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Review Article

Vaccination coverage among individuals receiving HIV pre-exposure prophylaxis (PrEP): A systematic review and meta-analysis

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ABSTRACT

Objective: This study aimed to assess vaccination coverage among individuals receiving HIV pre-exposure prophylaxis (PrEP).

Methods: A systematic review and meta-analysis were conducted following PRISMA guidelines. PubMed, Scopus, and Web of Science were searched from January 2011 to March 2026. Studies assessing vaccination coverage among individuals receiving PrEP within routine care were included. Random-effects meta-analyses were performed for each vaccine, and subgroup analyses were conducted when adequate data were available.

Results: Twenty-four studies including 13,087 individuals were analysed. Vaccination coverage was highest for HBV (73.00%, 95% CI [59.00, 88.00]), followed by Monkeypox (61.00%, 95% CI [40.00, 83.00]) and HAV (59.00%, 95% CI [48.00, 71.00]), and lowest for HPV (43.00%, 95% CI [34.00, 52.00]). Evidence on other vaccines was limited. High heterogeneity was observed across studies, and vaccination status was frequently self-reported (63.00%). No consistent geographical pattern emerged.

Conclusions: Vaccination coverage among individuals receiving PrEP remains relatively low across most key vaccines, highlighting missed opportunities for prevention. Strengthening the integration of vaccination within PrEP care pathways and enhancing proactive provider engagement are key priorities. Future efforts should focus on high-quality primary studies, standardized methodologies, evaluation of targeted interventions, and economic evidence to better inform policy decisions.

1. Introduction

HIV pre-exposure prophylaxis (PrEP) represents a cornerstone of biomedical HIV prevention. Since the iPrEx trial demonstrated that daily oral tenofovir disoproxil fumarate/emtricitabine reduces the risk of HIV acquisition by more than 90.00% among men who have sex with men (MSM) with high adherence (Grant et al., 2010), PrEP has been progressively implemented worldwide and incorporated into major prevention guidelines (Gandhi et al., 2025; Ambrosioni et al., 2026).

At the same time, PrEP does not protect against most other infections that continue to affect populations commonly represented in PrEP programmes. In many high-income settings, PrEP users are predominantly MSM and other individuals with ongoing sexual exposure (Huang et al., 2025), who remain at risk for vaccine-preventable infections, particularly Human Papillomavirus (HPV), Hepatitis A Virus (HAV), Hepatitis B Virus (HBV), and, more recently, Monkeypox (Mpox) (Terrault et al., 2018; Ndumbi et al., 2018; Thornhill et al., 2022; Wei et al., 2021).

These infections carry a substantial epidemiological burden among MSM. HPV infection is highly prevalent, with anal infection rates estimated at up to 50.00–70.00% (Chin-Hong et al., 2004),and is associated with an increased risk of high-grade intraepithelial lesions (Wei et al.,

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2021), anal cancer, and other HPV-related malignancies. MSM also have a higher prevalence of oral HPV infection and an increased risk of HPV-related oropharyngeal cancer compared with heterosexual men, while HPV is implicated in penile cancer, although MSM-specific data remain limited (King et al., 2016). HAV outbreaks have repeatedly involved MSM sexual networks in Europe and other high-income settings, including a large multi-country outbreak reported between 2016 and 2018 with over 4000 cases across European Union/European Economic Area (EU/EEA) countries, predominantly affecting MSM (approximately 84.00%) and largely driven by transmission among unvaccinated individuals (up to 92.00%), highlighting persistent gaps in vaccination coverage and prevention strategies (Ndumbi et al., 2018). HBV also represents a significant burden among MSM, with higher prevalence and incidence than in the general population, largely driven by sexual transmission. Despite vaccine availability, coverage remains suboptimal, with around half of MSM vaccinated, leaving a substantial proportion susceptible to infection (Esber et al., 2023; Brandl et al., 2024). More recently, the 2022 global Mpox outbreak disproportionately affected MSM, accounting for over 95.00% of reported cases and driven by transmission within interconnected sexual networks, further underscoring the vulnerability of this population to emerging infectious threats (Thornhill et al., 2022).

PrEP services provide an opportunity to integrate systematic assessment of vaccination status and vaccine delivery into routine clinical care. Baseline visits and periodic follow-up enable identification of susceptible individuals and implementation of indicated vaccination strategies (Ambrosioni et al., 2026). However, the extent to which this potential is realized in routine practice may vary, reflecting differences in healthcare organization, delivery models, and the integration of preventive services within PrEP programmes.

International and national guidelines provide specific vaccination recommendations for individuals at increased risk of infection, including MSM, with variations across national contexts and healthcare systems. In the USA, the Centers for Disease Control and Prevention (CDC) recommend vaccination against HAV, HBV and Mpox in individuals at increased risk, including MSM, while HPV vaccination is routinely recommended up to age 26 years and thereafter based on shared clinical decision-making; meningococcal vaccines (MenACWY and MenB) are recommended in MSM, particularly in the context of outbreaks (CDC, 2025). In the UK, the British Association for Sexual Health and HIV and the British HIV Association (BASHH/BHIVA) guidelines (British HIV Association, 2025) integrate vaccination assessment into PrEP care and recommend HAV, HBV, HPV and Mpox vaccination. Since August 2025, the vaccine 4CMenB (Bexsero) has also been offered to MSM at higher risk of gonorrhoea (UK Health Security Agency, 2025), based on observational evidence suggesting moderate cross-protection (Georgiadis et al., 2025). However, more recent randomized evidence from the GoGoVax trial has not confirmed this effect, and its role remains uncertain (The Lancet Infectious Diseases, 2026).

Similarly, France, Spain and Italy adopt risk-based vaccination frameworks that include recommendations for MSM, although implementation pathways and healthcare organization differ across settings (Ministère de la Santé, des Familles, de l'Autonomie et des Personnes handicapées, n.d.; Ministero della Salute, 2023; Ministerio de Sanidad, 2026).

Overall, the available evidence indicates that PrEP programmes constitute a favourable setting for the implementation of vaccination strategies, including the judicious use of co-administration, with broadly consistent recommendations across countries, albeit with context-specific national adaptations. Despite this rationale, a clear and comprehensive overview of vaccination coverage among individuals receiving PrEP is still lacking. This systematic review and meta-analysis provides an assessment of vaccination coverage among PrEP users, offering a quantitative synthesis of vaccination coverage across vaccines evaluated in the literature on this population.

2. Methods

A systematic search of the literature was conducted in the electronic databases PubMed, Scopus, and Web of Science from January 2011 (after the first landmark trial on PrEP efficacy) until March 2026. The review question was formulated using the Population–Intervention–Comparator–Outcome (PICO) framework. Because the objective of the review was to estimate vaccination coverage among individuals receiving PrEP, no comparator group was required. The guiding question of this systematic review was: "What are the vaccination coverage rates among individuals receiving PrEP?" The PICO domains were defined as follows: (P) individuals receiving PrEP, (I) vaccination against vaccine-preventable infections, (C) not applicable, (O) vaccination coverage.

To ensure the systematic review quality, the Preferred Reporting Items for Systematic Reviews, and Meta-Analyses (PRISMA) check-list and flow-diagram was used (Page et al., 2021).

The search string was constructed by combining keywords related to PrEP, vaccination, and vaccination coverage, including terms such as PrEP, pre-exposure prophylaxis, vaccination, immunization, coverage, adherence, compliance, and completion, together with their synonyms. These terms were combined using the Boolean operators AND and OR. The complete search strategy is provided in the Supplementary file. The reference lists of the retrieved articles were also screened to identify additional relevant studies.

Two investigators (D.P. and S·Cr) independently screened the titles and abstracts of all retrieved records to identify potentially relevant publications. The inclusion criteria were: articles published in English that quantitatively assessed vaccination coverage among individuals receiving PrEP. Studies were included only if vaccination coverage was evaluated within routine PrEP care pathways, defined as the care that the target population would normally receive in clinical practice, where vaccinations may be recommended or offered during standard PrEP visits, including routine counselling, but without the implementation of specific interventions or targeted strategies aimed at increasing vaccination coverage beyond usual clinical practice, thus ensuring the inclusion of studies reporting vaccination coverage as a point-in-time measure within routine care settings. Articles not meeting these inclusion criteria were excluded.

The evaluation of the eligibility criteria was performed independently by the two authors (D.P. and S.Cr), and in case of divergence, a third researcher (A.L.) was consulted.

The protocol of this systematic review has been registered in the International Prospective Register of Systematic Reviews (PROSPERO - CRD420261326203).

2.1. Quality assessment

The methodological quality of the included studies was separately assessed by two investigators (D.P. and S·Cr) using the National Institutes of Health (NIH) quality assessment tools (NIH. National Institutes of Health (NIH) quality assessment tools [Internet]. [cited, 2026), selecting the instrument most appropriate for the study design. In case of disagreement, discrepancies were resolved through discussion until consensus was reached within the research team. These tools evaluate several methodological domains, including study population, exposure and outcome assessment, and control of potential confounders. For each item, reviewers assigned one of the following judgments: "yes", "no", or "cannot determine/not reported/not applicable". Items rated as "no" or "cannot determine/not reported/not applicable" were considered indicative of a potential risk of bias. If the 'yes' answers were $\geq$ 75.00% of the total, an article was considered of 'good' quality; if they were $<$ 75.00% but $\geq$50.00%, an article was scored as 'fair'; if they were $<$ 50.00%, the article was scored as 'poor' (Damiani et al., 2021).

2.2. Data extraction and data analysis

Two reviewers (D.P. and S·Cr) independently extracted data using a standardized data collection form. The following information was recorded: bibliographic details, country of study, study design, sample size, participants' age, method used to ascertain vaccination status (e.g., self-reported or documented in medical or vaccination records), type of vaccine, coverage definition (defined as receipt of at least one dose – ≥1 dose - or completion of the recommended vaccination series), and vaccination coverage (%).

Separate meta-analyses were conducted for each vaccine evaluated in the included studies among MSM on PrEP. Each meta-analysis included only studies focusing on a specific vaccine and was repeated including only studies with high and fair quality scores. Subgroup analyses were performed based on variables selected a priori according to their potential influence on vaccination uptake and their role as common sources of heterogeneity. In particular, age was included as a key determinant of vaccination coverage, reflecting differences in eligibility and healthcare engagement (De Araújo et al., 2024). The distinction between self-reported data and medical records was considered to account for potential reporting and misclassification bias (Irving et al., 2009). Geographic area (continent) was included as a proxy for differences in healthcare systems, vaccination policies, and access to preventive services (Behavioural and Social Drivers of Vaccination: Tools and Practical Guidance for Achieving High Uptake, 2022). Finally, study quality was examined to assess the robustness of the findings, in line with methodological recommendations for systematic reviews and meta-analyses (Higgins et al., 2019) and with with previous meta-analyses assessing vaccination coverage in high-risk populations (Bianchi et al., 2021). Subgroup analyses were restricted to situations with an adequate number of studies per subgroup (>3) to ensure statistical reliability. Proportions were logit-transformed to stabilize variances and pooled using DerSimonian–Laird random-effects models. The pooled estimates were then back-transformed to the original proportion scale. The pooled prevalence and relative 95% Wald confidence interval were plotted and a forest plot was described. The I^2 statistic was calculated as a measure of the proportion of the overall variation attributable to between-study heterogeneity rather than to chance; the between-study heterogeneity of the different groups was also evaluated. For the heterogeneity determination, a p-value<0.05 was considered

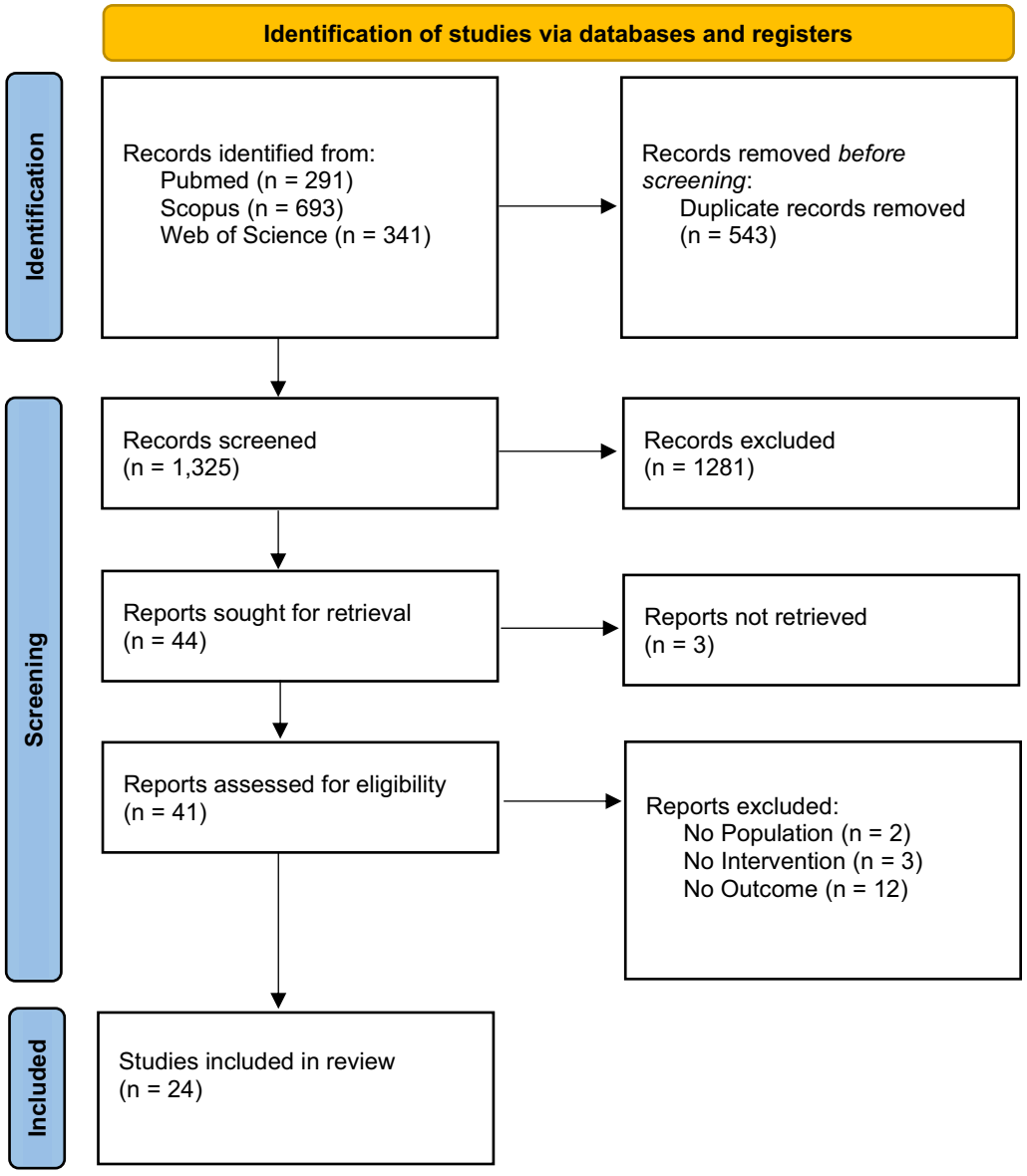


Fig. 1. PRISMA flow diagram of the review process to identify respectively the HPV, Monkeypox, HBV and HAV vaccination coverages among individuals receiving PrEP within routine care from from January 2011 to March 2026.

statistically significant. The statistical analyses were performed using STATA 19 software.

3. Results

The literature search identified 1325 records. After removal of duplicates, titles and abstracts were screened by the research team to assess their potential relevance. Overall, 41 articles were considered potentially eligible and their full texts were independently evaluated by two reviewers. Following full-text assessment, 17 studies were excluded because they did not meet the predefined inclusion criteria. The remaining 24 studies were included in the systematic review and subsequently considered for the meta-analysis (Fig. 1).

The included studies were published between 2018 and 2026 and were conducted predominantly in high-income countries across the Americas ($n = 12$), followed by Europe ($n = 6$), and Asia and Oceania ($n = 3$ each).Across the 24 included studies, 13,087 individuals receiving PrEP were represented, with study sample sizes ranging from 16 to 2668 participants. Among the included studies, fourteen had a cross-sectional design, while nine were cohort studies. The vaccines most frequently evaluated were HPV, followed by Mpox, HAV, and HBV, whereas influenza and meningococcal serogroup B (MenB) were each investigated in only one study. Vaccination coverage was generally defined as receipt of at least one vaccine dose (75.00%), with vaccination status primarily self-reported (63.00%), while a smaller number of studies assessed completion of the recommended vaccination schedule and/or verified vaccination through medical or vaccination records. A summary of the characteristics of each study is reported in Supplementary file Table S1.

3.1. Quality assessment

Given the nature of the included studies, methodological quality was assessed using the NIH Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies. The tool includes 14 items; however, three items were excluded from the assessment because they were not applicable to the design and objectives of the included studies. Specifically, the items addressing different levels of exposure, repeated exposure assessment, and blinding of outcome assessors were not considered relevant, as vaccination status was typically treated as a dichotomous variable and the included studies primarily evaluated vaccination coverage rather than exposure–outcome relationships. A score of nine or greater was considered indicative of good methodological quality, scores of six to eight were classified as fair, and studies scoring five or fewer were considered to be of poor quality. Overall methodological quality of all included studies ($n = 24$) is summarized in Supplementary file Table S2. Five studies were classified as good quality, ten as fair quality, and nine as poor quality, indicating a considerable

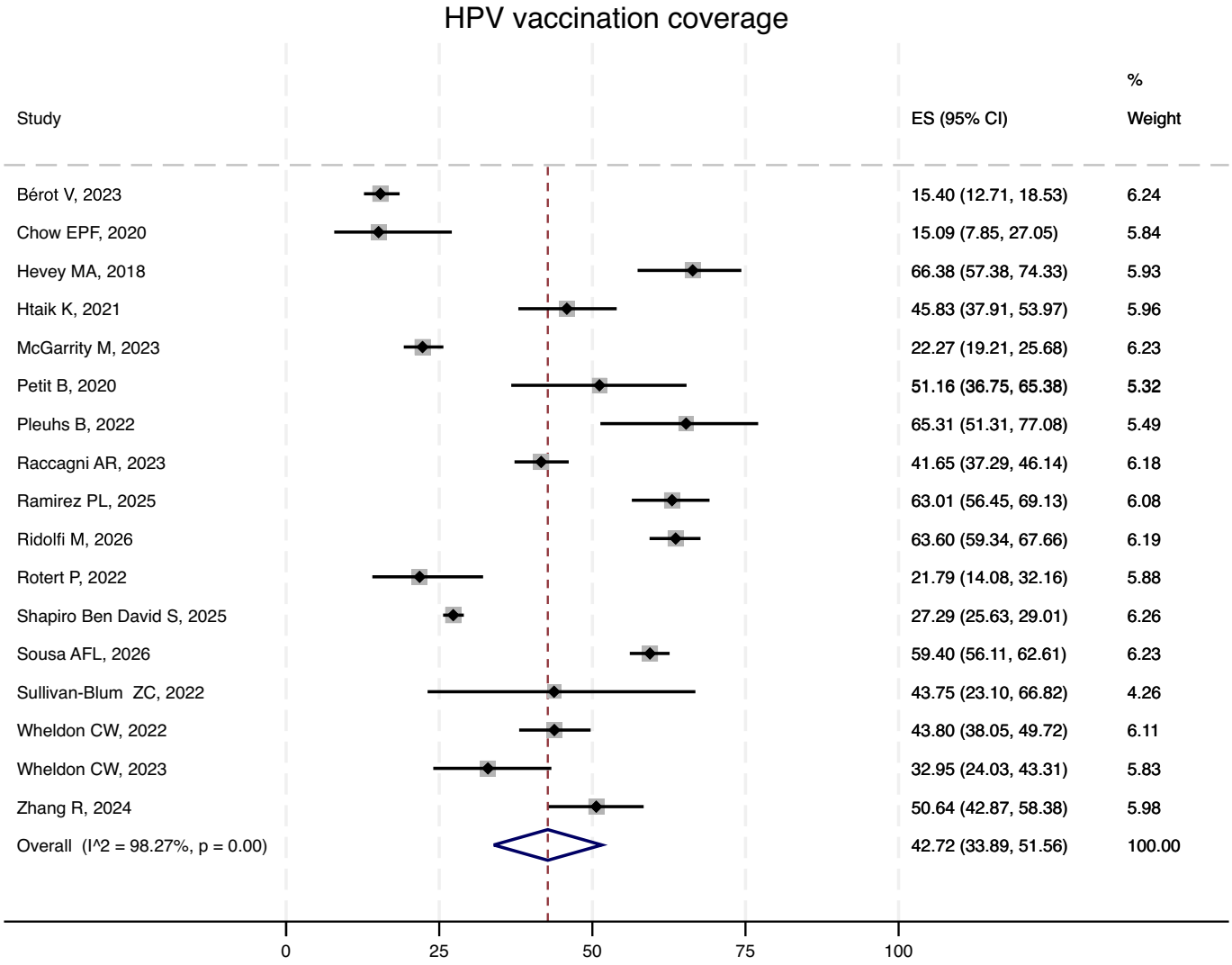


Fig. 2. Forest plot presenting the pooled percentage prevalence of HPV vaccination coverage among individuals receiving PrEP within routine care from from January 2011 to March 2026.

risk of bias across several of the included studies. The most frequently met quality criteria regarded research question/objective, study population and outcome measures. A number of items were rarely reported, including those relating to sample size justification.

3.2. Pooled analysis

3.2.1. HPV vaccination

Seventeen studies were included in the meta-analysis; the HPV vaccination coverage was 42.70% (95% CI [33.90, 51.60]) with an I^2 of 98.30% and a *p*-value for the heterogeneity test <0.05 (Fig. 2). When including only good and fair quality articles, the pooled estimate was 40.20% (95% CI [29.10, 51.30]) with an I^2 of 98.80% and a p-value for the heterogeneity test <0.05 (Supplementary file Fig. S1).

At the sub-group analyses, when stratifying by the study design, cross-sectional studies showed the highest coverage (46.80%, 95% CI [38.10, 55.40]), followed by retrospective studies (39.90%, 95% CI [24.60, 55.30]) and by prospective studies, however only one study for the latter category was included in the meta-analysis (Supplementary file Fig. S2).

When stratifying by age of participants, the sub-group equal to or older than 33 years of age showed similar coverage (43.80%, 95% CI [29.80, 57.90]) than the sub-group younger than 33 years of age (43.50%, 95% CI [26.00, 60.90]) (Supplementary file Fig. S3).

Moreover, vaccination coverage self-reported by patients was higher (50.60%, 95% CI [42.90, 58.40]) than the one derived from medical records (36.00%, 95% CI [25.30, 46.70]) (Supplementary file Fig. S4).

The higher vaccination coverage was observed in America (46.50%, 95% CI [32.70, 60.30]), followed by Europe (42.80%, 95% CI [17.40, 68.20]), Oceania and Asia, although both geographic areas were represented in only two studies (Supplementary file Fig. S5).

3.2.2. Mpox vaccination

Seven studies were included in the meta-analysis; the Mpox vaccination coverage was 61.40% (95% CI [39.50, 83.20]) with an I^2 of 99.80% and a *p*-value for the heterogeneity test <0.05 (Fig. 3).

When including only good and fair quality articles, the pooled estimate was 44.80% (95% CI [13.90, 75.80]) with an I^2 of 99.80% and a *p*-value for the heterogeneity test <0.05 (Supplementary file Fig. S6).

3.2.3. HAV vaccination

Six studies were included in the meta-analysis; the HAV vaccination coverage was 59.40% (95% CI [48.10, 70.70]) with an I^2 of 98.00% and a *p*-value for the heterogeneity test <0.05 (Fig. 4). All the studies included in this meta-analysis were all of good or fair quality.

3.2.4. HBV vaccination

Four studies were included in the meta-analysis; the HBV vaccination coverage was 73.40% (95% CI [58.50, 88.30]) with an I^2 of 97.70% and a p-value for the heterogeneity test <0.05 (Fig. 4). All the studies included in this meta-analysis were all of good or fair quality.

4. Discussion

This systematic review and meta-analysis provides an assessment of vaccination patterns among individuals receiving PrEP, together with a quantitative synthesis of the available evidence across vaccines evaluated in the literature on PrEP users. Overall, vaccination coverage across

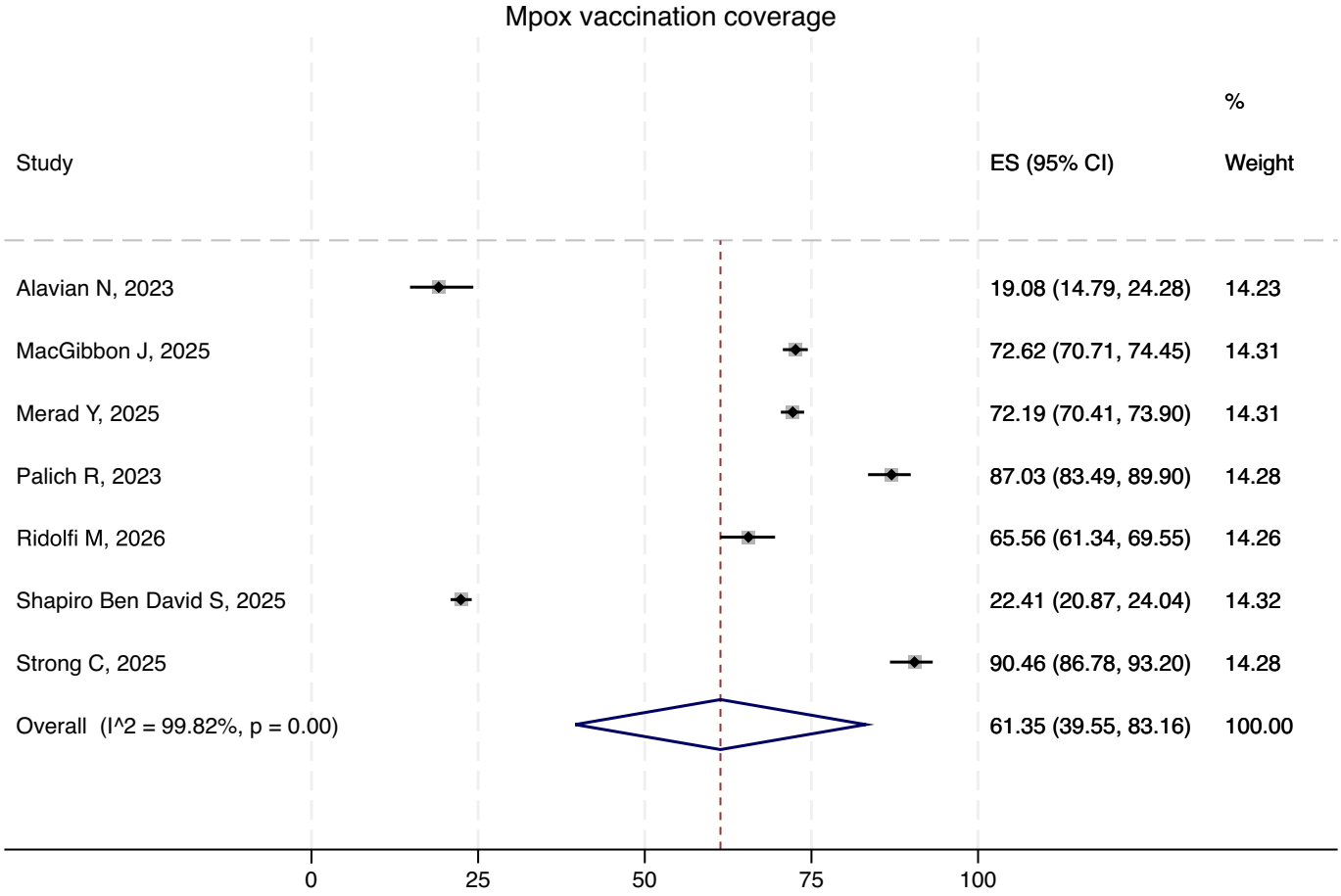
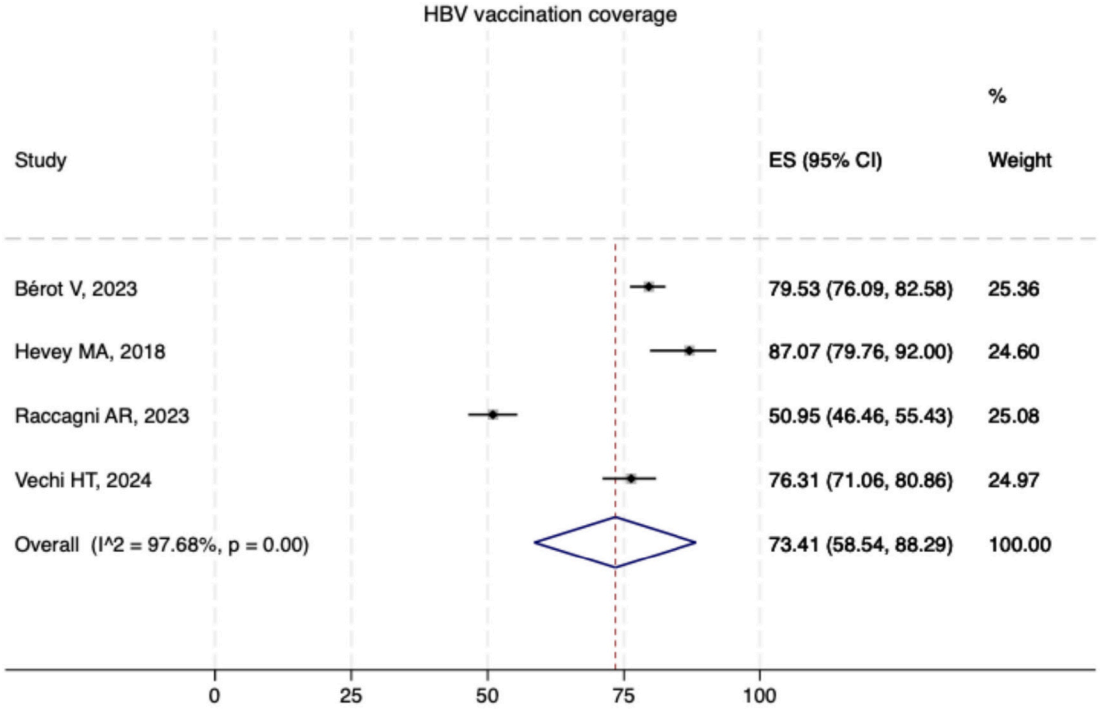


Fig. 3. Forest plot presenting the pooled percentage prevalence of Monkeypox vaccination coverage among individuals receiving PrEP within routine care from from January 2011 to March 2026.



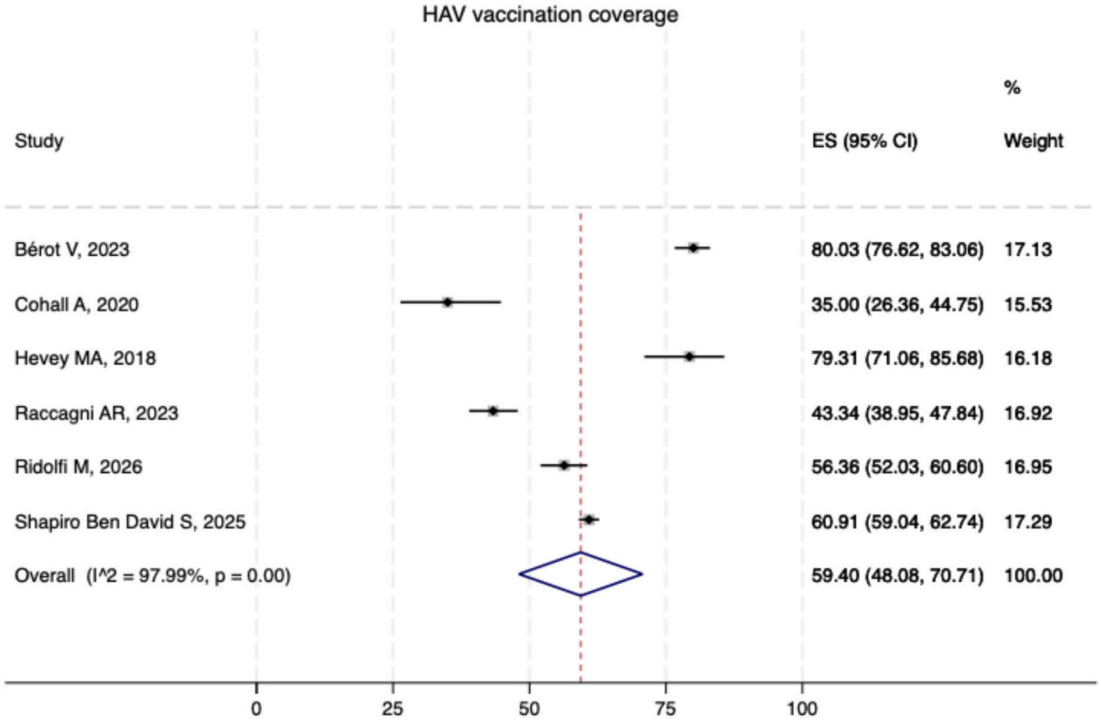


Fig. 4. Forest plot presenting the pooled percentage prevalence of HAV and HBV vaccination coverage among individuals receiving PrEP within routine care from from January 2011 to March 2026.

the included studies was relatively low, suggesting ongoing gaps in the implementation of preventive strategies among individuals at increased risk of vaccine-preventable infections, particularly when considered against the high coverage levels targeted in public health vaccination programmes (Global Strategy to Accelerate the Elimination of Cervical Cancer as a Public Health Problem, 2020), given the absence of specific coverage targets for this population. These findings may reflect a range of barriers at both the individual and system level, including limited awareness and risk perception among patients (Sullivan-Blum et al., 2022), vaccine hesitancy (Cogordan et al., 2024), gaps in provider training and vaccination recommendation practices (Chin et al., 2022), fragmented care pathway (Ridolfo et al., 2026) and missed opportunities for vaccination during routine clinical encounters (WHO, n.d.). When examined by vaccine type, vaccination coverage was highest for HBV (73.00%), followed by Mpox (61.00%) and HAV (59.00%), and lowest for HPV (43.00%). Evidence on other vaccines was limited: only one study evaluated influenza vaccination, reporting a coverage of 58.00%, and one study assessed meningococcal B vaccination, with a complete vaccination rate of 20.30%. No clear geographical pattern in HPV vaccination coverage emerged across studies, with substantial variability observed both within and between regions. For the other vaccines, the limited number of studies included in each meta-analysis has hindered further assessments of the geographical distribution of vaccination coverages. Subgroup analyses for HPV vaccine showed no substantial differences across most strata, including age groups, which could suggest suboptimal uptake across populations. Higher estimates observed in cross-sectional studies and in self-reported data likely reflect methodological and reporting biases rather than true differences. Furthermore, estimates for HPV remained consistent when restricting to higher-quality studies, although heterogeneity remained relevant. In contrast, the estimate observed for Mpox should be interpreted with caution, given the limited number of studies and wide confidence intervals.

The higher HBV vaccination coverage likely reflects its strong integration into PrEP care pathways, where HBV serological screening is routinely performed prior to PrEP initiation. In addition, tenofovir-containing regimens, which are active against HBV, require careful clinical management in individuals with chronic infection due to the risk of viral reactivation and hepatitis flares upon treatment discontinuation (Ambrosioni et al., 2026). This may be further explained by the long-standing implementation of universal childhood vaccination programmes across most countries, where HBV vaccination is routinely offered during infancy and, in some settings, is mandatory (Khetsuriani et al., 2021). This pattern suggests that higher vaccination uptake may be facilitated when vaccination is aligned with routine clinical workflows and standard clinical management. The relatively high Mpox vaccination coverage is largely driven by the 2022 global outbreak (WHO, 2022a), which prompted rapid, targeted vaccination campaigns among MSM (WHO, 2022b). Facilitated access, including free-of-charge provision in several settings, may have further contributed to higher coverage (Kolobova et al., 2022), although these estimates may partly reflect a temporal effect and may not be sustained outside the outbreak context, highlighting the need for continuity beyond emergency responses. As observed for Mpox, HAV vaccination coverage may partly reflect outbreak-driven increases in awareness and the implementation of targeted vaccination strategies among MSM (Ndumbi et al., 2018). However, vaccine availability constraints reported during large outbreaks, including documented shortages across several European countries, may have limited the expansion of vaccination programmes (Filia et al., 2022) indicating that supply constraints may represent a critical barrier to scaling up vaccination even in high-demand settings and highlighting the importance of ensuring adequate vaccine availability. Lower HPV vaccination coverage may reflect structural and behavioural factors (Newman et al., 2013). In contrast to outbreak-driven infections, HPV vaccination primarily prevents long-term outcomes and is associated with lower perceived risk and susceptibility, which may translate into reduced urgency of vaccination. Age-related eligibility, less explicit adult recommendations in some settings (CDC, 2025), and the historical focus on females (Sullivan-Blum et al., 2022) may further limit uptake among MSM, particularly in adulthood, where access may also be constrained by out-of-pocket costs in some settings. These factors contribute to a mismatch between the high burden of HPV infection and the relatively low vaccination coverage, suggesting that opportunistic approaches within PrEP care, which rely primarily on provider initiative rather than structured clinical triggers, may be insufficient to ensure adequate uptake. Although PrEP services offer an opportunity to reach at-risk individuals, this pattern points to the need for a more anticipatory approach, with greater emphasis on vaccination earlier in life to achieve optimal preventive impact.

Taken together, these findings highlight several key implications across policy, health system organization, and clinical practice. At the macro level (policy and public health frameworks), greater alignment across international and national vaccination recommendations is needed to ensure consistency in risk-based strategies targeting MSM and individuals receiving PrEP. Ensuring equitable access to vaccines, through free-of-charge provision or reimbursement schemes, may help reduce structural barriers and improve coverage (Kolobova et al., 2022). At the *meso* level (health systems and service organization), findings support the integration of vaccination services within existing care pathways, particularly in hospital and PrEP settings (Ridolfo et al., 2026), avoiding fragmentation and external referral and reducing missed opportunities for vaccination (WHO, n.d.) and promoting co-administration strategies when necessary (Bonanni et al., 2023). Strengthening digital vaccination registries and ensuring interoperability across services would enable comprehensive tracking of vaccination status and facilitate proactive review strategies (Dombkowski et al., 2025). At the micro level (clinical practice), improving vaccination uptake requires not only proactive provider engagement but also a broader, team-based approach. Systematic assessment of vaccination status and the integration of tailored counselling within routine PrEP visits are essential, and recommendation remains a key determinant of vaccine acceptance (Chin et al., 2022; Ogliastro et al., 2024). In this context, ongoing training and continuous professional education of healthcare providers are essential to support consistent and evidence-based vaccination practices (Uskun et al., 2008). At the same time vaccination strategies should be consistently embedded in clinical encounters and supported by the involvement of frontline healthcare staff, such as nurses and medical assistants (Stone et al., 2002; Bory et al., 2026; Lau et al., 2012). Organizational strategies, including standing orders (McKibben et al., 2000) and the presence of a vaccine champion (Kaufman et al., 2024), may further enhance vaccination delivery. The main limitation of this study is the high heterogeneity observed across included studies, which limits the interpretability and generalizability of pooled estimates. Where data allowed, subgroup analyses were performed to explore potential sources of heterogeneity; however, heterogeneity remained high and largely unexplained, indicating the presence of additional unmeasured factors and reflecting methodological, clinical, and contextual differences across studies. Similar findings have been reported in meta-analyses conducted in other high-risk populations, suggesting that such variability may be intrinsic to real-world vaccination data (Bianchi et al., 2021). In addition, most included studies were conducted in high-income countries, where access to PrEP and related healthcare services is generally well established. This has important implications for the interpretation of the findings, as the observed vaccination coverage estimates reflect contexts characterized by greater availability of healthcare services and a higher integration of PrEP within care pathways. Consequently, these estimates may not be directly transferable to other settings and may overestimate the levels of coverage achievable in systems with more limited access to preventive services.

A further limitation relates to heterogeneity in the definition and measurement of vaccination status, including differences between self-

reported data and medical records, and variability in defining coverage (e.g., at least one dose vs complete schedule), potentially introducing misclassification bias and reducing comparability. In addition, some included studies were brief reports or letters, which, despite clearly defined study designs, may have provided limited methodological detail. Conversely, although most studies were conducted in high-income countries, the inclusion of different national contexts represents a strength, providing a broader overview of vaccination patterns across healthcare systems.

Despite these limitations, to our knowledge, this study represents the first comprehensive assessment of vaccination coverage among individuals receiving PrEP using a systematic review and meta-analytic approach. Conducted according to established methodological standards, it provides a rigorous and transparent synthesis of the available evidence and the most robust overview currently achievable based on existing data. Further research should prioritize high-quality primary studies, particularly prospective designs, using standardized definitions of vaccination coverage and validated data sources, clearly distinguishing between at least one dose, full schedule completion, and documented immunity. Future studies should move beyond descriptive estimates and evaluate the effectiveness of integrated interventions within PrEP care pathways, including co-administration, reminder systems, and on-site vaccination. A better understanding of individual and structural determinants of vaccine uptake is also needed. Improved availability and sharing of vaccination data from PrEP clinical settings and public health institutions would further support more comprehensive and comparable analyses across countries. In addition, evidence on under-investigated vaccines should be expanded, and studies should assess clinical outcomes beyond coverage, alongside economic evaluations to better inform policy decisions. Finally, strengthening interoperable vaccination registries and data integration across services remains a key research and implementation priority.

5. Conclusion

This systematic review and meta-analysis provides a synthesis of the available evidence on vaccination coverage among individuals receiving PrEP, showing overall limited coverage across key vaccines. These findings highlight the need to strengthen the integration of vaccination within PrEP care and reinforce proactive provider engagement. Addressing existing gaps will require high-quality primary studies, standardized definitions, and evaluation of targeted interventions. Ensuring timely identification and vaccination of at-risk individuals within PrEP programmes remains a key challenge; vaccination also remains a critical intervention for people living with HIV and should be further strengthened. Future evidence and the dissemination of best practices may help improve vaccination coverage in these populations.

CRediT authorship contribution statement

Domenico Pascucci: Writing – original draft, Visualization, Validation, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Alberto Lontano:** Writing – original draft, Visualization, Validation, Software, Methodology, Investigation, Formal analysis, Data curation. **Simone Crovella:** Writing – original draft, Methodology, Investigation. **Simone Cosci:** Writing – original draft, Methodology, Investigation. **Patrizia Laurenti:** Writing – review & editing, Validation, Supervision, Methodology.

Ethics approval

Ethics approval was not required, as the research involved a meta-analysis of previously published studies, and no new data collection involving human participants was undertaken.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the author(s) used ChatGPT in order to improve readability and language. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ypmed.2026.108611.

Data availability

No data was used for the research described in the article.

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