedure demands substantial resources and experience in both quantitative bibliometric tools and qualitative analysis, potentially hindering replicability in resource-limited environments. Researchers contemplating analogous articulations should expressly allocate time for the necessary translation and triangulation processes. The analytical chain used in the research to fulfill the editorial request for more openness about analytical techniques.

Step 1 – Data Extraction to Codes: Data from the 28 included studies was uploaded into NVivo 14. Two independent reviewers originally analyzed three randomly chosen papers using the pre-defined deductive coding framework. Discrepancies in code application, such as whether a conclusion indicated "algorithmic bias" or "limitations in data representativeness," were deliberated and resolved by agreement. For instance, studies indicating that models exhibited subpar performance for indigenous populations were classified as "algorithmic bias" instead of "sampling limitation," subsequent to a discourse on the differentiation between statistical and equity-oriented issues.

Step 2 - Code Development: Subsequent to the first calibration, each reviewer individually coded the remaining 25 studies. Inductive codes developed iteratively; after the coding of 10 research, the reviewers convened to discern new trends. The phrase "structural stigma as a modeling challenge" originated from three Brazilian research that illustrated how the fear of discrimination resulted in the underreporting of sexual activities, which was not reflected in the training data. The term "fragmentation of health information systems" originated from many studies conducted in Mexico and Colombia, which highlighted the incompatibility of electronic health record systems across public and private providers.

Step 3 – Theme Aggregation: Codes were synthesized into overarching analytical themes via an iterative process of comparison and abstraction. Initial summarization of descriptive codes (e.g., "XGBoost accuracy 0.89," "privacy concerns raised," "Brazilian national database") was conducted. Subsequently, by axial coding, they were categorized into explanatory constructs. For example, codes pertaining to "unrepresentative training data," "performance degradation among subgroups," and "absence of external validation in rural contexts" were consolidated under the subject "algorithmic bias as a pervasive challenge." The reviewers individually suggested theme categories and then convened to reconcile discrepancies, reaching agreement via discourse on the fundamental connections across codes.

Step 4 – Addressing differences: During the code and theme development process, differences between the two reviewers were meticulously recorded. In instances of dispute (about 12% of coding judgments), reviewers participated in organized discussions, referencing the original retrieved data. In the absence of agreement after deliberation, a third senior reviewer with expertise in bibliometric research rendered the ultimate decision. A dispute over the classification of "limited internet access in rural areas" as either "infrastructure limitation" or "digital divide" was settled by the third reviewer, who proposed the more precise code "digital infrastructure fragmentation." All coding choices and resolves were recorded in an audit trail.

Step 5 – Synthesis: Subsequent to coding, data were methodically contrasted, abstracted, and synthesized to provide the conclusive analytical themes defined in Section 4 (Empirical Analysis). This method transitioned from descriptive codes to explanatory constructs, ensuring that results were anchored in both theoretical frameworks and the actual experiences of AI implementation research in Latin America.

This work provides three transferable methodological contributions to the qualitative research community, in addition to its particular results on AI for HIV/STI diagnosis.

Initially, an integrated bibliometric-thematic synthesis serves as an approach for delineating emerging topics. Qualitative researchers investigating emergent phenomena often encounter disjointed evidence across other fields. Conventional systematic reviews may unduly restrict the scope, while exclusively qualitative scoping assessments may lead to arbitrary choices. The integrative methodology presented—employing bibliometric mapping to systematically delineate the intellectual framework, followed by theme synthesis for interpretation and enhancement of that framework—provides a clear, reproducible technique for charting emerging domains. This methodology is especially beneficial for subjects at the convergence of technology and public health, where engineering, clinical, and social scientific discourses seldom cross.

Secondly, pragmatism serves as a methodological conduit. A considerable number of qualitative researchers express skepticism about mixed-methods designs that include interpretivist and positivist components. This study illustrates that pragmatism—emphasizing the research issue rather than adherence to paradigmatic purity—can provide a philosophically consistent basis for such integrations.

The essential understanding is not to overcome epistemological conflicts but to use them: bibliometric maps provide empirically based hypotheses; qualitative synthesis evaluates, refines, and contextualizes those hypotheses. For qualitative researchers contemplating the integration of computer approaches, pragmatism provides a pathway that preserves interpretivist principles.

Third, ethical reflexivity serves as an extension of methodological transparency. Qualitative research has consistently highlighted the need of reflexivity about researcher positionality. This research broadens that premise to include reflexivity about the ethical ramifications of the technology being examined. The analytical methodology clearly included ethical considerations (data privacy, algorithmic bias, health inequalities) in conjunction with technological performance indicators. The study propose that qualitative research on technology-mediated health interventions should systematically integrate "ethical reflexivity," which entails documenting both the influence of researcher assumptions on findings and the ways in which the technologies may embed values and generate disparate effects among populations. This expansion is especially pertinent as qualitative researchers increasingly examine AI systems that possess substantial potential for both advantage and detriment.

Transferable Lessons for Other Research Contexts: Three specific lessons arose from our methodological experience. Initially, allocate time for calibration; the preliminary calibration step, which involves coding three studies concurrently, is crucial for ensuring coding uniformity and should not be expedited. Secondly, the choices of document translation—specifically the criteria for transitioning from bibliometric clusters to analytical categories—must be well recorded, since these determinations influence the ultimate conclusions. Third, embrace constructive tension; instead of reconciling disparities between quantitative maps and qualitative interpretations, researchers should see these conflicts as opportunities for analytical insight, highlighting areas of coherence in the literature as well as contradictions or gaps.

Various measures were used to augment the credibility and reliability of the results. Credibility was created by investigator triangulation (involvement of several researchers in data collection, coding, and analysis), consistent peer debriefing on developing results with peers not participating in the initial analysis, and ongoing engagement with the dataset. Transferability was facilitated by a comprehensive discussion of the context, the studies included, and the research methodologies, allowing readers to evaluate the relevance of the results to other situations. Dependability and confirmability were established by a thorough audit trail that recorded all research choices, search techniques, selection criteria, coding frameworks, and analytical memoranda produced throughout the project.

Reflexivity—systematic consideration of how researcher positionality influences the research process—is crucial for qualitative rigor. The investigator is dedicated to enhancing health outcomes in Latin America and exhibits cautious optimism about the possibilities of technology, which may bias the study towards highlighting favorable results. To alleviate this danger, a reflective notebook recorded personal reactions and analytical choices throughout the investigation.

The coding carefully documented obstacles, constraints, and ethical considerations, guaranteeing that these aspects were systematically addressed. Frequent talks directly examined how assumptions may be affecting interpretation. According to Berger (2015), reflexive interaction converts potential bias into assets for enhanced comprehension.

This research presents several contributions to qualitative technique. Initially, it illustrates the significance of combining bibliometric mapping with theme synthesis to delineate emerging, transdisciplinary domains. Bibliometric approaches systematically identify intellectual structures, while theme synthesis facilitates profound interaction with conceptual material. This hybrid methodology mitigates the shortcomings of either bibliometric or exclusively qualitative assessments. The study demonstrates the implementation of Lincoln (1985) trustworthiness criteria in health technology research, enhancing discussions about quality standards for qualitative inquiry across multidisciplinary domains. The focus on ethical reflexivity—beyond conventional epistemological reflexivity to include systematic consideration of ethical ramifications—provides a framework for qualitative research in AI and health. Kumar et al. (2023) contend that examining technologies with considerable potential for both advantage and detriment necessitates that researchers evaluate not just the capabilities of these tools but also their appropriate applications, intended beneficiaries, and the contextual parameters governing their use.

6. Final Considerations

This study demonstrates that artificial intelligence is advancing the fight against HIV and STIs in Latin America by identifying key transmission patterns through predictive models, providing valuable insights for scientists, policymakers, and healthcare workers. The findings reveal that AI technologies, particularly the XGBoost algorithm, significantly improve diagnostic accuracy compared to traditional approaches, achieving F1 scores of 90% for men and 92% for women, which confirms AI's capacity to identify complex patterns in large datasets for rapid risk stratification.

The research also confirms that the epidemic has disproportionately affected vulnerable populations facing systemic barriers to prevention and treatment, with predictive models revealing the uniqueness of each subgroup and underscoring the need for tailored rather than one-size-fits-all interventions. Furthermore, structural factors including discrimination, poverty, inequality, and stigma continue to facilitate disease spread, and these cannot be resolved by technology alone; comprehensive approaches must tackle root causes alongside innovation. Persistent challenges emerged as well, including data quality issues, algorithmic complexity, and resource constraints, where underreporting and dataset biases compromise reliability while limited infrastructure hinders adoption in low-resource settings.

Based on these findings, four recommendations are proposed: first, engineers, epidemiologists, and social scientists must collaborate to develop contextually appropriate AI models; second, governments must establish ethical standards addressing data security, algorithmic bias, and equitable access; third, healthcare organizations in underserved areas require investment in infrastructure and training; and fourth, longitudinal studies are needed to evaluate long-term effectiveness. AI holds enormous potential to transform HIV and STI prevention in Latin America by identifying high-risk patients, improving diagnostic accuracy, and optimizing care.

However, realizing this potential requires interdisciplinary collaboration to address technical, ethical, and practical challenges. Integrating AI into healthcare represents both a technological advance and an ethical imperative. With sustained commitment to equity and responsible implementation, data-driven approaches can help eliminate HIV and STIs as public health threats, ultimately creating a fairer and healthier future for all.

Ethical Approval: This study involved a bibliometric review and thematic synthesis of previously published literature. No primary data collection from human participants or animals was conducted. Therefore, formal ethical approval from an institutional review board was not required. All sources of data were publicly available or accessible through academic databases, and the analysis adhered to standard ethical principles of scientific integrity, including accurate citation, avoidance of plagiarism, and transparent reporting of methods and findings.

Informed Consent: This work did not involve human participants or identifiable data; therefore, informed consent was not applicable.

Declaration of Conflicts of Interest: The author declares that there are no conflicts of interest regarding the research, authorship, and/or publication of this article. The material has not been published, in whole or in part, elsewhere and is not currently under consideration for publication in any other journal.

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