

What's Trending on Twitter Regarding the Most Recently Approved Oral Agent for HIV Pre-Exposure Prophylaxis (PrEP)?

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Abstract

Introduction: Pre-exposure prophylaxis (PrEP) is a key therapeutic strategy for HIV prevention. Descovy® is the most recently approved oral agent for PrEP. Despite availability, there continues to be suboptimal PrEP use among at-risk individuals. Social media platforms have a role in disseminating health information, to include education on PrEP. **Material and methods:** A content analysis was conducted of "tweets" posted on Twitter® during the initial year of Descovy's FDA approval for PrEP. The coding schema captured content related to the indication, appropriate use, costs, and safety profile of Descovy. **Results:** Most tweets provided information on target population, dosing strategy, and side effects of Descovy. Information on costs and appropriate use was frequently missing.

Conclusion: Health educators and providers should be aware of gaps in social media messaging concerning PrEP and should educate patients to ensure they are well informed when considering PrEP.

Keywords: HIV prevention, social media, content analysis, pre-exposure prophylaxis, Descovy

Introduction

Almost 35,000 new cases of HIV infection were recorded in the United States, according to the latest 2019 estimates from the Centers for Disease Control and Prevention (CDC) [1]. In evaluating the most recent prevalence data for new HIV infections, male-to-male sexual contact was the predominant transmission category, and the groups with the highest rates of HIV acquisition were those assigned male sex at birth, Black or African American race/ethnicity, and ages 25-34 years [1].

Pre-exposure prophylaxis (PrEP) is a key therapeutic strategy to lower the risk of HIV acquisition. Currently, there are two oral therapeutic agents in the US that are approved and available for use for PrEP, Truvada® and Descovy®, and one injectable agent for PrEP, cabotegravir. Cabotegravir is fairly new to the US market and is an extended-release injectable suspension for PrEP, released in spring of 2022. The oral agents for PrEP have a longer history of use in the US, with Truvada approved for PrEP in 2012 and Descovy approved for PrEP in October 2019.

Both of the oral PrEP regimens have a demonstrated efficacy of approximately 99% when taken as prescribed and combined with safer sex practices [2]. These oral PrEP agents are both formulated as a one-pill-once-a-day preventive regimen that contains a combination of two nucleoside reverse transcriptase inhibitors – emtricitabine and each with a distinctive prodrug of tenofovir. Truvada contains tenofovir disoproxil fumarate (TDF), which is associated with more plasma instability after oral administration when compared with the tenofovir alafenamide (TAF) prodrug formulated within Descovy [3,4].

This difference in plasma stability equates to higher plasma exposure to tenofovir and thus greater risk of renal- and bone-related adverse effects associated with Truvada vs. Descovy [3,4]. With the approval of Descovy for PrEP, came a distinction between therapeutic indications among the oral agents. Truvada for PrEP is indicated to reduce the risk of HIV-1 acquisition via sexual contact for at-risk adults and adolescents [5]. Whereas Descovy is indicated to reduce the risk of HIV-1 acquisition from sexual contact, excluding receptive vaginal sex, for at-risk adolescents and adults who weigh at least 35 kg [6].

Despite the availability of effective PrEP in the US, uptake continues to vary among geographic region and by different subgroups [7]. In a recent abstract presented at the Conference on Retroviruses and Opportunistic Infections (CROI) in 2020, researchers found that the vast majority (>80%) of at-risk men who have sex with men (MSM) were not using PrEP [8]. Beliefs concerning proper use, effectiveness, safety profile, and economic impact were associated with poor PrEP uptake [8]. Similarly, in a scoping review of published literature examining PrEP uptake, investigators found concerns related to costs and fear of potential adverse effects of PrEP consistently noted as barriers to patients' acceptance and use of PrEP [9]. As such, interventions targeted to increase PrEP uptake and improve knowledge of the benefits, appropriate use, and safety profile are needed – with an increase in PrEP utilization noted as a key priority of the US HIV National Strategic Plan [10]. The approval of Descovy for PrEP provided an additional option within the therapeutic arsenal for HIV prevention, and its FDA-approved indication targets a population that remains at high risk for and disproportionately affected by rates of new HIV infection [11].

Social media is a frequently consulted platform for information, to include health-promotion and disease prevention education. With an estimated 3.5 billion active social media users worldwide and approximately 72% of Americans reporting use

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of one or more platforms [12], social media with its high user engagement [13] has been recognized by several health-related organizations as an important tool for disseminating health education. Of the various social media platforms, Twitter® (Twitter, Inc., San Francisco, CA) has been studied most extensively for its role in disseminating real-time information to the public, for which it is increasingly establishing itself within the public view as an up-to-date and reliable source for health information [14]. However, a key challenge of using social media platforms for health promotion and disease prevention is preventing the spread and impact of incomplete and inaccurate information [15]. As such, some organizations, such as the CDC, have published best practices when using social media platforms to provide health information [16].

Twitter has approximately 199 million monthly active users worldwide, and the US leads other countries in the number of active monthly users on the platform [17]. The present study was designed as a content analysis of information published on Twitter during the initial year of Descovy's approval for PrEP, when the topic was trending on the platform. The conventional content analysis is a research methodology in which researchers derive a categorization procedure from data to objectively and systematically characterize content within text or images. To our knowledge, no content analyses of social media messaging on PrEP have been performed since the approval of Descovy. The findings of the present study characterize the messaging disseminated on the platform at that time and sheds light on gaps evident within the posted information.

Methods

Sample selection

An advanced Twitter search was conducted to retrieve "tweets," posted on the platform between the dates of October 3, 2019 and August 31, 2020. The hashtags of "Descovy," "HIV PrEP," "PrEP," and "HIV Prevention" were used to generate tweets that provided information on Descovy for PrEP. Tweets with embedded links were included within the advanced search. Non-English language tweets were excluded, and no limits were set regarding engagement (i.e., likes, replies and retweets). One author (AB) screened the tweets for duplicates to ensure that re-posted information or retweets, as indicated by the "RT" notation before the @username, were excluded and the original content was only analyzed once. Additionally, this author screened the tweets to identify those with content providing education on Descovy for PrEP. This allowed the current content analysis to be focused on substantive content related to the use of this pharmacotherapy for PrEP rather than brief mentions or questions from platform users related to Descovy and/or PrEP.

Given the nature of Twitter platform, which produces search results that continue to populate with scrolling the Twitter feed, a convenience sampling of tweets from the "Top Tweet"

category was utilized to identify eligible tweets for analysis - as tweets from this category represent those most relevant to search terms [18]. Twitter catalogues tweets from both verified and unverified sources. Verified accounts on Twitter receive a badge from the platform to indicate authenticity, and badges are given to notable and active accounts from six categories, to include: government; companies/brands and non-profit organizations; news organizations and journalists; entertainment; sports; and influential individuals [19]. To allow for comparison of tweets among verified accounts, indicated by the blue verified account Twitter badge, and unverified accounts, the first 25 tweets that met study criteria from verified accounts and the first 25 tweets from unverified accounts were analyzed. Any content from linked articles, webpages or images embedded within the tweet were also analyzed and attributed as the tweet's content.

Coding instrument

An iterative process of reviewing randomly selected tweets and determining overlying themes in content was utilized to develop the coding scheme. A coding rubric was developed and refined until the final schema was determined. The final coding instrument captured information on the following categories: indication, proper administration, safety profile, and costs related to use of Descovy for PrEP. Two coders coded the tweets. Randomly selected tweets coded by both authors were utilized to determine intercoder reliability, with Cohen's Kappa of 0.871, which is indicative of a strong level of reliability as reported in the literature [20].

Statistical analysis

Results were analyzed using SPSS, v23 (IBM, Armonk, NY). Chi-square test of independence was used to compare frequency of content themes among tweets from verified and unverified accounts. Statistical significance was defined as p-value <.05.

Results

General Characteristics of Twitter Accounts and Tweets

Fifty total tweets were analyzed, with 25 being from verified accounts and the remaining 25 from unverified accounts. Of the verified accounts, tweets linked to a government/public health entity, medicine-based website, a national news service, health/lifestyle magazine, consumer organization, and physician were fairly even in representation within the analysis (Figure 1). All tweets from unverified accounts were from accounts with a profile description reporting a focus on either general health promotion or HIV/AIDS awareness. The content analyzed from both sources, verified and unverified accounts, was from either linked articles or an attached chart or graphic embedded within the tweet. Of the 25 tweets from verified accounts, 24 contained a linked article and three attached a chart or graphic that were included in the analysis. Similarly, 23 tweets from unverified accounts linked an article and one contained a graphic which were included in the study.

Content Regarding Descovy

Categorization of content from both verified and unverified accounts is provided in Table I. Regarding the FDA-approved indication for Descovy, all tweets specifically mentioned the recent approval for PrEP, and the majority (88% and 84%, respectively) reported that the Descovy for PrEP is indicated for men who have sex with men (MSM) or transgender women. While most (92%) tweets from verified accounts explicitly stated Descovy for PrEP is not for use among those at risk of HIV acquisition secondary to vaginal sex, a significantly lower number (68%) of tweets from unverified accounts stated this clear exception in the approved indication. Less than fifty percent of tweets from both types of accounts reported that Descovy is indicated for PrEP in adults and adolescents ≤ 35 kg. Over half of tweets mentioned the landmark DISCOVER trial evidence supporting the use of Descovy for PrEP.

Regarding appropriate use of Descovy, most (80%) tweets from verified accounts explicitly mentioned Descovy is used once daily for PrEP vs. approximately half of tweets from unverified accounts. Two tweets from verified sources and none from unverified sources explicitly mentioned Descovy should be taken consistently to confer maximum protection against HIV acquisition. Less than one-half of tweets from both types of accounts stated that Descovy should be used as a component of a comprehensive strategy (i.e., pharmacotherapy plus safer sex practices) for prevention of HIV and sexually transmitted infections (STIs), while approximately one-third of tweets mentioned confirmation of HIV negative status (i.e., HIV testing) is recommended prior to initiating Descovy.

An equal number of tweets from both types of accounts reported common side effects of Descovy (e.g., GI effects, fatigue, decrease in bone mineral density) and explicitly stated that Descovy has a more favorable side effect profile when compared with Truvada's renal and bone-related adverse effects. Less than one-third of tweets mentioned costs or availability of prescription assistance programs for Descovy.

Discussion

Descovy for PrEP: Therapeutic Indication

The present content analysis suggests that general information on the FDA-approved indication and specific target population of Descovy for PrEP (i.e., MSM and transgender women) is accurately noted among Twitter social media messaging. A significant difference was noted in the number of messages that explicitly stated Descovy is not indicated for those at risk for HIV acquisition via vaginal sex, with a higher number of tweets from verified accounts highlighting this exception ($p=.034$). This gap in messaging is important to note, as it may contribute to confusion with the general consumer who mistakenly assumes Truvada and Descovy for PrEP as interchangeable in indication/target population. It is important to note that there is no data suggesting that Descovy for PrEP is harmful for patients at risk for HIV acquisition via vaginal

intercourse, but rather there is insufficient clinical data to support the efficacy of Descovy in preventing a potential HIV infection from this route of transmission. Health educators and clinicians should be careful to clarify the reasoning behind the difference in indication among the PrEP agents and dispel any potential misunderstandings on the target populations covered by therapeutic indication.

Studies have demonstrated that misconceptions about PrEP and recommended target groups for use are associated with poor uptake. In a focus group study by Taggart et al., with a largely female population, investigators noted a common theme of adolescent participants who misunderstood PrEP to be only indicated for men at risk for HIV [21]. This confusion influenced their perception of eligibility for and uptake of PrEP [21]. Similarly, a study by Raifman et al., conducted in a population of cis-women with low PrEP utilization, found participants overall lacked knowledge that PrEP is available to them as an option for HIV prevention [22]. As such, clinicians and health educators should be aware of this gap in information and ensure that health promotion materials available to the public clearly educate on the recommended PrEP option(s), based upon individual risk(s) for HIV acquisition.

Descovy for PrEP: Appropriate Use

Beyond prevalent messaging that Descovy is intended for use as a once daily regimen, information on appropriate use of Descovy was overall lacking or incomplete among tweets. Very few tweets from verified accounts and none from unverified accounts mentioned the importance of consistent, daily use of Descovy to achieve maximal efficacy for PrEP. During the timeframe of the present content analysis, the CDC recommended a total of seven days of consistent PrEP to reach maximum protection for those at risk for HIV via receptive anal sex [2]. This represented an important counseling point for the target population of Descovy for PrEP. These recommendations for daily PrEP were supported by evidence from the landmark iPREX and DISCOVER trials, which demonstrated a lower risk of HIV acquisition in patients with evidence of good adherence to the PrEP regimen [23, 24]. It should be noted that the updated US guidelines for PrEP now endorse "on-demand PrEP" as an optional, off-label, alternative regimen for MSM - utilizing the "2-1-1 regimen" of Truvada dosed as two pills in the first 2 to 24 hours before sex and one pill administered at both 24- and 48-hours after the initial two-pill dose [25].

In addition to the importance of consistent use for efficacy, an important finding of our analysis was that less than one-third of tweets from both sources mentioned the importance of utilizing Descovy for PrEP along with a comprehensive strategy of safer sex practices, to include condom use and/or limiting sexual partners. This comprehensive strategy is important to highlight with the public, as safer sex practices are not only beneficial for lowering the risk of HIV acquisition via sexual contact but also provide protection against other sexually

transmitted infections, for which PrEP does not prevent. The current analysis also revealed that less than one-third of tweets highlighted the importance of routine HIV testing with PrEP. Testing is a foundational element of PrEP. Establishing HIV negative status is important since the currently available PrEP regimens have not been demonstrated to adequately suppress HIV viral replication alone, and the inappropriate use of PrEP after seroconversion can lead to the development of drug resistance [26]. As such, patients should be educated on the importance of HIV testing prior to initiation of PrEP and the need for routine follow-up testing while on PrEP. Our study findings on the gaps in social media messaging are important to highlight, as misinformation on the importance of adherence, continuance of safer sex practices, routine HIV testing in the setting of PrEP have all been highlighted in the literature as need for improved education [27-29].

Descovy for PrEP: Safety

Concerns for PrEP-related adverse effects have been implicated in the literature as a barrier to uptake. In a focus group study by Thomann et al., investigators noted a consistent theme among participants' responses that highlighted their concern for potential side effects of PrEP therapy, to include bone- and kidney-related adverse effects; participants reported that unanswered questions related to potential side effects influenced their refusal to initiate PrEP [30]. Similarly, a systematic literature review by Ezennia et al. cited concerns for potential adverse effects as a key barrier to PrEP acceptance [9]. Likewise, in an evaluation of the motivations for declining PrEP in a study conducted by O'Byrne et al., the most commonly cited reason for denial was based on beliefs that "PrEP was "harmful" and "dangerous" [31]. Our study finding that most tweets mentioned commonly associated side effects of Descovy and noted the difference in renal- and bone-related effects of Descovy vs. Truvada is promising in that the messaging addressed the potential for adverse effects, which may positively influence willingness to use PrEP.

Descovy for PrEP: Costs

In the present study, messaging was overall lacking as it relates to costs of Descovy for PrEP and resources to improve patients' access to PrEP (e.g., manufacturer's assistance programs and U.S. Department of Health and Human Services "Ready, Set, PrEP program). This finding is concerning, as cost is a noted barrier to PrEP uptake within the literature [9,23]. In the US, most insurance and state Medicaid plans cover PrEP. For those who are underinsured or uninsured, co-pay and patient assistance programs from the PrEP manufacturer, state-specific PrEP assistance programs, and the national "Ready, Set, PrEP" program are available to provide affordable access to PrEP. As such, education on these programs should be widely publicized to the general public, since this information can help to mitigate cost-related concerns and improve PrEP uptake.

Limitations

This content analysis has several limitations. A convenience sampling of a limited number of tweets focused exclusively on Descovy for PrEP were selected and analyzed in this study. Additionally, tweets from more than a year past Descovy's FDA approval for PrEP were not included in the analysis. Furthermore, tweet content on the social media platform is limited by character count, which can impact the depth of information provided. However, the majority of tweets included in this evaluation linked external content, which the authors assessed in the present study. This study focused solely on an evaluation of Twitter social media content and did not investigate messaging on other online, social platforms. Lastly, to our knowledge, there is no published and validated sampling method for retrieving tweets from Twitter; thus, our advanced search methodology may not have contained all relevant tweets for use in our convenience sample.

Conclusion

Our analysis explored information posted on Twitter regarding Descovy for PrEP during the initial year of its approval. The findings indicate that information on the target population, dosing strategy, and side effects of Descovy was posted on the platform by both verified and unverified sources of health information. Information on costs and appropriate use was frequently missing from tweets, which may contribute to inappropriate and decreased use of Descovy for PrEP. Health educators and providers should be aware of the content on social media regarding PrEP and be attuned to any gaps in messaging which may contribute to inappropriate use and avoidance of PrEP. As social media use continues to be utilized as a health information platform and new options for PrEP are emerging, future research on the content, completeness, and accuracy of this information is needed.

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Table 1: Information about Descovy on Twitter (N = 25 verified, N = 25 unverified accounts)

Information	Verified accounts		Unverified accounts		p value
	n	%	n	%	
Indication					
• Stated Descovy use “for PrEP ^a ”	25	100	25	100	
• Mentioned approval for PrEP in “adults and adolescents ≥35kg”	10	40	6	24	.225
• Stated for use in MSM ^b or transgender women	22	88	21	84	.166
• Stated “not for vaginal sex”	23	92	17	68	.034
• Mentioned scientific evidence from DISCOVER ^c trial to support use of Descovy for PrEP	13	52	17	68	.248
Administration					
• Stated “once daily” administration	20	80	14	56	.069
• Stated number of days required before full effectiveness	2	8	0	0	
• Mentioned PrEP is component of comprehensive strategy (i.e., safer sex practice) for HIV & STI ^d prevention	8	32	6	24	.529
• Mentioned confirmation of HIV-negative status is recommended prior to start of Descovy	9	36	8	32	.765
Safety profile					
• Mentioned possible side effects	15	60	15	60	1.00
• Stated Descovy has more favorable renal- and bone-related side effect profile than Truvada	16	64	16	64	1.00
Costs					
• Mentioned patient assistance programs/funding to access Descovy	8	32	6	24	.529
• Stated cost of Descovy	6	24	4	16	.480

^aPrEP = pre-exposure prophylaxis

^bMSM= men who have sex with men

^c Mayer, K. H., Molina, J. M., Thompson, M. A., Anderson, P. L., Mounzer, K. C., De Wet, J. J., DeJesus, E., Jessen, H., Grant, R. M., Ruane, P. J., Wong, P., Ebrahimi, R., Zhong, L., Mathias, A., Callebaut, C., Collins, S. E., Das, M., McCallister, S., Brainard, D. M., Brinson, C., ... Hare, C. B. (2020). Emtricitabine and tenofovir alafenamide vs emtricitabine and tenofovir disoproxil fumarate for HIV pre-exposure prophylaxis (DISCOVER): primary results from a randomised, double-blind, multicentre, active-controlled, phase 3, non-inferiority trial. *Lancet (London, England)*, 396(10246), 239–254. [https://doi.org/10.1016/S0140-6736\(20\)31065-5](https://doi.org/10.1016/S0140-6736(20)31065-5)

^dSTI = sexually transmitted infection

Figure 1: Classification of Verified Twitter Accounts

Figure 1.

