

ORIGINAL RESEARCH ARTICLE

Trends and demographic patterns of HIV pre-exposure prophylaxis uptake in Nigeria

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Rui Bian

School of Law, Hainan University, Haikou570228, China

For Correspondence: Email : ruibian2738@163.com

Abstract

This study examined the trends and demographic patterns of HIV pre-exposure prophylaxis (PrEP) uptake in Nigeria from 2020 to 2024 using secondary programme data extracted from the national HIV prevention and treatment information system of Birni Kebbi general hospital, Nigeria. A retrospective descriptive design was employed, with data disaggregated by marital status, risk group, age, and gender. Descriptive statistics and trend visualizations were used for analysis. Findings revealed a distinct expansion in PrEP uptake between 2020 and 2022, followed by a decline from 2023 to 2024 across all demographic categories. Uptake was overwhelmingly concentrated among married individuals and serodiscordant couples throughout the five-year period, reflecting strong integration of PrEP within partner testing and treatment-linked referral pathways. Conversely, unmarried persons, younger age groups, and sex workers were minimally represented, indicating significant prevention gaps. Gender analysis showed higher male uptake during the expansion phase and slightly greater female stability in subsequent years. Age distributions were dominated by individuals aged 30–49 and 50+. In conclusion, the findings demonstrate that PrEP delivery in Nigeria remains marriage-centric and treatment-linked, highlighting the need for broader risk-based and community-oriented PrEP strategies to optimize preventive impact. (*Afr J Reprod Health* 2026; 30 [17]:31-45).

Keywords: Pre-exposure prophylaxis; HIV prevention; Demographic patterns

Résumé

Cette étude a examiné les tendances et les profils démographiques de l'adoption de la prophylaxie pré-exposition (PrEP) contre le VIH au Nigeria entre 2020 et 2024, en s'appuyant sur des données de programme secondaires extraites du système national d'information sur la prévention et le traitement du VIH de l'hôpital général de Birni Kebbi. Une approche descriptive rétrospective a été adoptée, avec des données ventilées selon la situation matrimoniale, le groupe à risque, l'âge et le sexe. L'analyse a reposé sur des statistiques descriptives et la visualisation des tendances. Les résultats ont révélé une augmentation marquée de l'adoption de la PrEP entre 2020 et 2022, suivie d'un recul entre 2023 et 2024 dans toutes les catégories démographiques. Sur l'ensemble de la période de cinq ans, l'adoption a été très majoritairement concentrée chez les personnes mariées et les couples sérodiscordants, reflétant une forte intégration de la PrEP dans les parcours de dépistage des partenaires et d'orientation vers les soins. À l'inverse, les personnes non mariées, les groupes d'âge plus jeunes et les travailleurs du sexe étaient peu représentés, ce qui témoigne d'importantes lacunes en matière de prévention. L'analyse selon le sexe a montré un taux d'adoption plus élevé chez les hommes durant la phase d'expansion, tandis que la participation des femmes est restée plus stable les années suivantes. La répartition par âge était dominée par les personnes âgées de 30 à 49 ans et celles de 50 ans et plus. En conclusion, ces résultats démontrent que la prestation de la PrEP au Nigeria reste centrée sur le mariage et liée au traitement, soulignant la nécessité d'adopter des stratégies plus larges, fondées sur les risques et axées sur la communauté, afin d'optimiser l'impact préventif.. (*Afr J Reprod Health* 2026; 30 [17]:31-45).

Mots-clés: Prophylaxie pré-exposition ; prévention du VIH ; caractéristiques démographiques

Introduction

Pre-exposure prophylaxis (PrEP) has become a central component of combination HIV prevention, defined as the use of antiretroviral medication by HIV-negative individuals to reduce the probability of HIV acquisition during periods of substantial risk

exposure. The World Health Organization recommends tenofovir disoproxil fumarate (TDF)-based oral PrEP for people at substantial risk of HIV infection as part of a comprehensive prevention package that includes HIV testing, condoms, sexually transmitted infection (STI) services, and risk-reduction counselling.¹⁻³

Within national programmes, PrEP performance is increasingly assessed through trends in initiation, continuation, and persistence, alongside demographic distribution by sex, age, and population subgroup. This emphasis reflects the practical reality that PrEP effectiveness at population level depends not only on biomedical efficacy, but also on timely identification of eligible clients, sustained adherence and continuation during risk periods, and equitable access among groups with higher incidence^{1,4,5,2}

Nigeria provides a policy-relevant context for examining both temporal trends and demographic patterns of PrEP uptake because the national HIV response is characterised by heterogeneous risk profiles and pronounced access barriers across subpopulations. National strategic communication and policy documents indicate that Nigeria approved and recommended PrEP in 2016 and subsequently integrated PrEP into broader HIV prevention planning. Building on these foundations, the National Oral PrEP Implementation Plan (2022–2024) outlines programmatic pathways for scaling PrEP delivery through differentiated service delivery models, demand creation, and integration with HIV testing services and key population programming. These national documents underscore that PrEP scale-up in Nigeria is expected to be targeted toward populations with elevated risk, including key populations and other vulnerable groups, while also addressing structural constraints such as stigma, service quality, and follow-up systems that influence retention.^{6–9}

From an analytic standpoint, “PrEP uptake” is not a single construct. It is commonly operationalised along a prevention cascade that includes awareness, willingness, access, initiation, continuation, and effective use. In routine programme settings, the most measurable points in this cascade are initiation (new PrEP starts) and continuation (return visits and refills over time). Empirical evidence from Nigeria illustrates why this distinction matters^{10,1,2,11}. A large programmatic analysis of key populations across seven Nigerian states reported 43,788 PrEP initiations between January 2020 and mid-March 2023, providing a concrete basis for tracking uptake trajectories and attrition patterns in the immediate post-introduction scale-up period.

In related evidence^{12,13}, a study examining PrEP delivery among key populations described high early uptake with most clients being recent initiates (0–3 months), highlighting a common programme challenge: converting initiation gains into sustained continuation during ongoing risk exposure. Together, these studies signal that trend analysis should explicitly consider whether increases in starts are accompanied by stable continuation, because rapid cycling in and out of PrEP can weaken the prevention impact even when initiation counts are rising.^{2,15,16}

Demographic patterning is equally critical, because uptake reflects the intersection of epidemiological risk and access constraints. In Nigeria, PrEP programmes have largely been implemented through differentiated delivery channels that often prioritise community-based platforms for key populations^{3,5,8,9,17}. Within such platforms, sex and age distributions provide important signals of who is being reached, who remains underserved, and where prevention services may be misaligned with risk. For example, programmatic evidence from Nigeria shows substantial female representation among PrEP initiators in key population-focused programmes, while also documenting meaningful male participation. At the same time, the persistence of stigma and concerns about confidentiality can differentially shape uptake by gender and age, particularly for men who have sex with men and other groups facing legal and social marginalisation. These realities are recognised in Nigerian policy communications that emphasise demand creation, risk communication, and service acceptability as prerequisites for sustained PrEP use.^{18–21}

Age gradients in PrEP uptake merit focused attention because HIV acquisition risk and service engagement are not evenly distributed across the life course. Young adults and adolescents can face distinct barriers linked to risk perception, disclosure concerns, mobility, and provider attitudes. In programmes that rely on frequent follow-up, younger clients may have higher discontinuation risk if services are not aligned with their schedules and preferences^{1,19,20}. While Nigerian programme documents support differentiated models intended to reduce these frictions, empirical monitoring is required to determine whether uptake is

concentrated in particular age bands and whether these patterns shift over time as scale-up expands beyond early adopters.²¹⁻²³

Against this backdrop, a study of trend and demographic patterns of PrEP uptake in Nigeria is motivated by three technical considerations. First, PrEP scale-up is inherently dynamic: early phases often show rapid growth in initiations driven by targeted campaigns and partner-supported service expansion, followed by stabilisation or volatility as programmes confront constraints in continuation, commodity security, and follow-up systems.^{17,12,22,23,2,20}

Nigeria's implementation plan frames scale-up as a phased process that depends on service integration and monitoring, implying that time-series analysis is needed to identify inflection points rather than relying on cross-sectional snapshots. Second, the national evidence base increasingly shows that continuation is a key bottleneck even when initiation expands; therefore, trend analysis that includes continuation metrics provides more policy-relevant insight than initiation counts alone. Third, demographic disaggregation is not optional: it is central to interpreting whether PrEP is reaching those with the highest marginal prevention benefit, and whether programme delivery modalities are reinforcing or reducing inequities by sex and age.

This study therefore positions PrEP uptake as a measurable expression of prevention system performance in Nigeria, focusing on temporal movement and demographic concentration. By examining trends over time and the distribution of uptake across sex and age categories, the analysis contributes to operational decision-making on targeting strategies, differentiated service delivery, and continuity supports required to translate PrEP availability into sustained prevention impact within a high-need setting.

The study was guided by the following objectives, which is to; i) analyse the temporal trends in HIV pre-exposure prophylaxis (PrEP) uptake in Nigeria from 2020 to 2024, ii) examine the demographic distribution of PrEP uptake by marital status, age, and gender within the five-year period, ii) assess PrEP uptake across key risk groups, with specific emphasis on serodiscordant couples, sex workers, and other populations, iii) identify demographic and risk-based gaps in PrEP utilisation

and highlight implications for programme targeting and prevention planning

Methods

Study design and setting

This study adopted a retrospective descriptive design to examine the trends and demographic patterns of HIV pre-exposure prophylaxis (PrEP) uptake between 2020 and 2024. The study was conducted at Federal Medical Centre (FMC) Birnin Kebbi, a tertiary health facility located in Kebbi State, Northwestern Nigeria. The hospital provides comprehensive HIV prevention, testing, and treatment services under the National AIDS and STIs Control Programme (NASCP) and serves as a referral centre for HIV services within the state.

Data source and data collection

Data used for this study were obtained from the HIV prevention unit of Federal Medical Centre Birnin Kebbi, where PrEP services are routinely provided to individuals at substantial risk of HIV infection. The facility maintains structured programme registers and clinical documentation systems for HIV prevention services.

Graphical techniques were used to illustrate trends and patterns, including stacked bar charts to show distribution by marital status and risk groups, line graphs to illustrate gender trends in PrEP uptake, and grouped bar charts to show age and gender distribution. Upon enrolment into the PrEP programme, each client is assigned a unique identification code and documented in the PrEP register. The register captures demographic and clinical characteristics such as age, sex, marital status, relationship status, baseline HIV test results, and risk category (e.g., sero-discordant couples or female sex workers).

Before PrEP initiation, all eligible clients undergo HIV screening using national HIV testing algorithms to confirm negative serostatus. Individuals meeting eligibility criteria are prescribed a three-month PrEP regimen, typically dispensed as 90 tablets. Dispensing details are recorded in both the pharmacy logbook and the PrEP follow-up register.

Follow-up visits are scheduled at three-month intervals, during which repeat HIV testing is conducted before re-prescription. Information captured during follow-up visits includes HIV test results, adherence assessment (pill count and self-report), reported side effects, changes in risk exposure, and continuation or discontinuation status.

For sero-discordant couples, additional documentation includes counselling sessions provided, viral load status of the HIV-positive partner where available, and psychosocial challenges affecting adherence. Clients who discontinue PrEP are documented with the reasons for discontinuation, such as reduced perceived risk or changes in relationship status.

For research purposes, de-identified data were extracted from these facility records using a structured data extraction sheet. Cross-verification between the PrEP register, HIV testing logbooks, and pharmacy records was conducted to ensure data completeness and minimize inconsistencies.

Data analysis and variable

Data analysis was primarily descriptive. Frequency distributions and percentages were calculated to examine the demographic composition of PrEP uptake across the study period. Graphical techniques were used to illustrate trends and patterns, including stacked bar charts to show distribution by marital status and risk groups, line graphs to illustrate gender trends in PrEP uptake, and grouped bar charts to show age and gender distribution. These graphical methods enabled comparison across demographic groups and facilitated the identification of temporal changes between 2020 and 2024. The variables used in this study were grouped into demographic, risk, and programmatic variables. Demographic variables included gender (male and female), age group (10–19, 20–29, 30–39, 40–49, and 50+ years), and marital status (married, single, divorced, and others). Risk categories included serodiscordant couples, sex workers, and other populations. Programmatic variables included the year of PrEP uptake (2020–2024) and PrEP status, defined as continuation or discontinuation of PrEP use.

Ethical consideration

To ensure the fulfilment of ethical considerations in this research, the researchers complied with the

following: The Research and Ethics Committee at the Department of Health Studies, Federal Medical Centre, Birnin Kebbi, provided administrative proposal. Approval to conduct the study was requested and obtained from the State Team Lead of Health System Consult Limited, Kebbi State with ref: FMC/BK/045/P/517/VOL.IV/10, dated December 4, 2023

Results

Figure 1 is a stacked chart showing the distribution of HIV Pre-Exposure Prophylaxis (PrEP) Uptake in Nigeria by marital status over the period (2020–2024). The figure depicts a highly skewed pattern, with married individuals consistently accounting for the largest share of users throughout the 2020–2024 period. In nearly all years, married persons account for close to the total PrEP uptake, indicating that PrEP services in Nigeria are predominantly accessed within marital or stable union contexts. This pattern reflects the strong integration of PrEP into couple-based HIV prevention strategies.

Across the five-year period, married individuals account for 80% in 2020, 100% in 2021, 89.7% in 2022, and 100% again in 2023 and 2024. This near-total dominance implies that PrEP delivery channels in Nigeria are properly integrated within health services that engage married populations, such as antenatal care, prevention of mother-to-child transmission (PMTCT) programmes, and partner testing services for serodiscordant couples.

On the other hand, the share of single individuals to overall PrEP uptake is small and sporadic, appearing only in 2020 (10%) and 2022 (10.2%). Thus, unmarried adults are largely not accessing PrEP through these mainstream channels. Furthermore, the complete absence of divorced individuals and those in the "others" category across all years highlights a systemic demographic blind spot. This pattern suggests that PrEP may have been framed primarily as a family-based or couples' intervention.

Figure 1 suggests that PrEP uptake among unmarried populations, who may include sexually active youth, students, migrants, and other mobile populations, remains limited. Given that these groups often face heightened HIV risk due to

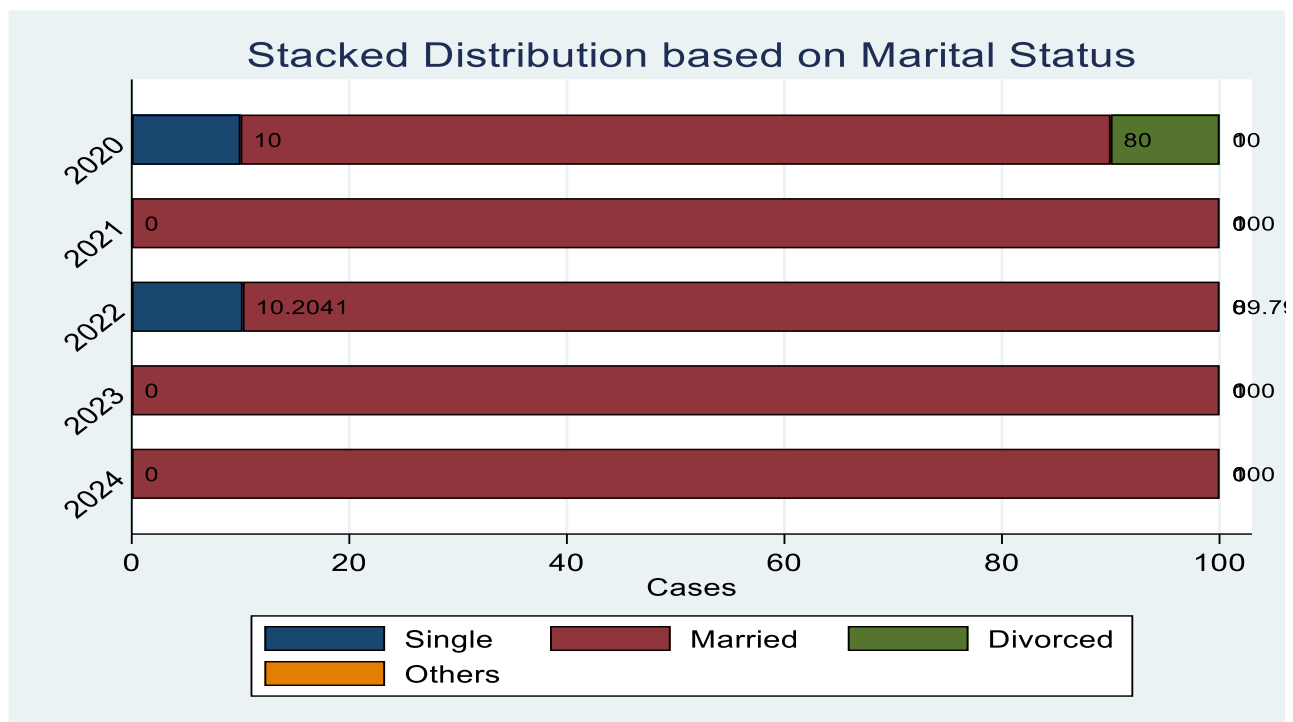


Figure 1: Distribution of HIV pre-exposure prophylaxis (PrEP) uptake by marital status

multiple partnerships, low condom use, or limited access to sexual health services, their underrepresentation points to a gap in Nigeria's PrEP delivery framework. Structural barriers such as stigma, low risk perception, limited youth-friendly services, and inadequate demand-creation efforts may be constraining PrEP utilization among single individuals.

Overall, the marital status distribution suggests that PrEP uptake in Nigeria is strongly marriage-centric, potentially limiting the preventive impact of PrEP among populations whose risk is not defined by marital status but by behavioral and structural factors.

Figure 2 further highlights the concentration of PrEP services among *serodiscordant* couples, where one partner is HIV-positive and the other is HIV-negative. Across all the years, serodiscordant couples constitute the largest proportion of PrEP users, exceeding 80% in most periods and reaching complete dominance in 2023. This trend reflects the success of Nigeria's HIV programmes in identifying HIV-negative partners within discordant relationships and effectively linking them to PrEP services. It also suggests strong referral pathways

from HIV treatment programmes, where HIV-positive partners are already engaged in care, thereby facilitating PrEP uptake among their negative partners.

On the other hand, the very low and declining representation of sex workers is particularly appalling, given their well-documented vulnerability to HIV infection. The share of sex workers in the PrEP uptake ranges from 6.66% in 2021 to 18.18% in 2024, with a drop to 0% in 2023. Despite being a priority population in the national HIV strategic plans, sex workers account for only an insignificant share of PrEP uptake in the earlier years and are entirely absent in later periods. This pattern may be attributed to persistent barriers such as criminalization, stigma, fear of discrimination within health facilities, and weak community-based PrEP delivery models. It may also reflect challenges in data collection, where sex workers accessing PrEP through informal or non-governmental channels are underreported in routine programme statistics.

The "other population" category shows a significant increase in 2024, suggesting a gradual broadening of PrEP access beyond serodiscordant couples. This rise may signal improved risk

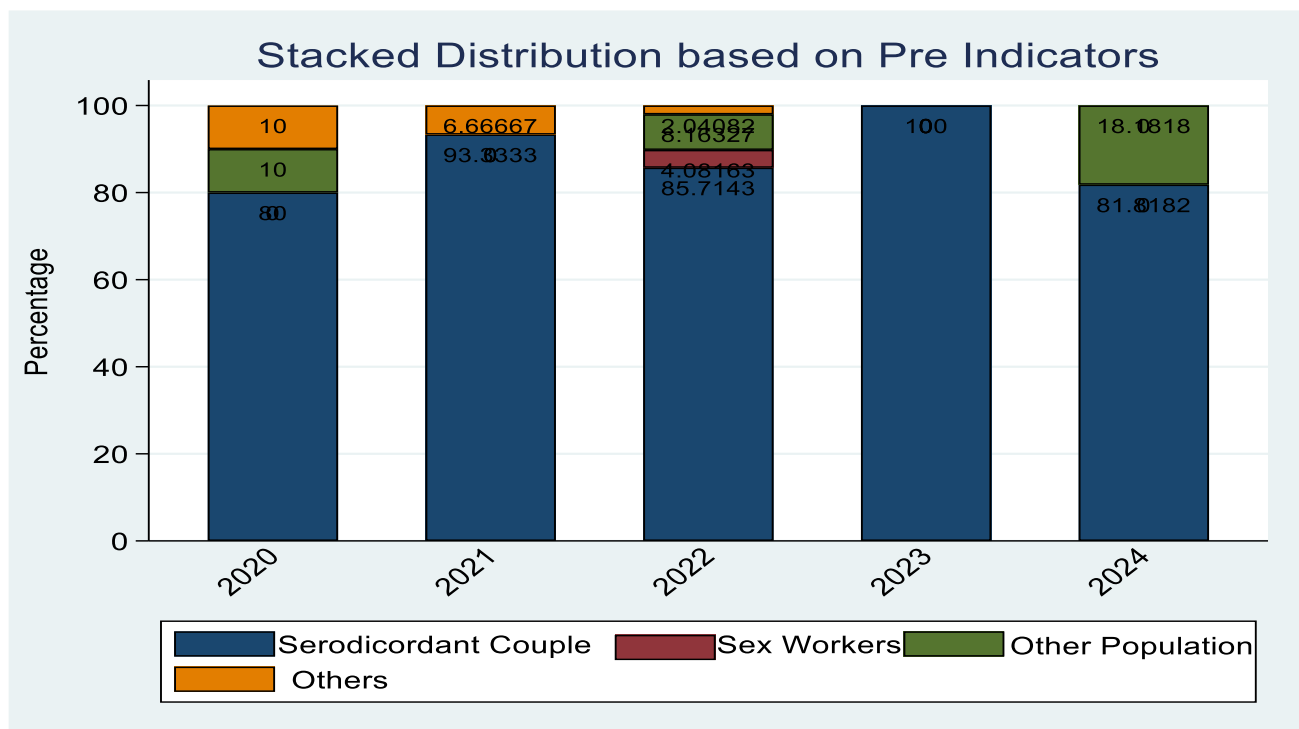


Figure 2: Distribution of HIV PrEP uptake by risk group (2020-2024)

screening, expansion of PrEP eligibility criteria, or targeted outreach to individuals with multiple partners, mobile populations, or persons identified through index testing and community testing initiatives. While this diversification is encouraging, the proportion remains relatively modest, indicating that PrEP uptake is still far from being fully risk-based.

Figure 3 illustrates trends in HIV PrEP uptake across genders from 2020 to 2024. Overall, PrEP use increased sharply for both males and females between 2020 and 2022, indicating a period of rapid scale-up or improved access and awareness. Male uptake rose more steeply, peaking in 2022 at a significantly higher level than females, suggesting stronger engagement or targeting of men during this period. Female uptake also increased steadily and reached its highest point in 2022, though at a slightly lower level. After 2022, PrEP use declined for both genders, with a sharper drop among males between 2022 and 2023. By 2024, uptake had fallen to levels close to those observed in 2020, which may point to programmatic challenges, reduced demand, changes in eligibility criteria, or shifts in prevention strategies. Despite these declines, females

maintained marginally higher PrEP use than males in 2023 and 2024, suggesting relatively better continuity of use among women in the later years.

Figure 4 presents the age-group composition among married individuals by gender and year. Across all years, most cases are concentrated in the 30–39 and 40–49 age groups for both males and females, indicating that middle-aged adults constitute the largest share of married individuals captured in the data. In 2022, there is a marked peak for both genders, particularly among males aged 50+ and females aged 30–39 and 40–49, suggesting either improved identification, increased service uptake, or demographic shifts during that year. Female counts tend to be higher than male counts in several age categories, especially in 2022 and 2023, which may reflect higher health-service engagement among married women. Younger age groups (10–19 and 20–29) consistently contribute very few cases, indicating that marriage within these ages is relatively uncommon or underrepresented. By 2024, there is a clear reduction across almost all age groups for both genders, mirroring the decline observed in the PrEP trend and suggesting an overall contraction in service utilization or reporting.

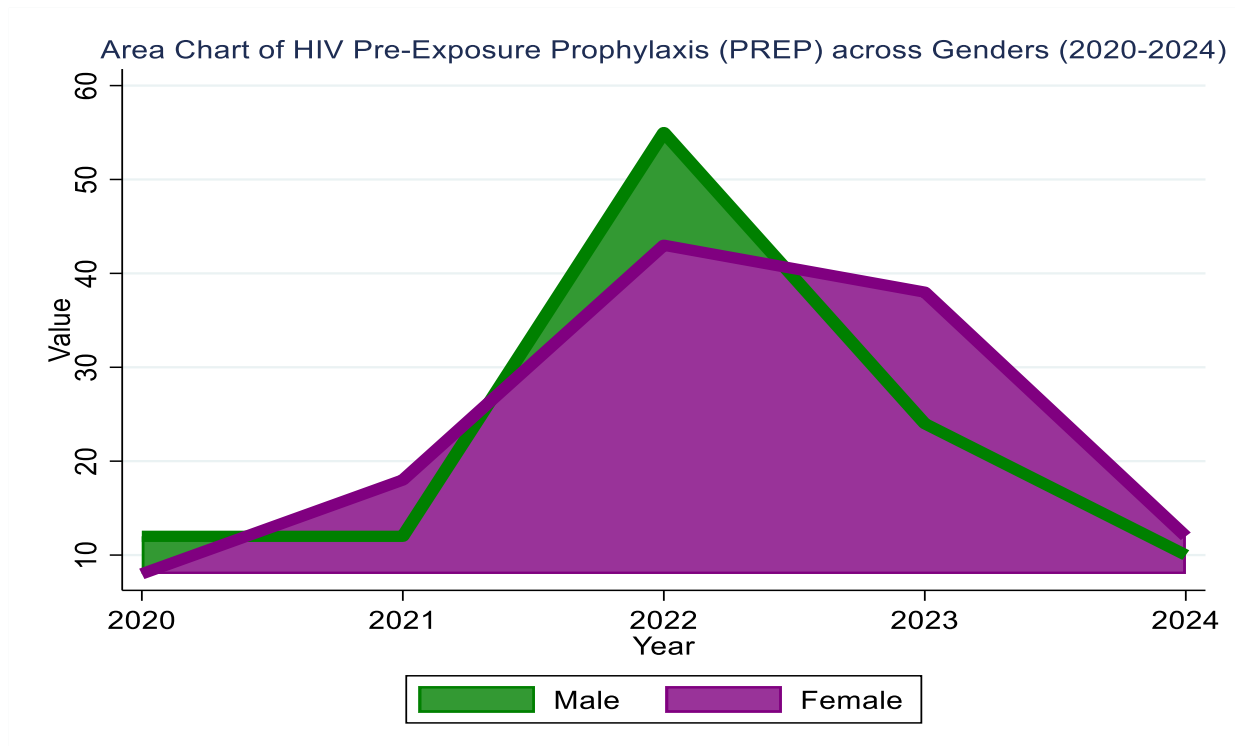


Figure 3: Trend of HIV PrEP uptake by gender (2020-2024)

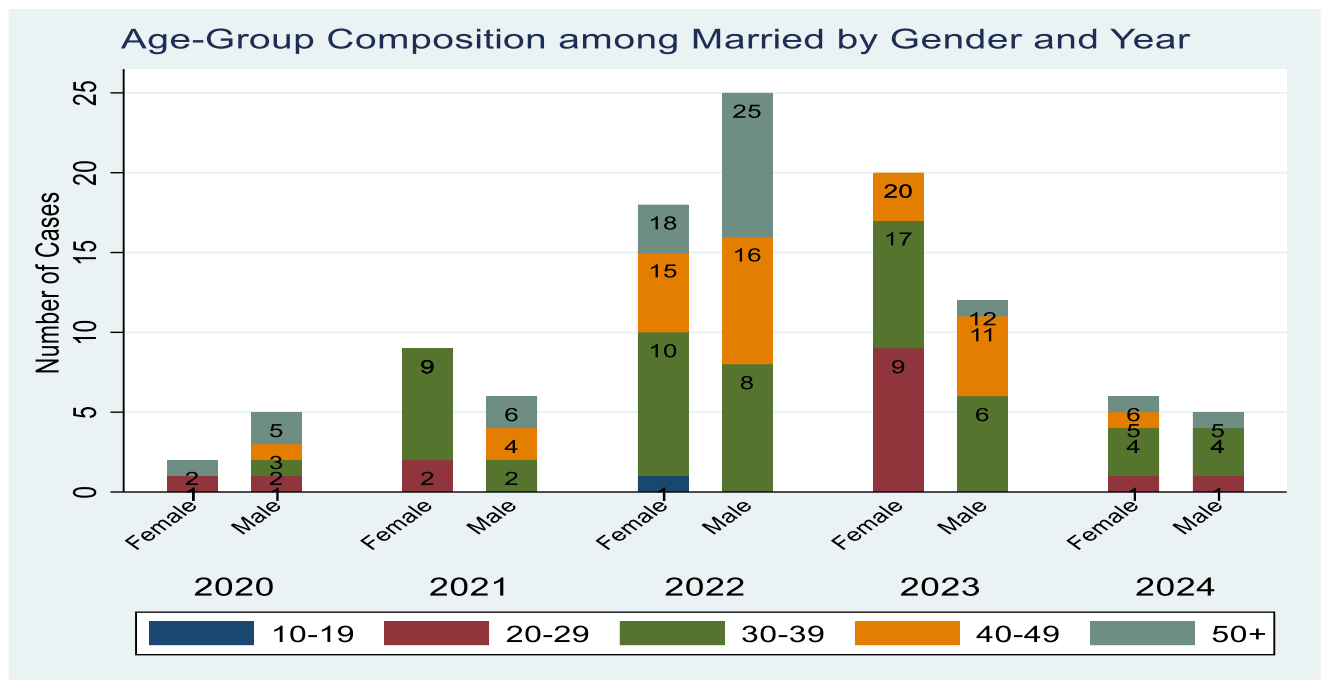


Figure 4: Age-group distribution of HIV PrEP uptake among married (2020-2024)

Figure 5 focuses on age-group composition among serodiscordant couples by gender and year. Similar to the married population, the majority of cases are concentrated in the 30–39, 40–49, and 50+ age groups. This highlights that serodiscordancy is most frequently identified among older, established couples. The year 2022 stands out with the highest number of cases for both females and males, particularly among those aged 40–49 and 50+, indicating a peak period of detection or enrollment into care. Females show notably high counts in the 30–39 and 40–49 age groups in 2023, while males display a more even distribution across older age groups.

Younger age groups again contribute minimally, reinforcing the pattern that serodiscordant relationships are more prevalent or more likely to be identified at later ages. The sharp decline in 2024 across all age groups and both genders suggests reduced case identification, possible service disruptions, or reporting delays instead of just a sudden epidemiological change. Overall, the analyses depict a consistent narrative across PrEP uptake, married populations, and serodiscordant couples: a strong expansion phase culminating around 2022, followed by a marked decline through 2023 and 2024.

Middle-aged and older adults dominate the distributions, emphasizing the importance of targeting prevention and care interventions toward these age groups. Gender differences are present but not extreme, with males often peaking higher during expansion phases and females showing slightly more stability afterward. These findings point to the need for sustained program support, renewed demand-creation efforts, and closer examination of the factors driving the post-2022 declines to ensure continuity of HIV prevention and care services.

From the preceding analyses, it is clear that HIV Pre-Exposure Prophylaxis (PrEP) uptake in Nigeria between 2020 and 2024 is highly concentrated among married individuals, highlighting a principally marriage-centric pattern of service utilization. Across the entire period, married persons steadily account for the overwhelming majority of PrEP users, reaching near-total dominance in several years. This pattern reflects the strong integration of PrEP into established couple-based HIV prevention platforms, such as antenatal

care, prevention of mother-to-child transmission (PMTCT), and partner testing services. While this integration demonstrates programmatic success in reaching stable unions, it also suggests that PrEP delivery in Nigeria remains largely framed within marital and family contexts.

On the contrary, PrEP uptake among single individuals is minimal and irregular, appearing meaningfully only in 2020 and 2022, while divorced and other marital-status categories are completely absent throughout the period. This demographic exclusion points to a systemic gap in PrEP outreach and service design. Unmarried populations, who usually include sexually active youth, students, migrants, and other mobile groups, are known to face elevated HIV risk driven by behavioral and structural factors rather than marital status. Their limited representation suggests that stigma, low risk perception, limited youth-friendly services, and insufficient demand-creation strategies may be constraining PrEP uptake outside marriage-oriented health platforms, thereby narrowing the overall preventive impact of PrEP in Nigeria.

The risk-group analysis further reinforces this concentration, with serodiscordant couples accounting for the vast majority of PrEP users across all years and achieving complete dominance in 2023. This finding highlights the effectiveness of Nigeria's HIV treatment and testing programmes in identifying HIV-negative partners within discordant relationships and linking them to PrEP through strong referral mechanisms. The close linkage between antiretroviral treatment services and PrEP provision appears to be a major driver of uptake, demonstrating the value of integrated prevention-treatment pathways.

Conversely, the very low and sporadic uptake among sex workers is particularly concerning, given their well-established vulnerability to HIV infection. Despite being a priority population in national HIV strategies, sex workers account for only a small fraction of PrEP users and are entirely absent in some years. This pattern likely reflects persistent structural barriers, including criminalization, stigma, fear of discrimination in health facilities, and weak community-based PrEP delivery models. It may also signal data limitations, where PrEP accessed through non-governmental or informal channels is not

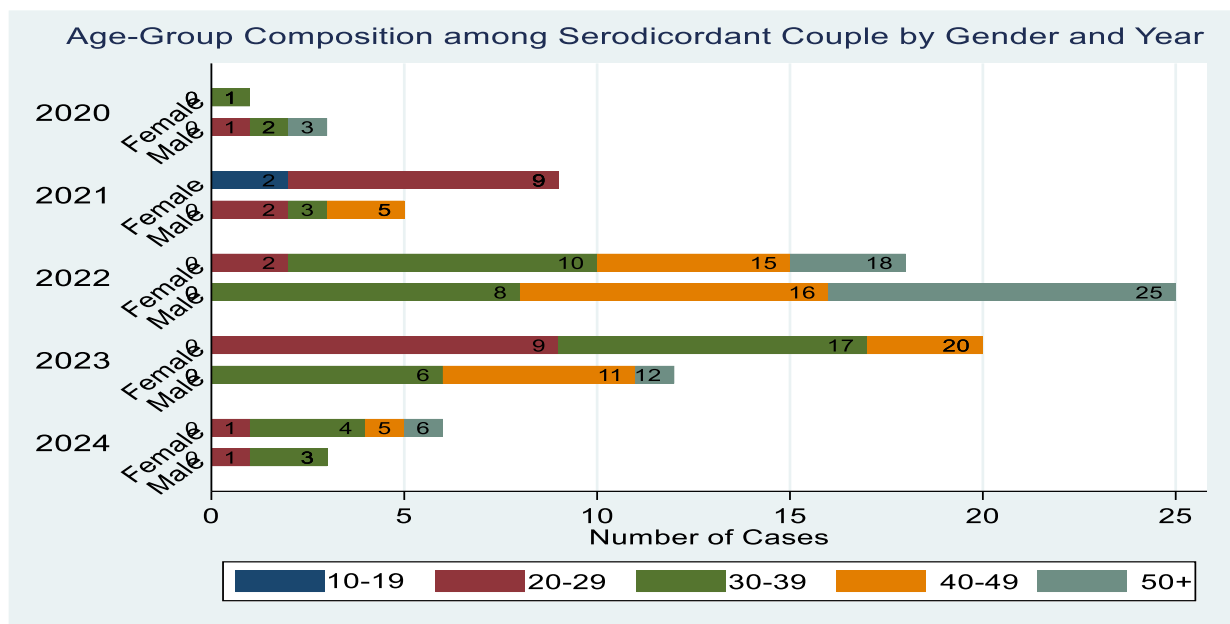


Figure 5: Age-group distribution of HIV PrEP uptake among serodiscordant

adequately captured in routine statistics. Although the rise in the “other population” category in 2024 suggests some diversification of PrEP access, uptake remains modest and far from fully aligned with risk-based prevention principles.

Gender-based trends show a rapid expansion of PrEP uptake for both males and females between 2020 and 2022, culminating in a clear peak in 2022. Male uptake increased more sharply during this expansion phase, possibly reflecting targeted interventions or higher enrollment of male partners in serodiscordant relationships. Female uptake also rose steadily and, while slightly lower at its peak, demonstrated greater stability in the post-2022 period. The sharp decline in uptake for both genders after 2022, particularly among males, raises concerns about programme sustainability, potential funding constraints, changing eligibility criteria, or disruptions in service delivery and demand creation.

Age-group analyses among married individuals and serodiscordant couples consistently show that PrEP uptake is dominated by middle-aged and older adults, particularly those aged 30–39, 40–49, and 50 years and above. The pronounced peak in 2022 across these age groups suggests a period of intensified case identification, enrollment, or

reporting. Younger age groups contribute very little across all years, reflecting either lower rates of marriage and identified serodiscordancy at younger ages or limited engagement of younger adults within existing PrEP delivery frameworks. The uniform decline across age groups in 2024 mirrors the overall downward trend in uptake and likely reflects programmatic or reporting challenges rather than abrupt epidemiological shifts.

In summary, the findings depict a coherent description of PrEP uptake in Nigeria; a strong scale-up phase peaking around 2022, followed by a notable contraction in subsequent years. Uptake is heavily concentrated among married, middle-aged, and serodiscordant populations, with limited reach among unmarried individuals, younger adults, and key populations such as sex workers. While existing strategies have been effective within stable unions and treatment-linked contexts, the results underscore the need to rebalance PrEP delivery toward a more inclusive, risk-based approach. Sustained program support, renewed demand-creation efforts, and targeted, stigma-free service models are essential to reverse the post-2022 decline and expand the preventive impact of PrEP across diverse demographic and risk groups in Nigeria.

Discussion

The findings from this study provide a programme-grounded account of how HIV pre-exposure prophylaxis (PrEP) uptake in Nigeria has evolved between 2020 and 2024, with clear temporal phases and pronounced demographic concentration. Rather than indicating uniform scale-up, the results reveal a pattern of expansion, saturation, and subsequent contraction that reflects the structure of PrEP delivery and the populations through which services are currently channeled.^{22,12}

The trend analysis shows a distinct expansion phase in PrEP uptake from 2020 to 2022, followed by a sharp decline from 2023 through 2024. The growth observed up to 2022 is consistent with an early scale-up period characterised by intensified partner-supported implementation, increased provider familiarity with PrEP protocols, and strong linkage from HIV testing and treatment services. This phase coincides with the consolidation of Nigeria's oral PrEP implementation framework and the prioritisation of PrEP within routine HIV prevention programming.^{22,23,2}

However, the post-2022 contraction is a critical empirical finding. The decline is evident across genders, age groups, and risk categories, suggesting a systemic rather than population-specific driver. Given the abruptness and breadth of the decline, it is unlikely to reflect a sudden reduction in HIV risk.^{22,23} Instead, it points to programme-level constraints such as reduced demand-creation activities, commodity or funding limitations, shifts in eligibility criteria, reporting disruptions, or declining continuation rather than initiation. The temporal alignment of this decline across multiple demographic strata suggests that PrEP scale-up in Nigeria has not yet transitioned into a stable, self-sustaining delivery phase, but remains sensitive to external programmatic inputs and system continuity.

One of the most striking findings is the overwhelming dominance of married individuals in PrEP uptake across all years. Married persons account for the vast majority of PrEP users, reaching near-total dominance in several years, particularly 2021, 2023, and 2024. This pattern reflects the structural integration of PrEP into couple-oriented HIV prevention platforms, including partner testing,

antenatal care, PMTCT services, and serodiscordant couple management. While this integration demonstrates effective linkage between HIV treatment services and prevention for stable unions, it also reveals a narrow framing of PrEP delivery.^{21,20,22}

PrEP uptake appears to be operationalised largely as a risk-management tool within marriage rather than a broader prevention option for individuals whose risk is shaped by behaviour, mobility, or structural vulnerability. The near absence of divorced individuals and the marginal representation of single persons underscore this limitation. Unmarried populations, including sexually active youth, students, migrants, and urban mobile populations, remain largely excluded from observed PrEP utilisation, despite their epidemiological relevance. This suggests that PrEP demand creation, eligibility screening, and service delivery models remain insufficiently adapted to non-marital risk contexts.

The risk-group analysis reinforces the marriage-centric pattern, with serodiscordant couples consistently accounting for the majority of PrEP uptake and achieving complete dominance in 2023. This finding highlights the strength of Nigeria's HIV programme in identifying HIV-negative partners of people living with HIV and effectively linking them to PrEP through treatment-based referral pathways. The strong performance in this domain reflects the benefits of integrated prevention-treatment cascades, where one partner's engagement in care facilitates prevention access for the other.^{10,15,22,23}

The findings of this study are consistent with existing evidence on healthcare access and utilisation. Chen *et al.*²⁴ demonstrated that population distribution, healthcare resource allocation, and transportation infrastructure significantly influence spatial accessibility to healthcare services. This provides a useful explanation for the concentration of PrEP uptake among married and clinic-connected populations observed in this study, as these groups are more likely to be reached through established healthcare systems. Similarly, Wang *et al.*²⁵ reported disparities in healthcare-seeking behaviours between impoverished and non-impoverished populations, highlighting how socioeconomic inequalities shape

access to healthcare services. This finding supports the observed limited uptake of PrEP among unmarried individuals, younger populations, and key risk groups, suggesting that structural and economic barriers may constrain access to preventive services. Liu *et al.*²⁶ developed a clinical screening tool for early detection of sepsis using biomarkers, emphasising the importance of early identification in improving health outcomes. This aligns with the present study, which highlights the need for early identification of individuals at substantial risk of HIV to enhance timely PrEP initiation.

Zhang *et al.*²⁷ examined adverse health outcomes following COVID-19 vaccination and underscored the importance of surveillance systems in identifying and managing health risks. This reinforces the importance of robust monitoring systems in PrEP programmes to track uptake trends and identify emerging gaps in service delivery. Yao *et al.*²⁸ identified elevated blood cell counts as early biomarkers for predicting preeclampsia risk, further highlighting the role of early risk detection in preventive healthcare. In the context of PrEP, this underscores the importance of proactive risk assessment and targeted interventions to improve uptake among high-risk populations.

Zeng *et al.*²⁹ evaluated treatment outcomes in patients with neuromyelitis optica spectrum disorder and highlighted the importance of timely and appropriate intervention strategies. This finding supports the need for sustained engagement and continuity in PrEP programmes to ensure effective prevention outcomes. Zhao *et al.*³⁰ analysed adverse events associated with antibiotic use and emphasised the role of pharmacovigilance systems in ensuring treatment safety. This highlights the broader importance of monitoring and evaluation frameworks in healthcare programmes, including PrEP, to ensure both effectiveness and safety in service delivery.

In contrast, PrEP uptake among sex workers remains extremely low and inconsistent, with complete absence in some years. This finding is particularly important given the elevated HIV incidence traditionally associated with sex work in Nigeria. The weak representation of sex workers suggests that structural barriers such as criminalisation, stigma, fear of disclosure, and limited trust in formal health facilities continue to

constrain PrEP access for this group. It may also reflect under-capture of community-based or non-governmental PrEP provision in routine reporting systems^{22,23}. The modest rise in the “other population” category in 2024 signals some diversification of access, but this remains insufficient to offset the broader concentration of PrEP uptake within serodiscordant couples.

Gender-disaggregated trends show that both males and females experienced rapid increases in PrEP uptake up to 2022, followed by declines thereafter. Male uptake rose more steeply during the expansion phase, likely reflecting the enrolment of male partners within serodiscordant relationships and targeted outreach to men through partner services. The sharper post-2022 decline among males suggests that male PrEP use may be more sensitive to programme disruption or changes in service delivery.

Female uptake, while slightly lower at peak, exhibits greater relative stability in the later years. This may be linked to women’s more consistent engagement with health services, particularly through reproductive and maternal health platforms. Nonetheless, the overall decline among both genders indicates that gender differences do not offset the broader structural fragility of PrEP delivery. Sustained uptake appears contingent on continued programme support rather than embedded demand or routine health-seeking behaviour.

Age-disaggregated analyses among married individuals and serodiscordant couples reveal a consistent concentration of PrEP uptake among adults aged 30–49 years and those aged 50 years and above. This pattern reflects the demographic profile of stable unions and identified serodiscordant relationships, which are more common at later stages of the life course. The pronounced peak across these age groups in 2022 suggests a period of intensified identification and enrolment rather than a long-term demographic shift.

Younger age groups, particularly those aged 10–19 and 20–29 years, contribute negligibly to PrEP uptake throughout the study period. This finding is not explained by low HIV risk alone but likely reflects barriers related to risk perception, stigma, consent requirements, service acceptability, and limited youth-friendly PrEP delivery models. The consistent underrepresentation of younger

adults indicates that current PrEP strategies are not effectively aligned with the prevention needs of populations entering periods of heightened sexual activity and mobility. The decline across all age groups in 2024 further reinforces the interpretation that the observed patterns are driven more by programme dynamics than by underlying epidemiological change.

Taken together, the findings depict a PrEP programme that has achieved notable success within narrowly defined delivery pathways, particularly among married and serodiscordant couples, but has struggled to sustain momentum and expand equitably across broader risk groups. The temporal peak around 2022 followed by contraction suggests that PrEP uptake in Nigeria remains highly dependent on active programme inputs rather than being embedded within routine prevention-seeking behaviour. The demographic concentration by marital status, risk group, age, and gender indicates that current delivery models, while effective for stable unions, leave substantial prevention gaps among unmarried individuals, younger adults, and key populations.

These results imply that future PrEP scale-up in Nigeria requires a strategic shift from predominantly couple-based and treatment-linked delivery toward more inclusive, risk-based, and community-oriented models. Without such reorientation, gains achieved during early scale-up phases may remain fragile, and PrEP's potential contribution to reducing new HIV infections may remain constrained despite demonstrated feasibility within specific population segments.

Strengths and weaknesses

A major strength of this study is its use of nationally consolidated routine programme data drawn from Nigeria's HIV prevention and treatment information system. This ensures strong external validity and policy relevance, as the findings directly reflect how PrEP services are delivered, accessed, and reported within real-world programme settings rather than controlled research environments. The reliance on five consecutive years of data from 2020 to 2024 enables the study to capture both the expansion and contraction phases of PrEP uptake, offering a dynamic perspective that would not be visible in cross-sectional analyses.

The study's emphasis on temporal trend analysis represents another important strength. By examining year-on-year changes in PrEP uptake, the analysis identifies a clear inflection point around 2022, distinguishing an early scale-up phase from a subsequent period of decline. This temporal structuring allows for a more accurate interpretation of programme performance and sustainability than single-year assessments, and it provides empirical grounding for discussions on programme fragility and continuity. A further strength lies in the detailed demographic disaggregation of PrEP uptake by marital status, risk group, gender, and age. This approach reveals systematic concentration of PrEP services among married individuals and serodiscordant couples, as well as persistent underrepresentation of unmarried individuals, younger age groups, and key populations such as sex workers. Such granularity strengthens the analytical contribution of the study by moving beyond aggregate uptake figures to uncover structural patterns in service reach and equity that are directly relevant for programme redesign.

Methodologically, the study adopts transparent and appropriate descriptive techniques, including proportional distributions, trend plots, and grouped bar charts. These methods are well suited to administrative data and enhance interpretability for programme managers, policymakers, and public health practitioners. The focus on descriptive inference ensures that findings remain closely tied to observed data rather than speculative modelling assumptions.

Finally, the study situates its empirical findings within Nigeria's PrEP implementation context, particularly the integration of PrEP into couple-based HIV prevention and treatment-linked referral pathways. This contextual grounding strengthens the internal coherence of the analysis and allows the findings to be interpreted as reflections of programme design rather than isolated behavioural outcomes. Despite these strengths, several limitations should be acknowledged. First, the study relies entirely on routine administrative data, which are subject to reporting delays, data entry errors, and inconsistencies across facilities and years. The sharp decline in PrEP uptake observed after 2022 may partly reflect reporting gaps or changes in data capture systems rather than a true

reduction in service utilisation, limiting causal interpretation of temporal trends.

Second, the analysis focuses primarily on PrEP uptake measured as enrolment or service contact and does not include detailed indicators of continuation, adherence, or duration of PrEP use. As a result, the study cannot distinguish between sustained PrEP use and short-term initiation, which constrains conclusions about the effectiveness of PrEP delivery in reducing HIV risk over time.

Third, the categorisation of risk groups into serodiscordant couples, sex workers, and “other populations” may obscure important heterogeneity within and across these groups. The broad “other” category in particular limits precise interpretation of who is being reached as PrEP access expands, especially in the later years of the study.

Fourth, the absence of spatial disaggregation by state or service delivery platform restricts the ability to identify subnational disparities in PrEP uptake. Given Nigeria’s wide variation in HIV epidemiology, service availability, and sociocultural contexts, national-level aggregates may mask important geographic inequities that are critical for targeted intervention. Finally, the descriptive study design does not allow for causal attribution of observed trends to specific programme interventions, funding changes, or policy shifts. While plausible explanations are discussed in relation to observed patterns, these remain inferential.

Future research incorporating facility-level data, longitudinal client tracking, or mixed-methods approaches would be required to more rigorously identify the drivers of PrEP uptake and discontinuation. While the study provides a robust and programme-relevant descriptive assessment of PrEP uptake patterns in Nigeria, its findings should be interpreted as indicative of system performance rather than definitive evidence of behavioural change or intervention impact.

Conclusion

This study provides a data-driven assessment of the evolution and structure of HIV pre-exposure prophylaxis (PrEP) uptake in Nigeria between 2020

and 2024, revealing a prevention programme that has expanded rapidly but unevenly and remains structurally fragile. The analysis identifies a clear scale-up phase culminating in 2022, followed by a marked contraction in uptake during 2023 and 2024 across all demographic and risk categories. This pattern indicates that PrEP expansion in Nigeria has been highly dependent on active programme inputs and has not yet matured into a stable or self-sustaining component of routine HIV prevention. A central conclusion emerging from the findings is the strongly marriage-centric and treatment-linked nature of PrEP delivery in Nigeria. PrEP uptake is overwhelmingly concentrated among married individuals and serodiscordant couples, reflecting the successful integration of PrEP into partner testing, PMTCT, and HIV treatment referral pathways. While this demonstrates effective targeting within stable unions, it also reveals a narrow operational framing of PrEP that limits its reach to populations whose HIV risk is shaped by behavioural, social, and structural factors rather than marital status. The persistent underrepresentation of unmarried individuals, younger adults, and key populations such as sex workers underscores significant prevention gaps. Despite being priority groups within national HIV strategies, these populations remain marginal in observed PrEP utilisation, suggesting that existing service delivery models, demand-creation strategies, and reporting systems are not adequately aligned with their prevention needs. The dominance of middle-aged and older adults in PrEP uptake further confirms that current programmes are more effective at reaching established, clinic-connected populations than those with higher mobility or weaker engagement with formal health services. The findings indicate that while Nigeria has demonstrated the feasibility of PrEP delivery within specific, well-defined pathways, the broader preventive potential of PrEP remains underutilised. Sustaining and expanding PrEP’s impact will require a strategic shift from predominantly couple-based and treatment-linked approaches toward more inclusive, risk-based, and community-oriented delivery models. Without such reorientation, the gains achieved during the early scale-up phase are likely to remain fragile, and PrEP

will continue to fall short of its potential contribution to reducing new HIV infections in Nigeria

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Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this study.

Authors contributions

All authors contributed to the conception and design of the study, data analysis, and manuscript preparation. All authors reviewed and approved the final version of the manuscript.

Data availability

The data used in this study are not publicly available due to ethical and institutional restrictions. However, the data may be made available from the corresponding author upon reasonable request and with permission from the relevant authorities.

References

1. Azuh DE, Osabohien R, Orbih M, Godwin A. Public health expenditure and under-five mortality in Nigeria: An overview for policy intervention. *Open Access Macedonian Journal of Medical Sciences*. 2020;8(E):353–362.
2. Zhou D, Bassey RA, Yan M, Aderemi TA. Do health expenditures affect under-five mortality and life expectancy in the ECOWAS sub-region? *African Journal of Reproductive Health*. 2023;27(8):105–113.
3. Ai W, Aderemi TA, Bassey R, Khalid AA. Out-of-pocket expenditure and maternal mortality nexus in China: Implications for the Sustainable Development Goal 3. *African Journal of Reproductive Health*. 2023;27(12):94–100.
4. Sikwela MM, Ntshangase BA, Ramsarghey K, Aderemi TA. Carbon emissions, out-of-pocket expenditure and life expectancy of reproductive age women in West Africa. *Asian Economic and Financial Review*. 2025;15(3):345–353.
5. Jia H, Han X, Aderemi TA, Ifekwem NE, Al-Faryan MAS. Out-of-pocket expenditure and human welfare in Nigeria: Evidence from a fully modified ordinary least squares regression. *African Journal of Reproductive Health*. 2025;29(2):151–159.
6. Feng Y, Ahuru RR, Anser MK, Osabohien R, Ahmad M, Efegber AH. Household economic wealth management and antenatal care utilization among business women in the reproductive-age. *African Journal of Reproductive Health*. 2021;25(6):143–154.
7. Gershon O, Akhigbemidu A, Osabohien R. Domestic resource mobilization and under-five mortality in Nigeria. *Research in World Economy*. 2020;11(3):320–332. <https://doi.org/10.5430/rwe.v11n3p320>
8. Jakovljevic M, Liu Y, Cerda A, Simonyan M, Correia T, Mariita RM, Kumara AS, Garcia L, Krstic K, Osabohien R, Toan TK. The Global South political economy of health financing and spending landscape—history and presence. *Journal of Medical Economics*. 2021;24(sup1):25–33. <https://doi.org/10.1080/13696998.2021.2007691>
9. Li H, Zhang X, Ma F, Osabohien R. Out-of-pocket medical expenditures, remittances and health outcomes in China. *African Journal of Reproductive Health*. 2024;28(8):122–132.
10. Matthew OA, Osabohien R, Fagbemiiniyi F, Fasina A. Greenhouse gas emissions and health outcomes in Nigeria: Empirical insight from auto-regressive distribution lag technique. *International Journal of Energy Economics and Policy*. 2018;8(3):43–50.
11. Matthew O, Osabohien R, Olawande T, Urhie E. Manufacturing industries and construction emissions in Nigeria: Examining the effects on health conditions. *International Journal of Civil Engineering and Technology*. 2019;10(1):2401–2414.
12. Nasir MH, Anser MK, Ahuru RR, Osabohien R, Ebiaku KC, Abbas S. A comparative study of the effect of health insurance on women's use of health facility delivery: Evidence from demographic health survey in Benin Republic. *African Journal of Reproductive Health*. 2022;26(6):104–115.
13. Obasaju B, Adama I, Ishola OP, Oloyede F, Osabohien R, Aregbesola A, Onabote A. Effects of immunisation on child mortality in West Africa. In: 2023 International Conference on Science, Engineering and Business for Sustainable Development Goals (SEB-SDG). IEEE; 2023. <https://doi.org/10.1109/SEB-SDG57117.2023.10124485>
14. Osabohien R, Jaaffar AH, Akpa AF, Jakovljevic M. Mobile money, medical cost anxiety and welfare of individuals within the reproductive age in Malaysia. *Humanities and Social Sciences Communications*. 2024. <https://doi.org/10.1057/s41599-024-02767-2>
15. Sui Y, Ahuru RR, Huang K, Anser MK, Osabohien R. Household socioeconomic status and antenatal care utilization among women in the reproductive-age. *Frontiers in Public Health*. 2022;9:724337. <https://doi.org/10.3389/fpubh.2021.724337>
16. Urhie E, Afolabi A, Afolabi A, Matthew O, Osabohien R, Ewetan O. Economic growth, air pollution and health outcomes in Nigeria: A moderated mediation model. *Cogent Social Sciences*. 2020;6(1):1719570.

- <https://doi.org/10.1080/23311886.2020.1719570>
17. Wang L, Nwabuoku M, Zhang J, Osabohien R. Gender disparity in access to education, under-5 mortality, and economic growth in sub-Saharan Africa. *African Journal of Reproductive Health*. 2023;27(12):27–35.
 18. Xu Y, Peng MYP, Ahuru RR, Anser MK, Osabohien R, Aziz A. Individual and community-level factors associated with non-institutional delivery of women of childbearing-age in Nigeria. *Humanities and Social Sciences Communications*. 2022;9(1):1–7. <https://doi.org/10.1057/s41599-022-01168-7>
 19. Zhang X, Anser MK, Ahuru RR, Zhang Z, Peng MY, Osabohien R, Mirza M. Do predictors of health facility delivery among reproductive-age women differ by health insurance enrollment? A multi-level analysis of Nigeria's data. *Frontiers in Public Health*. 2022;10:797272.
 20. Zhou D, Ahuru RR, Yan M, Osabohien R, Jakovljevic M. Influences of women empowerment indices on demand for childcare services: Evidence from the Nigeria Demographic and Health Surveys. *African Journal of Reproductive Health*. 2023;27(10):65–80.
 21. Zhang X, Abdu M, Osabohien R, Jakovljevic M. Managing financial risk in healthcare: Medical cost anxiety, financial innovation, and income mobility in China. *African Journal of Reproductive Health*. 2025;29(11):189–203. https://hdl.handle.net/10520/ejc-ajrh_v29_n11_a17
 22. Jia H, Solo CO, Igharo AE, Al-Faryan MA. Barriers to utilization of anti-retroviral therapy among HIV positive pregnant women in Birnin Kebbi, North West Nigeria. *African Journal of Reproductive Health*. 2025;29(6):82–93.
 23. Wang M, Oyebamiji MO, Igharo AE, Osabohien EU, Ifere EO. Prevalence of HIV and Hepatitis B virus among adolescents seeking healthcare services at the Federal Teaching Hospital, Kebbi State, Nigeria. *African Journal of Reproductive Health*. 2025;29(6):58–71.
 24. Chen L, Chen T, Lan T, Chen C, Pan J. The contributions of population distribution, healthcare resourcing, and transportation infrastructure to spatial accessibility of health care. *INQUIRY: The Journal of Health Care Organization, Provision, and Financing*. 2023; 60: 1438227527. <https://doi.org/10.1177/00469580221146041>
 25. Wang X, Seyler BC, Chen T, Jian W, Fu H, Di B, Pan J. Disparity in healthcare seeking behaviors between impoverished and non-impoverished populations with implications for healthcare resource optimization. *Humanities and Social Sciences Communications*. 2024;11(1):1208. <https://doi.org/10.1057/s41599-024-03712-z>
 26. Liu B, Du H, Zhang J, Jiang J, Zhang X, He F, Niu B. Developing a new sepsis screening tool based on lymphocyte count, international normalized ratio and procalcitonin (LIP score). *Scientific Reports*. 2022;12(1):20002. <https://doi.org/10.1038/s41598-022-16744-9>
 27. Zhang HQ, Cao BZ, Cao QT, Hun M, Cao L, Zhao MY. An analysis of reported cases of hemophagocytic lymphohistiocytosis after COVID-19 vaccination. *Human Vaccines & Immunotherapeutics*. 2023;19(2):2263229. <https://doi.org/10.1080/21645515.2023.2263229>
 28. Yao YL, Xu Z, Xiao R, Li EH, Zhang YJ, Zhou LY, Zhong ZH, Fu LJ, Qi HB, Wu XB, Ding YB. Elevated neutrophil, lymphocyte, and platelet counts as early biomarkers of preeclampsia risk: a retrospective cohort study. *American Journal of Reproductive Immunology*. 2025; 94(2): e70137. <https://doi.org/10.1111/aji.70137>
 29. Zeng Q, Cai H, Yuan X, Jiang F, Li H, Dong X, Chen S, Li J, Duan W, Ouyang S, Yin W, Li H, Zhong Y, Yin J, Long H, Li B, Yang H. Lymphoplasmapheresis for steroid-refractory neuromyelitis optica spectrum disorder: a real-world multicenter study in China. *CNS Neuroscience & Therapeutics*. 2025;31(10):e70628. <https://doi.org/10.1111/cns.70628>
 30. Zhao Y, Qu Q, Wang Y, Zhang Y, Qu J. A disproportionality analysis of adverse events associated with omadacycline based on the FDA adverse event reporting system database. *Journal of Antimicrobial Chemotherapy*. 2026;81(2): dkag006. <https://doi.org/10.1093/jac/dkag006>