




# Sexual Risk Behaviors Among Men Who Have Sex with Men (MSM) Using Pre-Exposure Prophylaxis (PrEP): A Systematic Review

Mahraniy<sup>1</sup> , Yossie Susanti Eka Putri<sup>2</sup> , Herni Susanti<sup>2</sup> , Yudi Ariesta Chandra<sup>2</sup> 

<sup>1</sup>Student of the Master's Program, Faculty of Nursing, Universitas Indonesia, Depok, Indonesia

<sup>2</sup>Department of Mental Health and Psychiatric Nursing, Faculty of Nursing, Universitas Indonesia, Depok, Indonesia

 Corresponding author: [mahraniyraniy@gmail.com](mailto:mahraniyraniy@gmail.com)

## ARTICLE INFO

### Article history:

Received 5 April 2025

Revised 24 June 2025

Accepted 11 July 2025

Available online

<https://talenta.usu.ac.id/IJNS>

E-ISSN: 2685-7162

How to cite: Mahraniy., Putri, Y.S.E., Susanti, H., Chandra, Y.A. (2025). Sexual risk behaviors among men who have sex with men (MSM) using pre-exposure prophylaxis (PrEP): a systematic review. *Caring: Indonesian Journal of Nursing Science*, 7(1), 84-94.

## ABSTRACT

According to 2023 global estimates, approximately 39.9 million individuals were living with HIV (Human Immunodeficiency Virus), with 1.3 million new infections reported. Men who have sex with men (MSM) continue to represent a key population at heightened risk. When used consistently, pre-exposure prophylaxis (PrEP) has been shown to reduce the risk of HIV transmission by more than 90%. However, stigma, limited awareness, and concerns about reduced condom use hinder its effectiveness. Therefore, this review examines whether PrEP increases or decreases sexual risk behaviors, such as unprotected anal intercourse, among MSM to inform better HIV prevention strategies. A search in PubMed and ScienceDirect identified 585 records, with 26 studies meeting the inclusion criteria after screening and quality assessment using the CASP checklist. Out of these, 14 high-quality articles, including cohort, cross-sectional, and randomized controlled trials, were analyzed. Studies focused on MSM aged 15 and older using PrEP, excluding non-MSM populations, qualitative reports, and reviews. Two reviewers independently screened and extracted the data, resolving the discrepancies through discussion. A narrative synthesis examined patterns of sexual risk behavior and PrEP impact. Subsequently, PrEP significantly reduces HIV transmission but is linked to risk compensation behaviors, such as decreased condom use and increased high-risk sexual activities. Social and cultural factors, including stigma and familism, influence adherence to safe practices. Comprehensive interventions integrating PrEP with education, Sexually Transmitted Infection (STI) screening, and psychosocial support are essential. Governments and health providers should prioritize expanding PrEP access, improving adherence support, and integrating condom promotion to achieve greater HIV prevention impact on MSM communities.

**Keyword:** Pre-exposure prophylaxis (PrEP), Men who have sex with men (MSM), Sexual risk behaviors, STI screening



This work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International.

<https://doi.org/10.32734/ijns.v7i1.20381>

## 1. Introduction

The global HIV epidemic remained a major public health concern in 2023, with an estimated 39.9 million people living with the virus worldwide. In that year, there were 1.3 million new HIV infections and 630,000 AIDS-related deaths, which demonstrates the ongoing challenges in combating the disease. However,

significant progress has been made in treatment access, with 30.7 million people receiving life-saving antiretroviral therapy (ART). The cumulative historical impact of the epidemic is substantial, with a total of 88.4 million HIV infections and 42.3 million AIDS-related deaths recorded since its emergence. According to 2023 statistics, 38.6 million of those living with HIV were adults aged 15 or older, while 1.4 million were children under 15. Although 86% of individuals with HIV were aware of their status, approximately 5.4 million people remained undiagnosed, underscoring persistent disparities in testing and healthcare access (Joint United Nations Programme on HIV/AIDS (UNAIDS), 2024).

Pre-Exposure Prophylaxis (PrEP) is a biomedical intervention designed to prevent HIV acquisition in HIV-negative individuals who are at a high risk of exposure (Brydon, 2016; Cimen et al., 2020; Guyonvarch et al., 2021; Ng & Mayeux, 2021; Toumasis et al., 2020). Among men who have sex with men (MSM), a population disproportionately impacted by HIV, PrEP regimens containing antiretroviral medications such as tenofovir disoproxil fumarate (TDF) and emtricitabine (FTC) have demonstrated high efficacy in preventing HIV infection (Fonner et al., 2016; Huang et al., 2018). Multiple studies have confirmed that consistent PrEP use reduces HIV incidence by over 90% in high-risk populations, including MSM (Butts et al., 2023; Grant et al., 2014). However, implementation faces several challenges, including social stigma, low awareness among MSM (O'Halloran et al., 2019; Underhill et al., 2015), and structural barriers such as mental health conditions and socioeconomic disparities (Onwubiko et al., 2024). Despite its effectiveness, PrEP use has been associated with potential risk-compensation behaviors, including an increase in higher-risk sexual practices (Liu et al., 2024) and decreased condom use (Sun et al., 2022). Additional factors that influence PrEP uptake include having multiple partners, engaging in unprotected sex, and substance use (Herder et al., 2020).

Several studies indicate that while PrEP use is increasing among men who have sex with men (MSM), this trend is not always associated with a decrease in consistent condom use; in some instances, condom use has reportedly increased (Oldenburg et al., 2016; T. Torres et al., 2018). This suggests that PrEP can function as an effective addition to existing prevention strategies, not as a substitute (Jenness et al., 2017). This concept is further supported by research from Yu et al. (2021), who utilized the UPREP application to record various risky sexual behaviors. Their findings demonstrated that combining PrEP with condoms was more effective for HIV prevention than using PrEP alone, highlighting the importance of integrated prevention strategies that account for various patterns of sexual behaviors and promote additional protective measures.

Other research has identified several behavioral factors associated with condomless anal sex among MSM not using PrEP. These factors include having a primary partner perceived to be HIV-negative, experiencing a depressive phase within the last 12 months, engaging in recent sexual activity (within the last four weeks), and having sexual intercourse under the influence of alcohol (Di Ciaccio et al., 2020). Unprotected anal intercourse is a significant risk factor for HIV transmission, making preventive strategies like Pre-exposure prophylaxis (PrEP) critically important. PrEP is particularly relevant for populations such as male sex workers, who may use the medication in response to frequent client requests for condomless sex. However, contextual factors can complicate prevention efforts. According to Bazzi et al., 2019, sex workers frequently consume alcohol with clients in nightlife establishments before sexual encounters, which can impair judgment. This impairment may lead to inconsistent condom use or agreeing to engage in unprotected sex, a decision that can be further influenced by offers of higher financial compensation.

To achieve PrEP adherence, the PrEP continuum of care requires the following steps: knowledge, motivation, access to healthcare services, provider and cost considerations, and adherence sustainability (Mansergh et al., 2023). In contrast, research by Wang et al. (2024) on the PrEP continuum in China covers four outcomes in the PrEP series, namely awareness, willingness to use, acceptance, and adherence. Their findings revealed low PrEP awareness among MSM in China (32.4%), although the willingness to use it was considerably higher (54.5%). Despite this willingness, the actual acceptance of PrEP remained very low (4.9%), a gap potentially attributable to barriers such as cost, access, or stigma. Furthermore, adherence among users was also low (40.7%), indicating challenges in maintaining consistent use. When compliance is not high, high-risk sexual behavior increases the transmission of HIV.

Against this background, this study describes sexual risk behavior among MSM using PrEP, including PrEP use, consistency of condom use, and risky sexual activities such as unprotected anal sex, group sex, partner number and substance use, influence sexual behaviour among men who have sex with men (MSM). It also examines whether PrEP use leads to increased, decreased, or unchanged sexual risk behaviors. By understanding this relationship, more effective interventions can be designed to improve the sexual health of MSM and reduce the HIV prevalence of HIV in this population (Lai et al., 2020; MacFadden et al., 2016; Peng et al., 2019).

## 2. Methods

### 2.1 Research Design

This study employed a systematic review methodology to (1) comprehensively describe sexual risk behaviors among MSM using PrEP, including patterns of PrEP use, condom use consistency, and engagement in specific high-risk activities (e.g., unprotected anal sex, group sex, multiple partners, and substance use); and to (2) systematically examine whether PrEP use is associated with an increase, decrease, or no change in these sexual risk behaviors. The review adhered to PRISMA guidelines and only included studies that measured redefined behavioral outcomes using validated instruments.

### 2.2 Search Methods

The search strategy using medical topic headings (MeSH) and keywords determined by the researcher. In PubMed, the keywords are ("Men who have sex with men" OR "MSM" OR "Gay" OR "Homosexual") AND "Pre-exposure Prophylaxis" OR "PrEP" AND ("Condom" OR "Contraceptive device" OR "Rubber") AND ("Behavioral sexual risk" OR "Condomless anal sex" OR "Condomless anal intercourse") NOT "Review" NOT ("Women" OR "Female") NOT ("Vaginal rings" OR "HIV vaccines") NOT "Qualitative". In ScienceDirect, the keywords are “Men who have sex with men” AND “pre-exposure prophylaxis” AND “condom” AND “behavioral sexual risk”.

### 2.3 Inclusion and Exclusion criteria

This review included original studies with cohort, cross-sectional, or randomized controlled trial designs published between February 2015 and February 2025. The participants were MSM aged 15 years and older. The studies compared PrEP use versus non-use or other STD prevention methods, focusing on outcomes related to risky sexual behavior. This systematic review excluded studies involving non-MSM populations such as women or females. Studies with terms unrelated to PrEP like vaginal ring or HIV vaccine were also excluded. Qualitative reports and review articles were not considered for inclusion.

### 2.4 Screening of Articles

Following the removal of duplicates using Mendeley, two reviewers independently screened the titles and abstracts of all records against the predefined eligibility criteria. The full-text versions of potentially relevant articles were then retrieved and assessed for final inclusion. Any discrepancies between reviewers during the screening or eligibility stages were resolved through discussion; a third reviewer was consulted to adjudicate any persistent disagreements. The initial database search in ScienceDirect and PubMed yielded 585 records. After 12 duplicate records were removed, 573 unique articles underwent title and abstract screening. At this stage, 544 records were excluded as they clearly did not meet the inclusion criteria, such as focusing on MSM (Men who have Sex with Men), and addressing sexual behavior with PrEP (Pre-Exposure Prophylaxis). After screening the abstracts, 34 records were considered, and five were excluded for reasons such as the articles are literature reviews or focusing on female participants. This left 29 full-text articles that were assessed for eligibility. Upon detailed review, three of these articles were excluded because they either did not focus on PrEP or did not utilize a relevant study design. Ultimately, 26 studies met all eligibility criteria and were included in the final data synthesis (Figure 1).

### 2.5 Data Extraction

We performed data extraction using a standardized form that was piloted and refined prior to its implementation. Key study characteristics were extracted, including: title, year of publication, problem statement, objectives, population, sample characteristics, setting, methodology, and conclusions (as detailed in Table 1). To ensure accuracy and minimize bias, two reviewers independently extracted all data. Any discrepancies identified during this process were resolved through discussion or, when necessary, through consultation with a third reviewer. This systematic approach to data extraction ensured a rigorous and transparent process, enhancing the overall reliability of the review's findings.

### 2.6 Quality Appraisal

To evaluate the methodological assessment quality of the included studies and identify potential sources of bias, the Critical Appraisal Skills Programme (CASP) Checklist will be employed. This instrument will be

adapted to the specific research design of each study to facilitate a comprehensive assessment. The primary objective of this study-level evaluation is to rigorously identify potential biases within the studies eligible for inclusion. The CASP checklists will be utilized to assess an initial pool of 26 articles, ensuring a thorough and incisive evaluation of the evidence. Subsequently, a selection of 14 articles that meet high-quality criteria will be chosen for detailed analysis and synthesis.

### *2.7 Data Analysis*

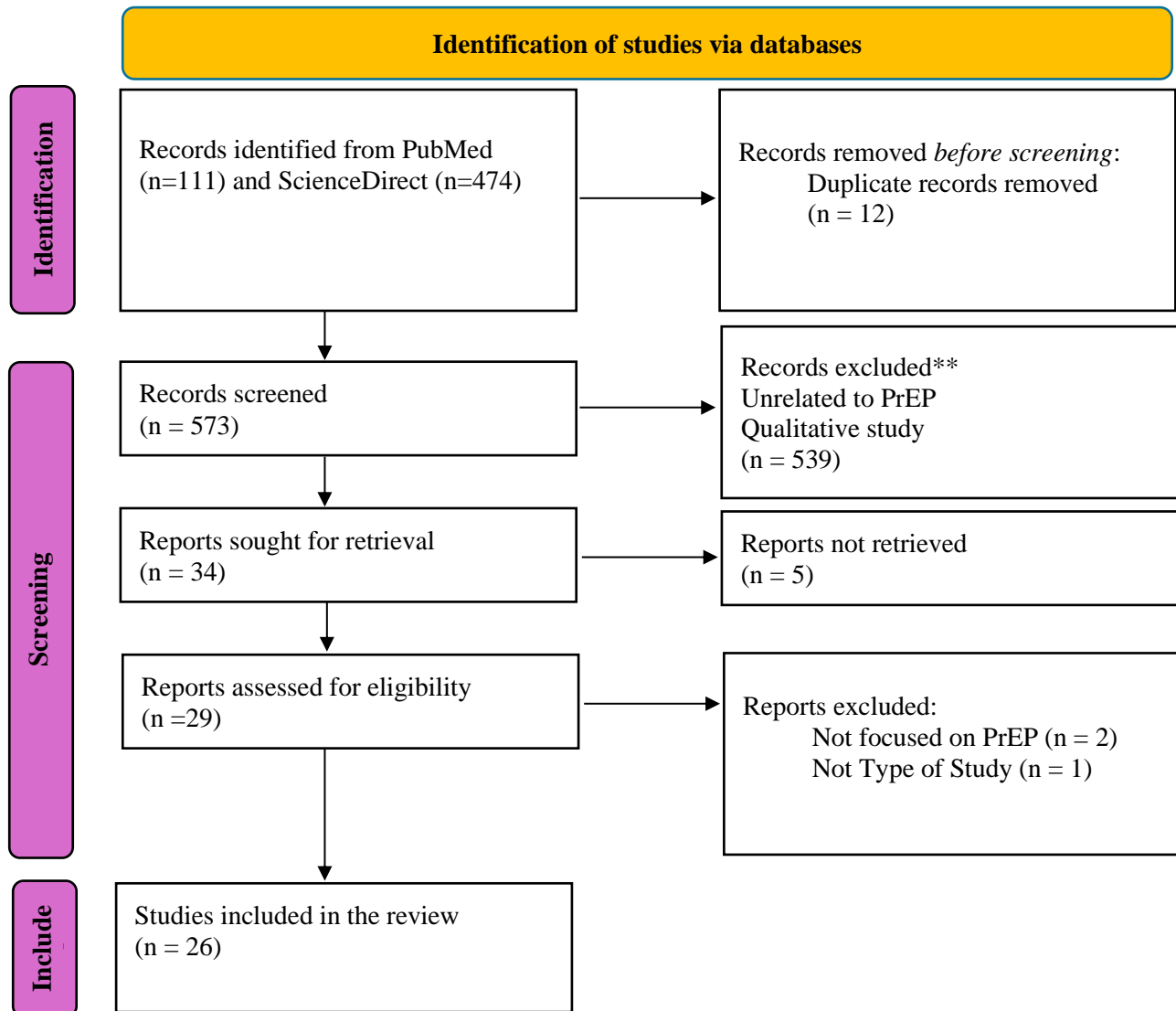
A narrative synthesis will be conducted to analyze the findings from all included studies, focusing on themes related to sexual risk behavior among MSM (men who have sex with men) using PrEP. The synthesis will explore various aspects of this behavior, including patterns of PrEP use, consistency of condom use, and specific risk activities such as unprotected anal sex, group sex, number of partners, and substance use. Furthermore, this review will examine whether PrEP use is associated with an increase, decrease, or no change in sexual risk behaviors. The review will adhere to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines (Page et al., 2021).

**Table 1** Data extraction

No	Author	Year	Country	Objective	Conceptual Framework	Sample	Design	Instrument/ Tool	Key Findings
1.	MacGregor et al.	2021	Bristol, UK	Examine MSM's likelihood of engaging in condomless anal intercourse (CAI) with PrEP users vs. non-users	Risk compensation theory	1975	Cohort	Survey/questionnaire	61.9% of MSM were more likely to engage in CAI with PrEP users. PrEP use influenced sexual risk perceptions.
2.	Crosby et al.	2020	Los Angeles, USA	Assess condom use disparities among racial minority MSM on PrEP	Behavioral disinhibition	399	Cohort	Behavioral surveys	PrEP users engaged in more unprotected anal sex ("condom displacement") and had higher STI risk.
3.	Lew et al.	2023	Melbourne	Describe sexual practices and condom use among MSM in group sex settings	Sexual network dynamics	1071	Cross-sectional	Sexual behavior diaries	High rates of oral/anal sex; inconsistent condom use during group sex. Chemsex and multiple partners linked to STI risk.
4.	Yu et al.	2021	Taiwan	Identify PrEP adherence patterns and associated sexual behaviors	Harm reduction	35	Cohort	Mobile app (UPREP) data	Three PrEP use patterns: inconsistent (high HIV risk), dual protection (PrEP + condoms), and adherent non-condom users (high STI risk).
5.	Sagaon-Teyssier et al.	2016	France and Canada	Evaluate PrEP impact on condomless sex and partner numbers	ANRS IPERGAY trial framework	400	Randomized controlled trials	Clinical trial records	70.3% engaged in condomless anal sex; PrEP use is stable but partner numbers declined. No significant behavioral changes post-PrEP.
6.	Dangerfield et al.	2021	Washington DC, Los Angeles, and Chapel Hill	Profile sexual risk behaviors among Black MSM (BSMM)	Syndemic theory	226	Cross-sectional	STI clinic records	High rates of unprotected sex, multiple partners, and substance use. STI diagnoses prevalent.
7.	Baltes et al.	2024	France	Assess post-HIV diagnosis sexual behavior changes among MSM on PrEP	Continuum of care	609	Cohort	Medical records	Increased inconsistent condom use post-diagnosis (linked to partners' PrEP use). High STI rates persisted.
8.	Van Wees et al.	2024	Dutch	Explore behavioral changes in MSM before/after PrEP initiation	Behavioral persistence	4367	Cohort	PrEP clinic surveys	Group sex, chemsex, and condomless anal sex persisted post-PrEP. Older MSM and those with prior STIs had higher risk.

Table 1 Continued

No	Author	Year	Country	Objective	Conceptual Framework	Sample	Design	Instrument/ Tool	Key Findings
9.	Shrader et al.	2021	Miami	Examine PrEP disclosure effects on condom use among Latino MSM	Social network theory	130	Cross-sectional	Paper-based survey	PrEP disclosure reduced condom use by 58%, but PrEP users had 9.48x higher consistent condom use than non-users.
10.	Ahouada et al.	2020	Benin	Assess PrEP acceptability and risk compensation among MSM	Health belief model	400	Cross-sectional	Community surveys	High PrEP acceptability but concerns about reduced condom use. Education and support needed for effective rollout.
11.	Gravett et al.	2020	Birmingham	Measure STI incidence and sexual behaviors among MSM in PrEP clinics	Clinical epidemiology	139	Cohort	STI testing records	33.1/100PY STI incidence; linked to high PrEP adherence and multiple partners (HR=7.57). Condom non-use prevalent in STI cases.
12.	Montaño et al.	2019	America	Track sexual behavior changes over 12 months of PrEP use	Behavioral adaptation	183	Cohort	Behavioral questionnaire	Condom use declined (peaked at 9 <sup>th</sup> month); partner numbers stable. Increased STI diagnoses due to screening or behavioral shifts.
13.	Torres et al.	2019	Brazil, Mexico, and Peru	Evaluate HIV risk factors and PrEP willingness among Latin American MSM	Socioecological model	19.457	Cross-sectional	Web-based questionnaire	Low condom use and sex with HIV+ partners drove HIV risk. PrEP deemed essential for prevention.
14.	Liu et al.	2024	America	Classify PrEP-eligible MSM by HIV risk profiles	Risk stratification	5877	Cross-sectional	The PrEP electronic questionnaire	Three risk profiles: low (consistent condom use), medium/high (transactional/group sex, STIs). Targeted interventions needed for high-risk MSM.



**Figure 1** PRISMA Flow Diagram

### 3. Results

Following a quality appraisal using the CASP tool, 14 of the 26 screened articles were assessed as high-quality and retained for analysis. The included studies consisted of seven cohort studies, six articles cross-sectional and 1 randomized controlled trial article. The main topics extracted from these articles were PrEP adherence, condom use consistency, and engagement in high-risk sexual behaviors, including unprotected anal sex, group sex, multiple partnerships, and substance use. The findings indicate that while PrEP is highly effective (more than 90%) in preventing HIV transmission, its use may be associated with an increase in risky sexual behaviors. Notably, PrEP users engaged more in unprotected anal intercourse and less frequent condom use compared to non-users, a phenomenon often termed 'condom displacement.' However, the analysis also revealed that a subset of PrEP users continued to use condoms consistently, thereby exhibiting two different forms of protection. These results underscore the complex relationship between PrEP adoption and sexual risk behaviors among MSM. Consequently, they highlight the importance of HIV prevention programs that integrate PrEP with continued messaging on condom use to mitigate the risk of other sexually transmitted infections (STIs) among MSM.

### 4. Discussion

Research on sexual behavior among men who have sex with men (MSM) reveals various patterns that influence the risk of HIV and sexually transmitted infection (STI) transmission. A prominent theme is risk

compensation, often termed 'condom displacement.' For example, MacGregor et al. (2021) found that MSM were more inclined to engage in unprotected anal sex with partners known to be using PrEP. This aligns with findings from Crosby et al. (2020), reported that PrEP users had unprotected anal sex more frequently than non-users.

Lew et al. (2023) identified that activities such as anal and group sex are common among MSM, often with inconsistent condom use. Furthermore, the risk is not uniform across all PrEP users; Yu et al. (2021) found that non-adherent PrEP users were more likely to engage in unprotected anal sex. Reinforcing this complexity, Sagaon-Teyssier et al. (2016) noted a high prevalence of unprotected sexual behavior even when PrEP use was stable.

Dangerfield et al. (2021) noted the intersection of substance use before sex and frequent STI diagnoses among Black MSM, while Van Wees et al. (2024) reported that practices like chemsex and group sex are common among high-risk MSM. Furthermore, Gravett et al. (2020) found that a majority of MSM seeking PrEP clinics report having multiple sexual partners and using condoms inconsistently.

Baltes et al. (2024) observed that inconsistent condom use actually increased following an HIV diagnosis, with a partner's PrEP use being a contributing factor. This aligns with findings from Shrader et al. (2021), who found that individuals' disclosure of their own PrEP status led to decreased condom use. This intention was also documented by Ahouada et al., (2020), whose study reported that most respondents anticipated they would reduce condom use if they believed PrEP to be highly effective. In contrast, Shrader et al. (2021) also noted that cultural factors, such as familism, could positively influence adherence to safer sexual practices.

Montaño et al. (2019) found that that PrEP can specifically influence condom use, even when other behaviors like partner numbers and types of sexual activity remain unchanged. This issue of low condom use is a significant factor driving high HIV infection risk in certain populations, as observed among MSM in Latin America by Torres et al. (2019). Furthermore, Liu et al. (2024) identified three patterns of sexual behavior among the MSM: low, moderate and high risk, with the high-risk group exhibiting more risky sexual practices.

These trajectories highlight the complexity of MSM sexual behaviour, underscoring the need for a comprehensive HIV prevention strategy. To be effective, interventions must incorporate all levels (social, cultural, behavioural) of intermediary variables with education surrounding safer sex practices as well as PrEP uptake to prevent HIV/STI transmission.

## 5. Conclusion

This systematic review fulfilled its aim by comprehensively investigating sexual risk behaviors among MSM utilizing PrEP. The analysis confirmed that key factors include PrEP adherence, condom use consistency, and engagement in high-risk activities (e.g., unprotected anal intercourse, group sex, numerous partners, and substance use). The findings indicate that while PrEP is highly effective in reducing HIV transmission risk, its use is often correlated with increased riskier behaviours. This includes reduced condom frequency ("condom displacement") and greater participation in high-risk encounters. Nevertheless, the review also identified a certain of MSM who practice combination protection (using both PrEP and condoms), underscoring the diversity in behavioral responses to PrEP.

Furthermore, these findings underline the significant influence of social and cultural factors on sexual behavior. For example, disclosure of PrEP status can reduce the impact of condom use, while concepts like familism and aspects of sexual identity can shape adherence to safer sex practices. Despite PrEP's proven efficacy, persistent challenges remain, including low condom use, a high incidence of STIs, and behavioral changes following an HIV diagnosis. Therefore, a comprehensive and holistic prevention strategy is imperative by considering social, cultural, and behavioral contexts. Effective interventions must integrate education on proper PrEP use with promotion of safer sex practices, routine STI screening, and robust psychosocial support to mitigate HIV and STI transmission risk among MSM.

## References

- Ahouada, C., Diabaté, S., Mondor, M., Hessou, S., Guédou, F. A., Béhanzin, L., Batona, G., Gning, N. N., Zannou, D. M., & Alary, M. (2020). Acceptability of pre-exposure prophylaxis for HIV prevention: facilitators, barriers and impact on sexual risk behaviors among men who have sex with men in Benin. *BMC Public Health*, 20(1), 1267. <https://doi.org/10.1186/s12889-020-09363-4>
- Baltes, V., de Boissieu, P., Champenois, K., Luan, L., Seng, R., Essat, A., Novelli, S., Spire, B., Molina, J., Goujard, C., & Meyer, L. (2024). Sexual behaviour and STIs among MSM living with HIV in the PrEP



- era: the French ANRS PRIMO cohort study. *Journal of the International AIDS Society*, 27(3). <https://doi.org/10.1002/jia2.26226>
- Bazzi, A. R., Yotebieng, K., Otticha, S., Rota, G., Agot, K., Ohaga, S., & Syvertsen, J. L. (2019). PrEP and the syndemic of substance use, violence, and HIV among female and male sex workers: a qualitative study in Kisumu, Kenya. *Journal of the International AIDS Society*, 22(4). <https://doi.org/10.1002/jia2.25266>
- Brydon, C. (2016). PrEP should be a key component of a comprehensive HIV prevention package fully funded on the NHS. *Clinical Pharmacist*, 8(12). <https://doi.org/10.1211/CP.2016.20201939>
- Butts, S., Young, B., Blackmon, J., & Doblecki-Lewis, S. (2023). Addressing disparities in pre-exposure prophylaxis (prep) access: implementing a community-centered mobile prep program in south florida. *BMC Health Services Research*, 23(1). <https://doi.org/10.1186/s12913-023-10277-1>
- Cimen, C., Emecen, A. N., & Barber, T. J. (2020). Attitude of infectious diseases physicians in Turkey about HIV pre-exposure prophylaxis: results of an online survey. *International Journal of STD and AIDS*, 31(7), 665 – 670. <https://doi.org/10.1177/0956462420921080>
- Crosby, R. A., Kipke, M. D., & Kubicek, K. (2020). Use of pre-exposure prophylaxis increases the odds of condomless anal sex among young men who have sex with men (MSM) of colour. *Sexual Health*, 17(1), 100. <https://doi.org/10.1071/SH19065>
- Dangerfield, D. T., Kuo, I., Magnus, M., Beauchamp, G., Fields, S. D., Nelson, L., Shoptaw, S., Wilton, L., & Wheeler, D. P. (2021). Sexual Risk Profiles Among Black Sexual Minority Men: Implications for Targeted PrEP Messaging. *Archives of Sexual Behavior*, 50(7), 2947–2954. <https://doi.org/10.1007/s10508-021-02066-w>
- Di Ciaccio, M., Sagaon-Teyssier, L., Mimi, M., Suzan-Monti, M., Protiere, C., Castro, D. R., Meyer, L., Tremblay, C., Chidiac, C., Capitant, C., Préau, M., Molina, J.-M., & Spire, B. (2020). What are the situational and behavioral factors associated with condomless anal sex without pre-exposure prophylaxis in MSM? *AIDS*, 34(9), 1367–1375. <https://doi.org/10.1097/QAD.0000000000002542>
- Fonner, V., Dalglisch, S., Kennedy, C., Baggaley, R., O'Reilly, K., Koechlin, F., & Grant, R. (2016). Effectiveness and safety of oral hiv preexposure prophylaxis for all populations. *Aids*, 30(12), 1973–1983. <https://doi.org/10.1097/qad.0000000000001145>
- Grant, R., Anderson, P., McMahan, V., Liu, A., Amico, K., Mehrotra, M., & Glidden, D. (2014). Uptake of pre-exposure prophylaxis, sexual practices, and hiv incidence in men and transgender women who have sex with men: a cohort study. *The Lancet Infectious Diseases*, 14(9), 820–829. [https://doi.org/10.1016/s1473-3099\(14\)70847-3](https://doi.org/10.1016/s1473-3099(14)70847-3)
- Gravett, R. M., Westfall, A. O., Overton, E. T., Kudroff, K., Muzny, C. A., & Eaton, E. F. (2020). Sexually transmitted infections and sexual behaviors of men who have sex with men in an American Deep South PrEP clinic. *International Journal of STD & AIDS*, 31(2), 127–135. <https://doi.org/10.1177/0956462419886228>
- Guyonvarch, O., Vaillant, L., Hanslik, T., Blanchon, T., Rouveix, E., & Supervie, V. (2021). HIV prevention with PrEP: Challenges and prospects; [Prévenir le VIH par la PrEP: enjeux et perspectives]. *Revue de Medecine Interne*, 42(4), 275 – 280. <https://doi.org/10.1016/j.revmed.2020.10.005>
- Herder, T., Agardh, A., Björkman, P., & Månsson, F. (2020). Interest in Taking HIV Pre-exposure Prophylaxis Is Associated with Behavioral Risk Indicators and Self-Perceived HIV Risk Among Men Who Have Sex with Men Attending HIV Testing Venues in Sweden. *Archives of Sexual Behavior*, 49(6), 2165–2177. <https://doi.org/10.1007/s10508-020-01740-9>
- Huang, X., Hou, J., Song, A., Liu, X., Yang, X., Xu, J., & Wu, H. (2018). Efficacy and safety of oral tdf-based pre-exposure prophylaxis for men who have sex with men: a systematic review and meta-analysis. *Frontiers in Pharmacology*, 9. <https://doi.org/10.3389/fphar.2018.00799>
- Jenness, S., Weiss, K., Goodreau, S., Gift, T., Chesson, H., Hoover, K., & Rosenberg, E. (2017). Incidence of gonorrhea and chlamydia following human immunodeficiency virus preexposure prophylaxis among men who have sex with men: a modeling study. *Clinical Infectious Diseases*, 65(5), 712–718. <https://doi.org/10.1093/cid/cix439>
- Joint United Nations Programme on HIV/AIDS (UNAIDS). (2024). Fact sheet 2024 - Latest global and regional HIV statistics on the status of the AIDS epidemic. <https://www.unaids.org/en>
- Lai, J., Pan, P., Yu-lun, L., Ye, L., Xie, L., Xie, Y., & Jiang, J. (2020). A survey on hiv/aids-related knowledge, attitudes, risk behaviors, and characteristics of men who have sex with men among university students

- in guangxi, china. *Biomed Research International*, 2020, 7857231. <https://doi.org/10.1155/2020/7857231>
- Lew, C., Fairley, C. K., Tran, J., Phillips, T. R., Maddaford, K., Chen, M. Y., Bradshaw, C. S., & Chow, E. P. F. (2023). High-Risk Sexual Activities and Condom Use Patterns During Group Sex Among Men Who Have Sex With Men in Melbourne, Australia. *JAIDS Journal of Acquired Immune Deficiency Syndromes*, 93(5), 356–363. <https://doi.org/10.1097/QAI.0000000000003211>
- Liao, J., Chen, S., Liu, Y., & Guo, C. (2024). The Effects of Family and School Interpersonal Relationships on Depression in Chinese Elementary School Children: The Mediating Role of Academic Stress and the Moderating Role of Self-Esteem. *Children*, 11(3), 327. <https://doi.org/10.3390/children11030327>
- Liu, Y., Liu, X., Wei, S., Cheng, Z., Xian, Y., Zhao, Y., Ma, J., Chen, J., Chen, Z., Yang, J., Liu, F., Yu, M., Cui, Z., & Li, C. (2024). Identifying patterns of sexual behaviors and PrEP uptake characteristics among MSM who were eligible for PrEP: A national cross-section study. *Journal of Virus Eradication*, 10(2), 100382. <https://doi.org/https://doi.org/10.1016/j.jve.2024.100382>
- MacFadden, D., Tan, D., & Mishra, S. (2016). Optimizing hiv pre-exposure prophylaxis implementation among men who have sex with men in a large urban centre: a dynamic modelling study. *Journal of the International Aids Society*, 19(1). <https://doi.org/10.7448/ias.19.1.20791>
- MacGregor, L., Speare, N., Nicholls, J., Harryman, L., Horwood, J., Kesten, J. M., Lorenc, A., Horner, P., Edelman, N. L., Muir, P., North, P., Gompels, M., & Turner, K. M. E. (2021). Evidence of changing sexual behaviours and clinical attendance patterns, alongside increasing diagnoses of STIs in MSM and TPMSM. *Sexually Transmitted Infections*, 97(7), 507–513. <https://doi.org/10.1136/sextrans-2020-054588>
- Mansergh, G., Sullivan, P. S., Kota, K. K., & Daskalakis, D. (2023). Pre-exposure prophylaxis in the era of emerging methods for men who have sex with men in the USA: the HIV Prevention Cycle of Care model. *The Lancet HIV*, 10(2), e134–e142. [https://doi.org/10.1016/S2352-3018\(22\)00309-5](https://doi.org/10.1016/S2352-3018(22)00309-5)
- Montaño, M. A., Dombrowski, J. C., Dasgupta, S., Golden, M. R., Duerr, A., Manhart, L. E., Barbee, L. A., & Khosropour, C. M. (2019). Changes in Sexual Behavior and STI Diagnoses Among MSM Initiating PrEP in a Clinic Setting. *AIDS and Behavior*, 23(2), 548–555. <https://doi.org/10.1007/s10461-018-2252-9>
- Ng, Y. C., & Mayeux, J. J. (2021). Initiating pre-exposure prophylaxis: What primary care providers should know. *Nurse Practitioner*, 46(8), 17 – 22. <https://doi.org/10.1097/01.NPR.0000757076.21006.50>
- O'Halloran, C., Owen, G., Croxford, S., Sims, L., Gill, O., Nutland, W., & Delpech, V. (2019). Current experiences of accessing and using hiv pre-exposure prophylaxis (prep) in the united kingdom: a cross-sectional online survey, may to july 2019. *Eurosurveillance*, 24(48). <https://doi.org/10.2807/1560-7917.es.2019.24.48.1900693>
- Oldenburg, C., Le, B., Huyen, H., Thien, D., Quan, N., Biello, K., & Colby, D. (2016). Antiretroviral pre-exposure prophylaxis preferences among men who have sex with men in vietnam: results from a nationwide cross-sectional survey. *Sexual Health*, 13(5), 465. <https://doi.org/10.1071/sh15144>
- Onwubiko, U. N., Murray, S. M., Rao, A., Chamberlain, A. T., Sanchez, T. H., Benkeser, D., Holland, D. P., Jenness, S. M., & Baral, S. D. (2024). Individual & joint associations of sexual stigma and mental distress with PrEP uptake, adherence and persistence among US gay and bisexual men. *Social Science and Medicine*, 363(June), 117493. <https://doi.org/10.1016/j.socscimed.2024.117493>
- Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., ... Moher, D. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ*, n71. <https://doi.org/10.1136/bmj.n71>
- Peng, L., Cao, W., Gu, J., Hao, C., Li, J., Wei, D., & Li, J. (2019). Willingness to use and adhere to hiv pre-exposure prophylaxis (prep) among men who have sex with men (msm) in china. *International Journal of Environmental Research and Public Health*, 16(14), 2620. <https://doi.org/10.3390/ijerph16142620>
- Sagaon-Teyssier, L., Suzan-Monti, M., Demoulin, B., Capitain, C., Lorente, N., Préau, M., Mora, M., Rojas Castro, D., Chidiac, C., Chas, J., Meyer, L., Molina, J.-M., Spire, B., & for the ANRS IPERGAY Study Group. (2016). Uptake of PrEP and condom and sexual risk behavior among MSM during the ANRS IPERGAY trial. *AIDS Care*, 28(sup1), 48–55. <https://doi.org/10.1080/09540121.2016.1146653>
- Shrader, C.-H., Arroyo-Flores, J., Skvoretz, J., Fallon, S., Gonzalez, V., Safren, S., Algarin, A., Johnson, A., Doblecki-Lewis, S., & Kanamori, M. (2021). PrEP Use and PrEP Use Disclosure are Associated with

- Condom Use During Sex: A Multilevel Analysis of Latino MSM Egocentric Sexual Networks. *AIDS and Behavior*, 25(5), 1636–1645. <https://doi.org/10.1007/s10461-020-03080-0>
- Sun, Z., Gu, Q., Dai, Y., Zou, H., Agins, B., Chen, Q., & Jiang, H. (2022). Increasing awareness of hiv pre-exposure prophylaxis (prep) and willingness to use hiv prep among men who have sex with men: a systematic review and meta-analysis of global data. *Journal of the International Aids Society*, 25(3). <https://doi.org/10.1002/jia2.25883>
- Torres, T., Boni, R., Vasconcellos, M., Luz, P., Hoagland, B., Moreira, R., & Grinsztejn, B. (2018). Awareness of prevention strategies and willingness to use preexposure prophylaxis in brazilian men who have sex with men using apps for sexual encounters: online cross-sectional study. *Jmir Public Health and Surveillance*, 4(1), e11. <https://doi.org/10.2196/publichealth.8997>
- Torres, T. S., Konda, K. A., Vega-Ramirez, E. H., Elorreaga, O. A., Diaz-Sosa, D., Hoagland, B., Diaz, S., Pimenta, C., Benedetti, M., Lopez-Gatell, H., Robles-Garcia, R., Grinsztejn, B., Caceres, C., & Veloso, V. G. (2019). Factors Associated With Willingness to Use Pre-Exposure Prophylaxis in Brazil, Mexico, and Peru: Web-Based Survey Among Men Who Have Sex With Men. *JMIR Public Health and Surveillance*, 5(2). <https://doi.org/https://doi.org/10.2196/13771>
- Toumasis, P., Psychogiou, M., & Vrioni, G. (2020). PrEP (Pre-Exposure Prophylaxis) as an innovative HIV prevention strategy. *Acta Microbiologica Hellenica*, 65(3), 151 – 159. <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85128730153&partnerID=40&md5=e2c14131fa731e095ec7583ec42c03fd>
- Underhill, K., Morrow, K., Collieran, C., Calabrese, S., Operario, D., Salovey, P., & Mayer, K. (2015). Explaining the efficacy of pre-exposure prophylaxis (prep) for hiv prevention: a qualitative study of message framing and messaging preferences among us men who have sex with men. *Aids and Behavior*, 20(7), 1514–1526. <https://doi.org/10.1007/s10461-015-1088-9>
- van Wees, D., Coyer, L., van den Elshout, M., de Coul, E. O., & van Aar, F. (2024). The Best Predictor of Future Behavior May Be the Past: Exploring Behavior Change in Men Who Have Sex with Men Using Pre-exposure Prophylaxis in the Netherlands. *Archives of Sexual Behavior*, 53(7), 2777–2793. <https://doi.org/10.1007/s10508-024-02863-z>
- Wang, L., Hong, C., Chen, L., John, S. A., Simoni, J. M., Wong, F. Y., Velloza, J., & Holloway, I. W. (2024). Engagement Along the PrEP Care Continuum Among Men Who Have Sex with Men in China: A Systematic Review and Meta-analysis. *AIDS and Behavior*, 3270–3282. <https://doi.org/10.1007/s10461-024-04420-0>
- Yu, Y.-F., Wu, H.-J., Ku, S. W.-W., Huang, P.-H., Li, C.-W., Huang, P., & Strong, C. (2021). Condomless Anal Sex Associated With Heterogeneous Profiles Of HIV Pre-Exposure Prophylaxis Use and Sexual Activities Among Men Who Have Sex With Men: A Latent Class Analysis Using Sex Diary Data on a Mobile App. *Journal of Medical Internet Research*, 23(12), e33877. <https://doi.org/10.2196/33877>