A systematic evaluation of mobile apps to improve the uptake of and adherence to HIV pre-exposure prophylaxis

J. Danielle Sharpe and Mustapha T. Kamara

Abstract. Background: Pre-exposure prophylaxis, or PrEP, has been shown to be effective at reducing the risk of HIV infection, yet persons at-risk for acquiring HIV exhibit suboptimal uptake of and adherence to this prevention modality. Although PrEP use among all at-risk groups is low, mobile apps have been shown to increase the use of PrEP; however, it is unknown whether currently available apps have been designed with features to facilitate PrEP uptake and adherence. Methods: The Google Play store and Apple App store were systematically searched for currently available PrEP-related apps. A qualitative evaluation was conducted on apps that met the inclusion criteria for the presence of features that can contribute to PrEP uptake and adherence, and the quality of apps was assessed using the Mobile Apps Rating Scale (MARS) tool. Results: From the systematic search, less than 2% (11/621) of the identified apps were relevant to improving PrEP uptake and adherence. Demonstrating a moderate capacity for facilitating PrEP use, the 11 PrEP-related apps, on average, contained features that addressed two of four factors that can contribute to the uptake of PrEP, particularly features that provided comprehensive information on PrEP and resources to locate providers and clinics offering PrEP services. Findings from the app quality assessment suggested that existing PrEP-related apps are of acceptable quality (mean overall MARS score: 3.2 on a five-point scale). Conclusion: Overall, currently available mobile apps for PrEP demonstrate some promise as potential avenues for increasing PrEP uptake and adherence among persons at-risk for HIV infection.

Introduction

Pre-exposure prophylaxis, or PrEP, is a biomedical intervention that has been shown to be highly effective at reducing the risk of acquiring HIV among men who have sex with men (MSM), persons who inject drugs and heterosexual men and women. In 2012, the USA Food and Drug Administration approved PrEP as daily, oral use of tenofovir disoproxil fumarate and emtricitabine (TDF-FTC) for high-risk HIV-negative persons. The Centers for Disease Control and Prevention (CDC) subsequently published interim guidelines for prescribing PrEP to MSM, heterosexual men and women and persons who inject drugs. In 2014, the CDC published comprehensive clinical practice guidelines for all at-risk populations seeking PrEP. National-, state- and local-level efforts have been implemented to target PrEP towards persons who may be at a high risk for acquiring HIV, but recent research has documented that uptake of this HIV prevention modality is suboptimal. The CDC have reported that over 1.2 million Americans are at high risk for HIV infection and have indications for PrEP, however, recent studies have shown that only ~70,000 unique persons were using PrEP by late 2017. Beyond low PrEP uptake, research has also reported low rates of PrEP adherence among high-risk populations. With PrEP being such an effective method for preventing HIV but with such low uptake and adherence, public health approaches aimed at improving PrEP use among at-risk persons need to be planned and implemented using different avenues.

Although the uptake of and adherence to PrEP is reportedly low, mobile apps or programs for mobile devices such as smartphones have the potential to contribute to the scale up of PrEP, increasing its uptake and adherence among high-risk populations. In one study testing Healthmindr, a HIV prevention app, Sullivan et al. reported that nearly 10% of MSM who were PrEP-eligible began taking PrEP during a
4-month study period, with the majority reporting that the app influenced them to begin PrEP. Mobile technology-based interventions, such as the Healthmindr app, have shown that apps may have some capacity to increase the use of PrEP; however, it is unknown whether currently available mobile apps have been designed with features to facilitate PrEP uptake. Therefore, this study sought to systematically review and describe available mobile apps for PrEP use in the Google Play store and Apple App store, evaluate the presence of features within PrEP-related apps that can contribute to PrEP uptake and adherence and assess the quality of PrEP-related apps using the Mobile App Rating Scale (MARS).

Methods

App search criteria and selection
Between 26 and 30 July 2017, the Google Play store and the Apple App store were searched for apps relevant to the utilisation of PrEP using the following terms and combinations of terms: pre-exposure prophylaxis; PrEP; HIV pre-exposure prophylaxis; HIV PrEP; PrEP pre-exposure prophylaxis; and HIV PrEP pre-exposure prophylaxis. App titles and descriptions were read to determine relevance to PrEP. Apps were included if they met all of the following inclusion criteria: a focus of the app is specific or relevant to PrEP; the app is accessible or functional; the app is designed for civilian smartphone users, not healthcare providers or other professionals; the app is hosted in the English language; and the app is not a duplicate.

All qualitative and MARS app evaluations were performed using Android app versions for consistency purposes, as all apps meeting the inclusion criteria were available in the Android version. iPhone mobile apps for PrEP were excluded largely due to insufficient resources to evaluate both Android and iPhone apps, as Android smartphones were only available for the analyses conducted in this study. Previous work has found that ownership of Android smartphones is greater among youth, male persons and persons of colour, which are the populations with the greatest burden of HIV diagnoses and at highest risk for HIV infection in the USA.

Qualitative evaluation strategy
On 30 July 2017, a qualitative evaluation of all Android apps meeting the inclusion criteria was conducted to assess the presence of app features that can contribute to the uptake of PrEP and facilitate adherence. We evaluated apps for features providing the following four factors: (1) comprehensive information about PrEP; (2) self-assessments for app users to independently gauge whether they would be suitable candidates for PrEP; (3) PrEP locators, directories of providers and clinics that offer PrEP services, or other resources to assist app users with locating healthcare services to obtain PrEP; and (4) reminder systems for adherence to PrEP or related healthcare appointments.

App rating approach
Between 11 and 29 August 2017, two researchers (J. D. Sharpe and M. T. Kamara) assessed the quality of apps using the Mobile Apps Rating Scale (MARS), which is a 23-item rating scale designed for evaluating the quality of mobile health apps. The MARS is a validated, reliable tool that has been used for evaluating apps for the self-management of chronic diseases, smoking and alcohol consumption, diet and physical activity, medication adherence, and mental health, among many other health issues. The MARS tool includes an app classification section for gathering descriptive information on rated apps, an objective app quality assessment section that includes four subsections and 19 total items for rating apps based on engagement, functionality, aesthetics and information, and a subjective quality section in which four items are used to rate apps on perceived user satisfaction. The 19 items in the objective app quality assessment section and four items in the subjective quality section are rated using a five-point scale or as not applicable.

Pre-exposure prophylaxis-related Android apps from the Google Play store were rated and reviewed by both authors for reliability purposes. Scores were calculated for each MARS subsection on engagement, functionality, aesthetics and information quality, and then combined to provide an overall MARS score. Scores given on the subjective quality items were computed as satisfaction ratings, but were not included in the calculation of the overall MARS score due to the subjective nature of these ratings. MARS scores made by both authors were averaged for each MARS item. As recommended by Stoyanov et al., both authors conducted the app quality assessment after completing MARS training, adhering to the instructions provided in the YouTube MARS training tutorial. Spearman’s rank correlation coefficient was used to assess inter-rater reliability for the MARS app quality assessment and was performed using SAS version 9.4 (SAS Institute, Cary, NC, USA).

Results

App search results
A total of 621 apps were identified in the Google Play store and Apple App store using the search strategy, of which 11 apps met our inclusion criteria (Fig. 1). Overall, 113 app results from the Apple App Store were excluded, 496 of the 508 apps from the Google Play store were excluded and one additional app was excluded because it was not accessible, requiring login credentials. A majority of the excluded apps were not related or specific to PrEP for the prevention of HIV infection. For example, several apps were explicitly relevant for HIV post-exposure prophylaxis (PEP), professional HIV scientific events or general educational and exam preparation.

Table 1 presents descriptive app information for the 11 Android apps included in the analyses. All apps were downloadable at no cost. Most apps were hosted under the ‘Medical’ and ‘Health & Fitness’ categories. At the time that these apps were downloaded and assessed, most (82%, n = 9) had been updated within the last year (data not shown). There was a range of installation totals for the PrEP apps. Most apps (82%, n = 9) had been installed between 10 and 500 times. One app, AIDSinfo Drug Database, had been installed between 5000 and 10,000 times. PreP4U was the least downloaded app with one to five installs.
Qualitative evaluation

The 11 PrEP apps were qualitatively evaluated for the presence of app features that can contribute to uptake of and adherence to PrEP, specifically features providing: (1) comprehensive information about PrEP; (2) self-assessments to determine suitability for PrEP; (3) resources to locate PrEP services; and (4) reminder systems for PrEP or appointment adherence. Table 2 provides complete results of the qualitative evaluation of app features. While an average of two features were present across all 11 apps, only one app (bePrEPed) possessed features for all four factors. Most (64%, $n = 7$) of the apps provided comprehensive information on PrEP hosted within the app, such as what PrEP is, when it should be taken and who would benefit from using PrEP. Only one-third of the apps ($n = 4$) provided PrEP self-assessments for app users to independently determine whether they would be suitable candidates for PrEP and should receive a prescription for PrEP.

Over half (55%, $n = 6$) of the apps provided resources for app users to locate healthcare services for the purposes of obtaining PrEP. There was a range of geographic regions covered by apps with PrEP services locators (Fig. 2). The bePrEPed app provided a map-based searching feature of PrEP providers in the Washington D.C. area and parts of Maryland and Virginia, while the PEP and PrEP app presented a list of information for a single clinic that provides PrEP services in New York, NY, USA. The PrEP SQUAD app hosted the Emory University-developed PrEP Locator within its app, which is a national directory of clinics and providers that offer PrEP services.35 The Florida HIV/AIDS Hotline, Is PrEP Right for Me?, and PrEPme apps serviced the states of Florida, Ohio and Maryland respectively. Approximately half (45%, $n = 5$) of the apps provided a reminder system to aid app users in maintaining PrEP adherence. Of these apps, tracking systems were also provided for managing

Apps identified through online app store searches:

- Google Play store ($n = 508$)
- Apple App store ($n = 113$)

App titles and descriptions screened ($n = 508$)

Downloaded apps assessed ($n = 12$)

Apps included in the qualitative evaluation and MARS assessment ($n = 11$)

Apps from Apple App store excluded ($n = 113$)
- Specific to PrEP ($n = 3$)
- Not specific to PrEP ($n = 104$)
- Non-English ($n = 2$)
- Duplicates ($n = 4$)

Apps from Google Play store excluded ($n = 496$)
- Not specific to PrEP ($n = 377$)
- Non-English ($n = 1$)
- Not specific to PrEP & non-English ($n = 38$)
- Duplicates ($n = 78$)
- Targeted towards providers/healthcare professionals ($n = 2$)

Apps excluded ($n = 1$)
- Not accessible; required login credentials

Fig. 1. Search strategy for pre-exposure prophylaxis (PrEP)-related mobile apps.

Table 1. Descriptive characteristics of mobile apps meeting the inclusion criteria

<table>
<thead>
<tr>
<th>Mobile app name</th>
<th>Developer</th>
<th>Version</th>
<th>Price</th>
<th>Installs (n)</th>
<th>Category/Type</th>
<th>Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIDSinfo Drug Database</td>
<td>National Library of Medicine at NIH</td>
<td>1.0.4</td>
<td>0.00</td>
<td>5000–10000</td>
<td>Medical</td>
<td>Android only</td>
</tr>
<tr>
<td>bePrEPed</td>
<td>JEL Creative, Inc.</td>
<td>0.0.1</td>
<td>0.00</td>
<td>10–50</td>
<td>Health and Fitness</td>
<td>Android only</td>
</tr>
<tr>
<td>Florida HIV/AIDS Hotline</td>
<td>Bowman Systems, LLC</td>
<td>1.0.3</td>
<td>0.00</td>
<td>100–500</td>
<td>Books and Reference</td>
<td>Android and iPhone</td>
</tr>
<tr>
<td>Is PrEP Right for Me?</td>
<td>ARC Ohio</td>
<td>0.2</td>
<td>0.00</td>
<td>100–500</td>
<td>Medical</td>
<td>Android only</td>
</tr>
<tr>
<td>myPrEP App</td>
<td>Trillium Health</td>
<td>1.4</td>
<td>0.00</td>
<td>50–100</td>
<td>Health and Fitness</td>
<td>Android and iPhone</td>
</tr>
<tr>
<td>PEP and PrEP</td>
<td>HIV prevention PEP and PrEP</td>
<td>1.0</td>
<td>0.00</td>
<td>50–100</td>
<td>Health and Fitness</td>
<td>Android only</td>
</tr>
<tr>
<td>PrEPme by emocha</td>
<td>emocha Mobile Health Inc.</td>
<td>3.0.5</td>
<td>0.00</td>
<td>50–100</td>
<td>Medical</td>
<td>Android and iPhone</td>
</tr>
<tr>
<td>PrEP SQUAD</td>
<td>PrEP SQUAD</td>
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<td>0.00</td>
<td>100–500</td>
<td>Health and Fitness</td>
<td>Android only</td>
</tr>
<tr>
<td>PrEP Time</td>
<td>PrEP SQUAD</td>
<td>1.6</td>
<td>0.00</td>
<td>50–100</td>
<td>Medical</td>
<td>Android only</td>
</tr>
<tr>
<td>PreP4U</td>
<td>HealthHIV</td>
<td>1.0.0</td>
<td>0.00</td>
<td>1–5</td>
<td>Medical</td>
<td>Android only</td>
</tr>
<tr>
<td>YHEP-PrEP</td>
<td>Ziyan Yang, Zhuyun Maggie Xiao, Manman Lu</td>
<td>1.0</td>
<td>0.00</td>
<td>10–50</td>
<td>Medical</td>
<td>Android only</td>
</tr>
</tbody>
</table>

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**MARS assessment**

Table 3 presents the results from the MARS assessment for each of the 11 PrEP apps. The inter-rater reliability for the MARS scores assigned by the authors was moderate (\( r = 0.57752, P < 0.0001 \)). Overall, the apps were of average quality (mean Overall MARS score: 3.2) when assessed using the MARS rating tool. In fact, nearly all apps (82%, \( n = 9 \)) had a minimum acceptable score of 3.0. Of the four subscales, Functionality had the highest mean score across the apps (4.2; range: 3.3–5.0) and Engagement had the lowest (2.1; range: 1.5–3.3). Mean scores across the apps for the Aesthetics and Information subsections were above average, with scores of 3.2 and 3.5 respectively. The apps had a suboptimal mean score for their satisfaction ratings (2.8; range: 1.8–4.8).

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**Fig. 2.** Geographic range of pre-exposure prophylaxis (PrEP) services locators within PrEP-related mobile apps.
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Discussion

Key findings

This is the first study to systematically review and evaluate currently available mobile apps for facilitating PrEP utilisation using qualitative and validated quantitative measures. In the systematic search for apps with capabilities to increase PrEP use and adherence, less than 2% (11/621) of the identified apps met our inclusion criteria and were appropriate apps for improving PrEP uptake and adherence. Most apps were excluded because they were either Apple apps or, for the Android apps, not relevant for increasing PrEP use. Each of the apps included in the qualitative evaluation and MARS assessment was freely downloadable. This is significant in that currently available mobile apps with features to increase PrEP uptake and adherence do not present any economic barriers for persons interested in initiating PrEP use. In addition, most of the apps were updated within the past year, signifying that developers of these apps are actively working to provide functional and user-friendly app products. Also, such recent updates of these PrEP-related apps indicate that those who may use these apps are being provided with the most recent evidence-based information about PrEP. However, low overall installation counts for these apps highlight missed opportunities for using mobile technology to improve PrEP usage rates. This is an area that future work and interventions can emphasise in efforts to increase PrEP usage among high-risk populations.

Regarding the qualitative evaluation, the PrEP-related apps contained features that encompassed, on average, two of four factors that may contribute to PrEP uptake and adherence. The two most common factors that were identified among the apps were providing some level of comprehensive information on PrEP and some variation of resources that presented location-based information on clinics and providers offering PrEP services. While there was a range of geographic areas covered by apps with service location information, only one of the apps (PrEP SQUAD) incorporated the PrEP Locator, which is a national database of PrEP clinics and providers that persons at risk for HIV infection can use to identify PrEP-friendly venues and access PrEP-related care and prescriptions. Fewer apps provided self-assessments for users to gauge their own suitability for a PrEP prescription, while several of the apps contained reminder systems for tracking daily PrEP compliance. One of the systems (YHEP-PrEP) even provided functionality for alerting an accountability coach for when a PrEP dose was missed. Largely, these PrEP-related apps demonstrated a moderate capacity for facilitating the uptake of and adherence to PrEP. In addition, few of the apps were targeted towards a specific at-risk population. Only two apps (bePrEPed and PrEP SQUAD) were clearly targeted towards MSM, while one app (YHEP-PrEP) was targeted towards youth at high risk for becoming HIV infected. While young persons and MSM are two of the priority populations for current national HIV prevention efforts, other priority populations were not represented among the target audiences of the PrEP-related apps, indicating the need for expanded app development to target other high-risk populations of interest.

In regards to app quality, the PrEP-related apps were found to be of average quality using the MARS tool. The YHEP-PrEP app and the bePrEPed app were the most engaging apps, as these apps incorporated entertainment and gamification, engaging content presentations, a variety of interactive features and targeted messaging for specific at-risk groups. The AIDSinfo Drug Database app and the Is PrEP Right for Me? app exhibited the most optimal functionality. Both of these apps were characterised by intuitive ease of use; logical navigation and screen flow; consistent and simple gestural design; and timely response of functions with no technical problems. Aesthetically, the bePrEPed app and AIDSinfo Drug Database app were scored highly due to their overall visual appeal, use of colour, stylistically consistent and high-resolution graphics and device display-optimised layouts. Both apps also provided the highest quality of PrEP information, ranking well because they included high-quality information in a comprehensive and concise format, while including links to more resources. Ultimately, both the qualitative evaluation and MARS app

<table>
<thead>
<tr>
<th>Mobile app name</th>
<th>Engagement</th>
<th>Functionality</th>
<th>Aesthetics</th>
<th>Information</th>
<th>Satisfaction</th>
<th>Overall MARS score</th>
</tr>
</thead>
<tbody>
<tr>
<td>All apps collectively</td>
<td>2.1</td>
<td>4.2</td>
<td>3.2</td>
<td>3.5</td>
<td>2.8</td>
<td>3.2</td>
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<tr>
<td>bePrEPed</td>
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<td>4.8</td>
<td>4.7</td>
<td>4.3</td>
<td>4.8</td>
<td>4.2</td>
</tr>
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<td>5.0</td>
<td>4.7</td>
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<td>3.5</td>
<td>3.9</td>
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<tr>
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<td>1.9</td>
<td>5.0</td>
<td>3.7</td>
<td>3.7</td>
<td>3.8</td>
<td>3.5</td>
</tr>
<tr>
<td>Florida HIV/AIDS Hotline</td>
<td>1.6</td>
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<td>3.5</td>
<td>3.5</td>
<td>1.8</td>
<td>3.1</td>
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<td>myPrEP App</td>
<td>2.1</td>
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<td>3.4</td>
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<td>3.1</td>
</tr>
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<td>PrEP SQUAD</td>
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<td>3.9</td>
<td>2.7</td>
<td>3.5</td>
<td>2.3</td>
<td>3.1</td>
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<td>YHEP-PrEP</td>
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<td>3.3</td>
<td>2.3</td>
<td>3.5</td>
<td>2.6</td>
<td>3.1</td>
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<td>PrEPme by emocha</td>
<td>1.5</td>
<td>3.9</td>
<td>3.0</td>
<td>3.7</td>
<td>3.0</td>
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<td>PrEP Time</td>
<td>1.9</td>
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<tr>
<td>PrEP4U</td>
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<td>3.2</td>
<td>1.8</td>
<td>2.7</td>
</tr>
<tr>
<td>PEP and PrEP</td>
<td>1.6</td>
<td>3.5</td>
<td>3.5</td>
<td>2.3</td>
<td>2.0</td>
<td>2.6</td>
</tr>
</tbody>
</table>

A The overall MARS score does not include satisfaction ratings, as these ratings are subjective.
B The information quality score for all apps excluded item 19 (Evidence base) of the MARS because a literature search in the PubMed database returned no studies for all 11 apps.
C The information quality score for this app excluded item 17 (Visual information) because no visual information was presented within the app.
quality assessment verify that there is promise in using mobile apps to contribute to PrEP uptake among high-risk persons and maintain compliance among those who end up using PrEP.

In comparison to mobile apps for other health conditions, the PrEP-related apps included in this study underperformed in certain app quality areas and performed better in others. PrEP apps were generally worse than other health apps in regards to the level of user engagement and app aesthetics. Apps for managing diabetes, physical balance, smoking cessation, breastfeeding support, weight and mental health were more engaging and had better aesthetics than apps for PrEP uptake and management. Conversely, PrEP-related apps performed markedly better than other health apps in terms of information and functionality. Apps in this study were found to possess higher-calibre app functionality and information quality than asthma management apps, weight management apps, diabetes management apps and apps to self-manage alcohol consumption and prevent drunk driving.

In addition, the PrEP-related apps have unique features that could be utilised to enhance other sexual health promotion apps. Compared with other sexual health apps, PrEP apps were unique in that they provided the ability for users to self-assess their indications for PrEP to evaluate their HIV risk and suitability for the prevention modality. Also, providing high-quality information and functionality is important concerning the acceptability of sexual health apps, and the PrEP apps in this study performed well with respect to both of these aspects and could guide future sexual health apps in this regard. Research on sexual health apps has acknowledged the importance of integrating healthcare provider locators and reminders for medications, appointments and laboratory results, both of which were features found within several of the PrEP apps. These apps could benefit from features in other sexual health promotion apps also. App entertainment and gamification have been found to improve user engagement and the reach of sexual health app interventions. The PrEP-related apps did not score well in terms of engagement, thus apps for improving PrEP utilisation may benefit from incorporating additional gaming and entertainment features. PrEP-related apps could also benefit from including more features that allow for app user communication with healthcare providers or educators, tracking of key personal sexual behaviours and locating other types of sexual healthcare services, such as HIV testing.

Limitations
Despite the novelty of this study and its promising findings, there are limitations that should be addressed. First, the terms used in the search strategy may not have been exhaustive of pertinent terms to use for finding PrEP-related apps, thus some relevant apps may have been missed. We may have inadvertently excluded apps that were not publicly accessible, such as apps requiring a PrEP prescription or participation in a specific research study. Also, excluding iPhone mobile apps from the analyses may have prevented us from identifying app functionality that differed from Android apps, yet we deem this is unlikely due to system operability requirements for both Apple and Android platforms.

Second, the app quality for each of the PrEP-related apps was assessed using the point of view of a researcher, not a user’s perspective. The MARS tool was created to be employed by researchers, academics and health professionals, not the end user. However, a user-tailored version of the MARS has been developed and should be used in future studies to assess PrEP-related apps using app users who identify as persons at-risk for HIV infection. Third, the scope of this study strictly focussed on PrEP-related mobile apps, excluding alternative types of mobile technologies, such as online widgets. Other mobile technology modalities may be as or more effective in accessing more persons to increase PrEP uptake. Future work should explore and evaluate other technology modalities in addition to mobile apps to provide a more comprehensive understanding of the potential of mobile technology to contribute to efforts for improving PrEP utilisation.

Also, the evolving nature of app stores and their app products presents a challenge to maintaining a consistent inventory of currently available PrEP-related apps. Not only does content within apps change occasionally, apps are constantly added to or removed from the Google Play store and Apple App store, and the search algorithms for these app stores are frequently modified to contend with changing user preferences. Thus, as this study can only provide a cross-sectional view of PrEP-related apps during the study period, iterative studies on PrEP-related apps should conduct more updated reviews and evaluations of mobile apps for PrEP uptake and adherence. Finally, we cannot make inference as to the actual effect of the PrEP apps and the association of such effect with their app features and rated quality, as this was not the purpose of our study. There needs to be additional research conducted to provide evidence in regards to the measured effect of these apps on the uptake of and adherence to PrEP.

Conclusions
With the low uptake of and adherence to PrEP among high-risk populations, mobile apps have demonstrated the potential for enhancing PrEP scale-up efforts. Although few PrEP-related apps are available in either the Google Play store or the Apple App store, the apps that are accessible are free, indicating no economic barriers for at-risk persons interested in these apps. Low installation totals for these apps and few apps being targeted for specific groups indicate there are missed opportunities in reaching app-using MSM, heterosexual active men and women and persons who inject drugs, which can be addressed through promotion campaigns and other interventions to increase PrEP use among high-risk groups. Most of the PrEP-related apps included in our analyses contained features to contribute to PrEP initiation, uptake and adherence, such as the provision of comprehensive information on PrEP and resources for identifying healthcare providers and clinics that offer PrEP services. Providing PrEP self-assessments is an area of improvement for currently available PrEP-related apps. Findings from the MARS assessment suggests that existing apps for the facilitation of PrEP uptake and adherence are of moderate quality and show some promise as avenues for increasing PrEP utilisation among populations at high risk of HIV infections.
Conflicts of interest
The authors declare that they have no conflicts of interest.

Acknowledgements
The author(s) disclosed receipt of the following financial support for the research, authorship, or publication of this article: J. D. Sharpe was supported, in part, by the Laney Graduate School at Emory University and the National Institute of General Medical Sciences (R25GM09644–3S1). The authors thank the following mobile app development companies and mobile app developers for making their mobile apps publicly and freely available: National Library of Medicine at NIH; JEL Creative, Inc.; Bowman Systems, LLC; ARC Ohio; Trillium Health; HIV prevention PEP and PrEP; emocha Mobile Health Inc.; PrEP SQUAD; PrEP SQUAD; HealthHIV; Ziyan Yang, Zhuyun Maggie Xiao and Mannan Lu.

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