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Increasing prevalence of self-reported HIV preexposure prophylaxis use in published surveys: a systematic review and meta-analysis

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Abstract

When combining results from all published surveys, about one in nine global study participants (10.7%) reported ever using preexposure prophylaxis (PrEP) by 2017, a significant increase since US FDA approval in 2012 [odds ratio (OR) = U 1.6/year, $P < 0.00001$]. Moreover, nearly one in six US-based study participants (17.3%) and nearly one in four MSM who met the Centers for Disease Control and Prevention's PrEP indications (24.5%) reported ever using PrEP by 2016. The odds of reporting PrEP use are approximately doubling each year (OR = U 1.8/year, $P < 0.00001$; OR = U 2.0/year, $P < 0.00001$).

Preexposure prophylaxis (PrEP) with emtricitabine/tenofovir disoproxil fumarate (FTC/TDF) has been shown to be effective at reducing the risk of acquiring HIV infection [1–4]. In 2014, the first comprehensive clinical practice guideline was released by Centers for Disease Control and Prevention (CDC) with indications for PrEP use for behaviours leading to risk of HIV acquisition [5]. An estimated 1.2 million individuals in the USA meet these indications [6]. A recent assessment of US retail pharmacies estimated almost 120 000 individuals received PrEP between 2012 and early 2017. However, this number excluded clients in closed healthcare systems with pharmacies [7], and the proportion of PrEP prescriptions to CDC's PrEP-indicated individuals is unknown. The purpose of this meta-analysis was to estimate the prevalence over time of self-reported PrEP use to prevent HIV among persons in published surveys, particularly among populations meeting CDC's PrEP indications in the USA.

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We conducted a systematic literature search to identify original studies on HIV PrEP. In consultation with subject matter experts, we collected 24 published citations to develop and test possible search terms. The finalized search in the database (platform) MEDLINE (OVID) in Supplemental Table 1, http://links.lww.com/QAD/B343 was adapted for EMBASE (OVID), PsycINFO (OVID) and CINAHL (EBSCOhost). The searches were run in March 2017 from 2000 through 2016. The citations captured were uploaded to the CDC HIV/AIDS Prevention Research Synthesis Project Database. The manual search included reference list checks, a hand search of journals and searches in PubMed for newly published literature. All identified citations were uploaded to DistillerSR (Evidence Partners, Ottawa, Canada) to assess for this review.

Two reviewers independently screened citations to identify primary studies that were published in English; and reported PrEP use (ever user/current user) among study participants. One primary study reporting PrEP use by prescription count [8] and all systematic reviews were excluded. When studies used the same dataset, we included the study with the larger number of participants. For prospective and intervention studies, only baseline data were included. If studies spanned multiple years, the midpoint of the study years was used. We screened study inclusion criteria and study population characteristics to determine whether target populations met PrEP indications. Study quality was assessed using the Modified Newcastle–Ottawa scale adapted for this review (≥3 points considered as low-risk of bias) [9–12]. Data abstraction and quality assessment were conducted by two independent reviewers; conflicts were resolved through discussion. Pooled self-reported prevalence of PrEP use and heterogeneity (I^2; ≥75% considered as high) [13] were determined via mixed-effects models with subgroup analyses of study years, US-based studies only and PrEP-indicated populations [MSM, heterosexuals and people who inject drugs (PWID)]. Self-reported PrEP use prevalence rates were summarized, and an odds ratio (OR) for an increase in PrEP use per year was estimated using mixed-effect logistic regression models in meta-analysis [14] using Comprehensive Meta-Analysis Software (Biostat, Englewood, New Jersey, USA).

We screened 1732 PrEP citations and identified 72 studies published from 2006 through 2018 that met review criteria (Supplemental Figure 1 & Table 2, http://links.lww.com/QAD/B343). The majority of studies were US-based (n = 55) and sample sizes varied from 30 to 6483. The most common target populations were MSM (n = 58), followed by young adults (n = 15), transgender persons (n = 10) and African–Americans (n = 8). Twenty-seven studies exclusively focused on PrEP-indicated populations (n = 19) or reported self-reported prevalence of PrEP use for relevant subgroups (n = 8). The majority of studies (n = 60) had more than three points on the study quality's scale.

Pooled prevalence of global self-reported PrEP use was 2.6% [95% confidence interval (95% CI): 1.3–4.8, k = 83, I^2 = 97.7; Supplemental Figure 2, http://links.lww.com/QAD/B343]. Findings from logistic regression analyses indicated that the prevalence of global self-reported PrEP use has increased significantly following FDA approval in 2012 [OR = 1.6/year, P < 0.00001; 1.1% (before 2012), 2.6% (2012), 2.1% (2013), 3.6% (2014), 5.6% (2015), 15.0% (2016), 10.7 (2017); Fig. 1].

Over 3% of US-based study participants (3.4%, 95% CI: 2.6–4.6, $k = 62$, $I^2 = 96.7$) reported having ever used PrEP. The prevalence has also increased significantly since 2012 [OR = 1.8/year, $P < 0.00001$; 1.0% (before 2012), 3.0% (2012), 2.6% (2013), 4.1% (2014), 8.7% (2015), 17.3% (2016)].

The reported prevalence in PrEP-indicated MSM in the USA was 5.0% (95% CI: 3.4–7.3, $k = 21$, $I^2 = 94.3$). All studies with PrEP-indicated populations focused on MSM, except one that was on PWID and reported no PrEP use among study participants [15]; thus, we were unable to conduct a meta-analysis on either PrEP-indicated heterosexuals or PWID. The growth rate has been rising even faster among PrEP-indicated MSM populations [OR = 2.0/year, $P < 0.00001$; 1.9% (before 2012), 10.0% (2012), 3.2% (2013), 5.6% (2014); 14.4% (2015); 24.5% (2016)].

This meta-analysis, in which the majority of included studies had a low risk of bias, found that 11% of study participants in all published surveys reported ever using PrEP by 2017. In US-based published surveys, 17% of study participants and 25% of PrEP-indicated MSM reported ever using PrEP by 2016; the rate has significantly increased over the past few years, although there were a limited number of studies for some years.

Limitations of this review include that all studies were self-reported surveys and may not measure actual current use. Our estimate is limited to published studies only. The majority of PrEP users are not captured in studies; therefore, our findings cannot be generalized beyond the study population. Finally, there may be some participant overlap among included studies. High heterogeneity of studies is noteworthy, but subgroup analyses reduced heterogeneity. Despite these limitations, this is the first known review to estimate self-reported PrEP use in published surveys.

A previous modelling study projected that PrEP use by 40% of MSM could prevent 33% of expected HIV infections among US. MSM [16]. The most recent strategic plan released by the CDC's Division of HIV/AIDS Prevention in 2017 set the objective to increase the number of PrEP users by at least 500% by 2020 [17]. Although this is not an actual prevalence of use, our data suggest self-reported PrEP use is doubling among MSM. Thus, if current efforts to promote effective PrEP use are maintained, we may see maximum coverage of PrEP use within several years and thus may meet these assertive US national objectives.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

Conflicts of interest

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

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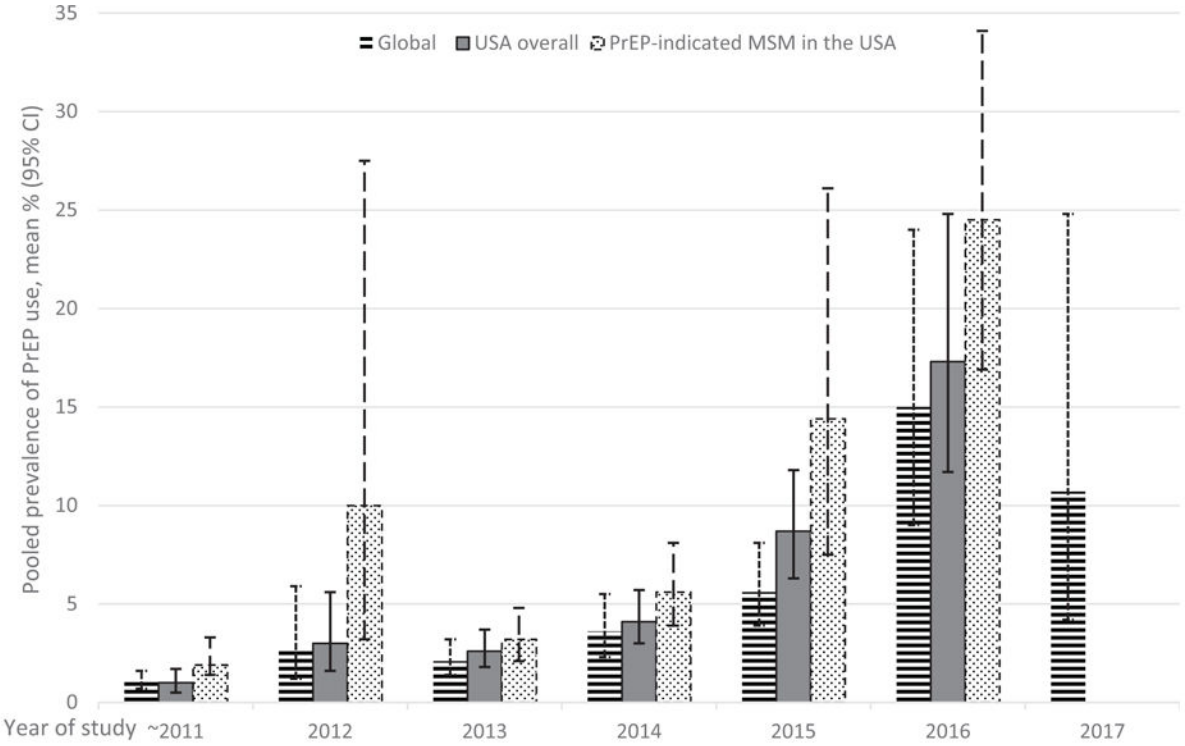

Global	1.1 (0.7-1.6) $k = 24$ $I^2 = 84.0\%$	2.6 (1.2-5.9) $k = 5$ $I^2 = 94.3\%$	2.1 (1.4-3.2) $k = 13$ $I^2 = 77.4\%$	3.6 (2.3-5.5) $k = 15$ $I^2 = 89.0\%$	5.6 (3.9-8.1) $k = 17$ $I^2 = 96.5\%$	15.0 (9.0-24.0) $k = 7$ $I^2 = 96.8\%$	10.7 (4.2-24.8) $k = 2$ $I^2 = 99.6\%$
USA overall	1.0 (0.5-1.7) $k = 17$ $I^2 = 85.5\%$	3.0 (0.3-8.4) $k = 5$ $I^2 = 94.3\%$	2.6 (1.8-3.6 = 7) $k = 10$ $I^2 = 73.5\%$	4.1 (3.0-5.7) $k = 13$ $I^2 = 88.1\%$	8.7 (6.3-11.8) $k = 11$ $I^2 = 89.9\%$	17.3 (11.7-24.8) $k = 6$ $I^2 = 95.3\%$	$k = 0$
PrEP-indicated MSM in the USA	1.9 (1.1-3.3) $k = 6$ $I^2 = 73.1\%$	10.0 (3.8-27.5) $k = 1$	3.2 (2.1-4.8) $k = 6$ $I^2 = 37.8\%$	5.6 (3.9-8.1) $k = 4$ $I^2 = 89.0\%$	14.4 (7.5-26.1) $k = 1$	24.5 (16.9-34.1) $k = 3$ $I^2 = 53.7\%$	$k = 0$

Mean % (95%CI)

Fig. 1.

Pooled prevalence of self-reported preexposure prophylaxis use in study participants: global vs. USA overall vs. MSM meeting CDC's PrEP indications in the USA ($N = 72$).