

Utilization of Social Media for the Prevention and Control of HIV/AIDS: A Scoping Review

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Abstract: Social media has been used widely in public health for understanding health risks and intervening to improve health. However, the utilization of social media for HIV prevention and control interventions has not been clearly characterized. We conducted a scoping review on the utilization of social media for HIV prevention and control to identify gaps in the literature and highlight opportunities for future research and intervention. A comprehensive search of seven databases was performed: PubMed, Embase, CINAHL Complete (EBSCO), PsycInfo (EBSCO), Scopus, and WOS (Science Citation Index Expanded (SCI-EXPANDED)). The Preferred Reporting Items for Systematic Review and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) was used as a framework. A total of 790 articles were screened at the title and abstract level, and 78 were screened at the full-text level. Twenty-three articles met the eligibility criteria for review. We found that Facebook was still the most common social media service used to reach target populations. Lesbian, gay, bisexual and transgender (LGBT) individuals were the primary groups and were the most common targets of social media-based HIV prevention interventions. Outcomes of social media-based interventions, such as increased HIV testing, social networking and social support, condom use attitudes, behavioral skills, and research participation, were reported. Most social media-based interventions have emphasized HIV prevention, with fewer interventions focused on improving linkage to care and adherence to treatment among people living with HIV. Future studies may benefit from using social media for interventions to improve HIV-related outcomes in high-risk populations. This review highlights the potential and challenges of social media approaches for HIV/AIDS prevention and control.

Keywords: AIDS, HIV, prevention and control, social media

Introduction

Human immunodeficiency virus (HIV) infection remains a major global public health issue, although the estimated number of new infections decreased in the last decade from 2.6 million in 2009 to 1.5 million in 2020.¹ The COVID-19 pandemic has impacted the continuity of HIV services and efforts to halt the HIV epidemic to meet the 2030 goals set by UNAIDS.² In a 2019–2020 survey of 502 health facilities in 32 Asian and African countries, the Global Fund reported a 41% decrease in the HIV testing rate during the COVID-19 pandemic.³ In addition, access to and utilization of HIV referrals and testing services for the diagnosis of HIV or sexually transmitted infections decreased 37% in 2020 compared in 2019.³ UNAIDS recommends that HIV health services should continue to be available for people with and at risk of HIV, including people with access to prevention, care, treatment, and support.⁴ Magnani et al reported that COVID-19 not only affects the economy but also provides HIV/AIDS-related health care services such as outreach to at-risk groups, HIV testing, and treatment initiation.⁵ Disruptions in HIV service utilization need to be mitigated and recovered to ensure that prevention, care, treatment, and support for People Living with HIV (PLWH) are continuously available.

On the other hand, the COVID-19 pandemic has accelerated changes in behaviors and activities from in-person and face-to-face contact to virtual rooms or digital contact.⁶ The advancement of information and communication technology provides more opportunities for communication and connection, including through social media. Social media is a type of digital

communication and interaction media produced by Web 2.0 technology development that facilitates interactions among people through which they create, share, or exchange information and ideas online in virtual communities and in virtual networks.⁷ Public participation in social media has increased sharply in recent decades and has gained increased popularity, particularly among young adults.^{8,9} The COVID-19 pandemic has amplified the use of social media and digital platforms to communicate, share, and stay connected to each other. Even in the post-pandemic era, social media and digital technologies continue to develop and are present in almost all aspects of human life. In the public health sector, social media has been used for various purposes and goals, such as increasing knowledge of services, promoting specific behaviors, raising awareness of general health issues, fighting stigma, supporting growth and mutual support networks among at-risk groups, and providing answers or responding to particular questions or queries related to health matters.¹⁰ Health researchers have also increasingly used the social media has also for a range of professional purposes, including participant recruitment, content analysis, promotion of academic research, data mining, intervention or campaign implementation, engagement in collaboration, data collection, reporting research findings, accessing scientific resources, and information health management.¹¹ In the field of HIV research, using social media has covered various purposes, such as disseminating HIV information, encouraging HIV testing, and promoting ART adherence.¹² Social media development is growing rapidly, resulting in large pools of data that can be used to develop innovative interventions addressing HIV prevention and control. To date, the use of social media for HIV prevention and control has not been comprehensively mapped and characterized. Therefore, this paper aims to identify, explore, and summarize the current evidence of literature on the utilization of social media for the prevention and control of HIV. It is expected that the findings of this report will be helpful for healthcare professionals as well as health researchers concerned with this topic.

Method

Study Design

A scoping review was conducted to identify key gaps in the literature and to broadly scope the existing scientific and gray literature to provide a greater understanding of key constructs in HIV prevention and control interventions using social media. We developed the scoping review protocol following the methodological framework outlined by Arksey and O'Malley.¹³ This five-stage approach is described below. To ensure transparency and methodological rigor throughout this scoping review, this protocol followed the Preferred Reporting Items for Systematic Review and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) checklist. The following research question was the foundation for this scoping review: what is known from the published literature and gray literature about the utilization of social media in relation to the prevention and control of HIV/AIDS?

Eligibility Criteria

All the research studies (experimental, quasi-experimental, observational, qualitative) and gray literature (guidelines, conference papers and proceedings, government reports, community agency/group reports, editorials, policy documents, dissertation) containing concepts and information about social media used in the prevention and control of HIV/AIDS were included. We restricted the studies to those published between January 1, 2012, and December 31, 2021. The population studies were focused on people living with HIV and/or AIDS or populations at risk for HIV infection, including the general youth population, Men who Have Sex with Men (MSM), transgender, Commercial Sex Worker (CSW), and Persons who Inject Drugs (PWID). We excluded studies on HIV/AIDS populations aged younger than 16 years. We also restricted the language of the studies to English.

Search Strategy

We developed preliminary search strategies in consultation with an experienced librarian in the Taubman Health Science Library at the University of Michigan. The search strategy draws upon relevant terms or similar key words that are available in MeSH terms. Supplemental strategies were used to identify relevant systematic reviews that were excluded; however, the reference lists/included studies were reviewed, and all cited and cited references of all included articles were reviewed after the full-text screening. We searched from the following electronic databases: PubMed, Embase,

CINAHL Complete (EBSCO), PsycInfo (EBSCO), Scopus, and WOS (Science Citation Index Expanded (SCI-EXPANDED)). The syntax was adjusted according to the needs of each database. The search strategy and keyword of each data bases is shown in [Supplementary S1](#).

Study Selection

All retrieved studies were screened, and eligibility was determined based on the inclusion and exclusion criteria at the title and abstract levels. The eligibility criteria were continuously refined to ensure that all the criteria were met. The records selection process involved two layers of screening: (1) title and abstract and (2) full-text review. In both stages, two reviewers independently reviewed the articles and determined eligibility using the set inclusion/exclusion criteria. Throughout this process, both reviewers used Rayyan, a web online application tool for systematic reviews.¹⁴ The search strategy results and eligibility screening process are reported in detail using the PRISMA flow diagram for scoping reviews.¹⁵ The combined database search yielded 1519 records, 734 of which were removed prior to review. The title and abstract were screened based on the inclusion/exclusion criteria, and 78 records were retrieved for full-text assessment. The 23 final articles were deemed eligible for inclusion in the scoping review. A flowchart of the study selection process is provided in [Figure 1](#).

Data Extraction

Based on our research question, a standardized charting form was developed to capture relevant data in a matrix table. The following information was extracted from each article and entered into the form:

- Descriptive information about the studies; authors, year of publication, country of origin, and study design
- Type of social media used
- Outcomes and conclusion of the studies

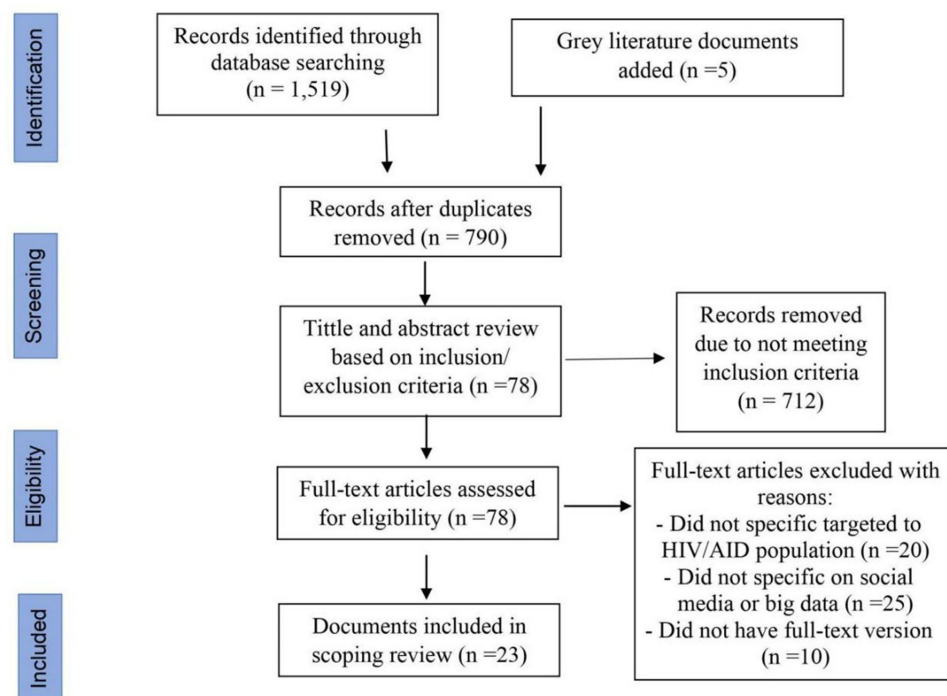


Figure 1 PRISMA flow diagram. Adapted from Tricco AC, Lillie E, Zarin W, et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): checklist and Explanation. *Ann Intern Med*. 2018;169(7):467–473. Creative Commons.¹⁵

Data Analysis and Synthesis

The data extracted from the data charting form were then explored following the thematic qualitative analysis method. Thematic analysis is a method for analyzing qualitative data that entails searching across a dataset to identify, analyze, and report repeated patterns.¹⁶ This analysis comprised six steps: 1) familiarizing with the data, 2) generating initial codes, 3) searching for themes, 4) reviewing themes, 5) defining and naming themes, and 6) producing the report.

Results

Study Included in the Study

A total of 790 unique articles were screened at the title and abstract level, and 78 were screened at the full-text level. Twenty-three articles met the eligibility criteria and were included in this scoping review (see [Figure 1](#)). All the included articles were original quantitative research articles. The study designs of the articles were as follows: randomized control trial/experimental (n = 10),^{17–26} cross-sectional survey (n = 8),^{27–34} retrospective study (n = 2),^{35,36} prospective study (n = 1),³⁷ comparative study (n = 1),³⁸ and case study (n = 1). The studies were carried out across 7 different countries, but the majority were conducted in the US (n = 12). Among the World Bank income groups (2021), 10 studies involved individuals from lower-middle income countries, and 13 studies involved individuals from high-income countries. All the included articles were published between 2012 and 2021, with the majority published in 2020 (n = 6). A summary of the publications included in this review is presented in [Table 1](#).

Use of Social Media for Sharing Information, Seeking Support, and Networking

Among the 23 included articles, 11 reported using social media mainly for surveying health or risky behavior related to HIV. Social media was utilized by users for sharing information, seeking information and support, and networking ([Table 2](#)). The types of social media used to obtain the data included social network communities such as Facebook, Google+, Reddit, and LinkedIn; microblogs such as Twitter; multimedia such as Instagram and YouTube; Skype; social messaging apps such as WeChat and WhatsApp; and unidentified networking sites or apps such as MySpace, Adam4Adam, ManHunt, Craigslist, BGC live, Grindr, ooVoo, Blued, and Tagged. Several studies have used multiple types of social media to collect data. The subjects involved in these studies were mostly MSM; the rest were health providers or community popular opinion leaders; and the texts were posted by the general public. The purpose of the survey was to determine the characteristics, prevalence, and patterns of various HIV-related social media posts to understand social media use and how it may be related to HIV risk behaviors. The findings of these studies highlighted the linkage between social media posts, tweets, or messages and patterns of HIV-related risk behaviors and sexual health,^{28,33,36} and an increase in behavioral risk conversations was associated with HIV incidence.^{35,40} Social media users used social media to arrange sexual hookups, seek sexual partners, and exchange sex for money, clothes, or drugs.^{17,34} Social media was also proven to be an effective means to learn clinical information and improve HIV-related knowledge, as reported by peer leaders and health care providers.^{21,31} In addition, studies have shown that social media posts could be used as a surveillance tool for identifying depressive emotion signs, opioid use disorders, and overdose for high-risk and hard-to-access populations.^{28,30,35}

Use of Social Media to Deliver Health Interventions to Change Health Behaviors

Among the 23 reviewed articles, 12 were related to interventional studies that targeted controlling for outcome variables. The contents of the social media health interventions were mostly related to sexual health, HIV prevention, and HIV testing. Two intervention studies related to recruitment were included in the Randomize Control Trial (RCT), and the rest related to retention in care and stress management. The outcomes of the reviewed studies were mostly related to condom usage to promote safe sex practices, followed by HIV knowledge, behavioral skills, retention in care, HIV testing, and depressive symptoms. The included studies reported significant findings in improving the studied outcomes; however, study limitations should be acknowledged to raise awareness for future research. Several of the study limitations included limited generalizability, reliance on self-report instruments, long retention times, and sample issues ([Table 3](#)).

Table 1 Summary of Publications Included in the Review (n = 23)

Author	Year	Study Sample	Study Aim	Study Design	Social Media Use	Key Findings	Country
Broaddus et al ¹⁷	2015	205 MSM (34 social media non-user, 171 social media user)	To examine the associations between social media use and sexual behavior among Black MSM.	A randomized trial	Generic social media sites (Facebook, MySpace, and Twitter), and hookup-focused sites (Adam4Adam, ManHunt, Craigslist, BGC, Grindr, and ooVoo)	MSM spent an average of 34 h per week on social media sites, 53% arranged sexual hookups online in the previous 3 months. Users of social media who arranged sexual hookups online engaged in more risky behaviors than non-users who did not arrange sexual hookups online.	USA
Bull et al ¹⁸	2012	1581 adolescents (Completed 2-month follow-up: 653 intervention, 439 control; Completed 6-month follow-up: 427 intervention, 377 control)	To determine whether STI prevention messages delivered via Facebook are efficacious in promoting condom use.	Cluster RCT	Facebook	Time by treatment effects were observed at 2 months for condom use (intervention 68% vs control 56%, $p=0.04$) and proportion of sex acts protected by condoms (intervention 63% vs control 57%, $p=0.03$).	USA
Cai et al ³⁵	2020	Tweets publicly posted by twitter users, 1350 tweets included keywords related to HIV (n = 487), heroin (n = 592), injection drug use (271), and opioids (505)	To detect, classify and characterize Twitter messages associated with opioid abuse, heroin injection drug use, and HIV risk behaviors and attitudes.	A retrospective analysis	Twitter	Data filtered and confirmed of 358 tweets were relevant, 41.9% (n = 150) were associated with HIV, 37.2% (n = 133) were associated with heroin IDU, and 20.9% (n = 75) were associated with opioid use disorder. In total, 32.7% (n = 117) of the relevant tweets in the dataset were in the pre period of the HIV outbreak, while 67.3% (n = 241) tweets were in the post period.	USA
Cao et al ²⁷	2017	2105 MSM	To examine the association between social media use and HIV testing behaviors among Chinese MSM.	cross-sectional study	Weibo, QQ, Gay mobile apps, WeChat	More than half of the respondents (58.14%, 1224/2105) reported HIV testing-related social media use. Men with HIV testing-related social media use was more likely to have had multiple sexual partners in the past 3 months (33.2% vs 27.02%, $X^2=9.6$, $P=0.01$), and have been recently tested for HIV (40.5% vs 26.15%, $X^2=48.6$, $P<0.001$).	China

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Table 1 (Continued).

Author	Year	Study Sample	Study Aim	Study Design	Social Media Use	Key Findings	Country
Cavazos-Rehg et al ²⁸	2019	681 general participants joined the survey, among which 582 were eligible (US resident, fluent in English, age ≥ 15 , ever used opioids).	To access and survey individuals currently misusing opioids in order to better understand their unique patterns of risk and risk behaviors.	Online survey	Reddit	The overdose risk group were more likely to be younger in age and female, and more likely to desire or be ready for treatment. The sexual risk group were more likely to be of a minority race/ethnicity, to desire or be ready for treatment, and to post more often on Reddit about opioid use.	USA
Chan et al ²⁹	2021	30,675 MSM from counties with higher and lower rates.	To examine the associations among tweets, in person communications, and HIV prevention and testing in regions with higher (vs lower) estimated rates of MSM.	Ecological analyses	Twitter	Hearing about PrEP and discussing PrEP use were positively correlated with actual PrEP use ($rs=0.17-0.61$, $BF10>100$) and discussing HIV testing was positively correlated with actual testing ($rs=16$, $BF10>100$). In counties with higher rates of MSM, tweet rates were directly associated with PrEP use and HIV testing ($rs=0.06$, $BF10>10$). Hearing about and discussing PrEP mediated the relations between tweet rates and PrEP use ($bi^*=0.01-0.05$, $BF10>100$) and between topics and PrEP use ($bi=-0.04-0.05$, $BF10>10$). Hearing about PrEP was associated with PrEP use, which was in turn associated with tweet rates ($bi=0.01$, $BF10>100$) and topics ($bi=-0.03-0.01$, $BF10>10$).	USA
Cuomo et al ³⁶	2020	257 messages about substance abuse and HIV	To assess social media messages about HIV, opioid use and injection drug use in order to understand how unstructured data can prepare public health practitioners for response to future outbreaks.	Retrospective analysis	Twitter	Messages about substance abuse and HIV were significantly related to HIV rates ($P < 0.001$) and opioid-related hospitalizations ($P = 0.037$).	USA

Dulli et al ¹⁹	2020	349 Youth Living with HIV (n=177, intervention), (n=172, control).	To test the effectiveness of a social media based structured support group intervention to promote HIV treatment adherence and retention, HIV knowledge, and social support among YLHIV.	Randomized Controlled Trial	Facebook	The probability of being retained in treatment did not differ significantly between the 2 study arms during the study. Retention was high at end line, with 75.7% (112/163) of intervention group participants and 83.4% (126/161) of control group participants active on treatment. HIV-related knowledge was significantly better in the intervention group at end line, but no statistically significant differences were found for ART adherence or social support. Intervention group participants overwhelmingly reported that the intervention was useful, that they enjoyed taking part, and that they would recommend it to other YLHIV.	Nigeria
Guo et al ²⁰	2020	300 people living with HIV and depression (PLWHD) were randomly assigned to an intervention or a control group in a 1:1 ratio.	To assess the efficacy of a WeChat-based intervention, Run4Love, among PLWHD in China.	A randomized controlled trial	WeChat	Participants in the intervention and control groups were comparable at baseline; about 91.3% (139/150), 88.3% (132/150), and 86.7% (130/150) participants completed the 3-, 6-, and 9-month follow-ups, respectively. At the 3-month follow-up, a significant reduction in CES-D score was observed in the intervention group (from 23.9 to 17.7 vs from 24.3 to 23.8; mean difference= -5.77, 95% CI -7.82 to -3.71; P<0.001; standard effect size d=0.66).	China
Iribarren et al ³⁸	2018	216 MSM and TGW	To analyze recruitment strategies seeking HIV negative MSM and TGW for a RCT for efficiency in [1] reaching eligible participants, [2] finding participants who would make and attend an enrollment appointment, and [3] determining relative time investments per successful recruitment.	Comparing recruitment strategies for RCT study between traditional approach (in-person) and social-media based (websites and apps).	Social media: Craigslist, Facebook, Twitter Apps: Adam4Adam, Grindr, Growlr, Hornet, Scruff, and Jack'd.	Social media-based strategies resulted in the highest number of individuals. Dating sites/apps reached large numbers of eligible participants. Internet dating and social media platforms for recruiting hard-to reach populations for research will remain essential and likely continue to be successful tools.	USA

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Table I (Continued).

Author	Year	Study Sample	Study Aim	Study Design	Social Media Use	Key Findings	Country
Jaganath et al ²¹	2012	Peer leaders represented Community Popular Opinion Leader (C-POL) MSM were recruited for social media training.	To evaluate the feasibility, acceptability, and preliminary effectiveness of using social media for peer-led HIV prevention, specifically, among African American and Latino MSM.	a longitudinal experimental study	Facebook	A new training curriculum that adapts the evidence-based C-POL method of HIV prevention to Facebook. The training included discussion and role playing exercises to integrate basic knowledge of HIV/AIDS, awareness of sociocultural HIV/AIDS issues in the age of technology, and communication methods for training peer leaders in effective, interactive social media-based HIV prevention	USA
Jones et al ²²	2017	516,498 Facebook users	To evaluate Facebook advertising to reach at-risk, predominately African American or Black women in higher HIV prevalence communities for an HIV prevention clinical trial, and to compare baseline characteristics to those recruited on-The-ground.	clinical trial	Facebook	A total of 516,498 Facebook users viewed the ads an average of four times, resulting in 37,133 clicks to the study website. Compared to 495 screened on-The ground, 940 were screened via Facebook ads, of these, half (n = 477, 50.74%) were high risk, and of those at risk, 154 were randomized into the 6-month clinical trial. Black women screened via Facebook twice compared to on-The-ground, the percentage at high risk was similar.	USA
Krueger et. al ²³	2016	556 MSM	An intervention delivered over Facebook, which aimed to increase HIV testing and prevention behaviors.	Correlational Study	Facebook	Younger age and non-gay identity were significantly associated with lower likelihood of getting tested. After controlling key behaviors and AIDS-related stigma, younger age remained significantly associated with decreased testing. Participants who engaged in discussions online about HIV testing were more likely to get tested, while AIDS-related stigma presented a significant barrier to testing.	Peru
Lelutiu-Weinberger et.al ²⁴	2015	41 Young MSM	To test the feasibility, acceptability, and preliminary efficacy of a live chat intervention delivered on Facebook in reducing condomless anal sex and substance use.	a pre-post experimental design with no control group.	Facebook	Participation in the intervention (n = 31) was associated with reductions of days of drug and alcohol use in the past month and instances of anal sex without a condom (including under the influence of substances), as well as increases in knowledge of HIV-related risks at 3-month follow-up.	USA

Li et.al ³⁰	2020	A large-scale MSM data set including 664,335 users and over 12 million posts was collected from the most popular MSM-oriented geosocial.	to predict multidimensional depressive emotions among MSM through social media with machine learning methods, which can achieve early detection of depressive emotions, and complement and extend traditional approaches to diagnose depression.	Descriptive analytics	Blued, Twitter	MSM with depressive emotions published posts with more depressive words, negative words and positive words than the MSM without depressive emotions. MSM with depressive emotions showed more significant depressive symptoms, such as insomnia, depressive mood, and suicidal thoughts. Automated depressive emotion screening via social media is a feasible and efficient measure for both the general population and hard-to-access populations.	China
Manciuc et. al ³¹	2018	125 Romanian HIV/AIDS clinical providers	To determine existing and upcoming continuing medical education and capacity-building needs surrounding HIV/AIDS, and to indicate the frequency of using social media.	Descriptive online survey	Facebook, Instagram, LinkedIn, WhatsApp, Skype,	Social media are currently popular and perceived to be useful for learning clinical information. Providers indicated Facebook and WhatsApp were the most common social media platforms, with 62% and 45% reporting daily use, respectively. Providers who used one media platform were significantly more likely to use another social media platform ($p < 0.05$).	Romania
Nielsen et. al ³²	2017	Over 100,000 geo-located tweets	Assessed social media data from Twitter to inform communication campaigns to promote HIV testing and reduce discrimination related to HIV/AIDS.	Development social media monitoring tools and methods to capture the Brazilian population's perceptions of HIV and AIDS, HIV prevention, and discrimination towards HIV and AIDS and key populations to support programmatic HIV prevention activities in Brazil.	Twitter	Clinical HIV test data was collected monthly from the city of Curitiba and compared to the number of tweets mapped to the city showing a moderate positive correlation ($r = 0.39$). The potential of social media as a proxy for HIV testing uptake with higher frequency and higher spatial granularity of service delivery data, enabling comparisons with the social media data.	Brazil
Ovalle et. al ³³	2021	51 MSM	To evaluate the practicality of social media as an intervention modality through social media data to identify health risk behavior in a sample of MSM.	Survey	Twitter, Facebook, MSM specific social networks websites.	The social media data were correlated with offline sexual health and substance use, verified through biological testing. The results validate public health interventions can indeed use social media-based systems to successfully determine offline health risk behaviors.	USA

(Continued)

Table 1 (Continued).

Author	Year	Study Sample	Study Aim	Study Design	Social Media Use	Key Findings	Country
Patel et al ³⁹	2016	102 YMCSM and TW	To understand social media use and how it may relate to HIV risk behaviors to inform social media-based interventions.	Cross-sectional survey	Facebook, Twitter, Google+, Adam4Adam, Tagged, Grindr, BGC Live	All participants reported having at least one social media profile, with most having multiple profiles (83.3%). The vast majority (87.3%) accessed the Internet and social media sites multiple times per day. Over a third (34.3%) primarily used sexual networking sites to meet new people offline versus about half (52%) that used more general social networking sites (eg, Facebook, Twitter) to meet new people, and a smaller proportion (13.7%) did not use social media to meet new individuals. Of 56.7% used social media to seek sexual partners, nearly 20% used it to exchange sex for money or clothes, and almost 10% used it to exchange sex for drugs.	USA
Sun et al ²⁵	2017	196 college students (100 control, 96 intervention)	To compare a peer-led, social media-delivered, safer sex intervention with a sexual health website.	RCT	Facebook	Participants in the intervention group reported more satisfying online experiences ($P<0.001$) and a higher level of online-visiting frequency ($P<0.001$). They also had more positive comments when compared with the control group. For outcome evaluation, within-group analysis showed significant improvement in condom use attitude ($P=0.02$) and behavioral skills ($P<0.001$) in the intervention group, but not in the control group.	China
van Heerden et al ⁴⁰	2020	654,373 tweets, 90,410 Instagram posts and 14,133 YouTube videos with 1121 comments.	1) To describe the prevalence and characteristics of various social technologies within South Africa 2). To analyze the prevalence and patterns of social media use related to HIV risk in South Africa using Twitter, Instagram, and YouTube as a case study. 3) To map and statistically tested differences in HIV-related social media posts within regions of South Africa.	Case studies for the proposed health surveillance approach.	Twitter, Instagram, YouTube	Of all tweets, 4524 (0.7%) were found to be related to HIV and AIDS. The percentage was similar for Instagram 95 (0.7%) but significantly lower for YouTube 18 (0.1%). It was found regional differences in prevalence and use of social media related to HIV. The social media platforms people access on these devices and the content they create all hold potential as sources of health data.	South Africa

Young et al ²⁶	2015	556 Peruvian MSM were randomly assigned to intervention groups (N=278) or control groups (N=278).	To examine the efficacy of the Harnessing Online Peer Education (HOPE) social media intervention to increase HIV testing among MSM in Peru.	Cluster RCT	Facebook	The HOPE Peru social media intervention increased the odds of HIV testing by a factor of almost three compared with the control condition.	Peru
Yun et al ³⁷	2019	999 MSM for the model construction. Of these, 667 MSM were randomly placed in the training dataset, and 332 were randomly placed in the validation dataset.	To develop a social media platform-based HIV risk prediction tool for MSM in China based on an independent MSM cohort to help medical providers determine target populations for counseling and risk reduction treatments.	Prospective cohort study	WeChat	The characteristics of the sample between the training dataset and the validation dataset were similar. The risk prediction model identified the following predictors for HIV seroconversion: the main venue used to find male sexual partners, had condomless receptive or incentive anal intercourse and used rush poppers. The model was well calibrated. The bootstrap C-index was 0.75 (95% CI 0.65–0.85) in the training dataset, and 0.60 (95% CI 0.45–0.74) in the validation dataset. The calibration plots showed good agreement between predicted risk and the actual proportion of no HIV infection in both the training and validation datasets.	China

Table 2 Use of Social Media for Sharing Information, Seeking Support, and Networking

Purpose of social media use	Social media tool
<p>Sharing information:</p> <ul style="list-style-type: none"> - deliver messages related to HIV prevention among high-risk populations through peer educators. - post messages related to health risk behaviors, HIV, opioids, IDU, depressive emotions. - posts indicated risk behaviors related to overdose and HIV/HCV risk group (injection risk, history of drug overdose, inconsistent condom use, number of sexual partners, exchange of sex for drugs). - messages related to opioids, intravenous drug use (IDU) and HIV. - Texts, videos, and emojis related health behavior risk - geolocation that linkage to users, words posted to social media. - HIV infection risk assessment tool built on the most popular social media platform in China. <p>Seeking support:</p> <ul style="list-style-type: none"> - learning clinical information - meet new individuals and seek sexual partner. <p>Networking:</p> <ul style="list-style-type: none"> - to arrange sexual hookup - MSM-specific social networking - to exchange sex for money or clothes, and for drugs. 	<p>Facebook (n=13)</p> <p>Twitter (n=10)</p> <p>WeChat (n=3)</p> <p>Adam4Adam (n=3)</p> <p>Grindr (n=3)</p> <p>Instagram (n=2)</p> <p>Craigslist (n=2)</p> <p>BGC Live (n=2)</p> <p>MySpace (n=1)</p> <p>ManHunt (n=1)</p> <p>ooVoo (n=1)</p> <p>Reddit (n=1)</p> <p>LinkedIn (n=1)</p> <p>WhatsApp (n=1)</p> <p>Skype (n=1)</p> <p>Google+ (n=1)</p> <p>Tagged (n=1)</p> <p>Hornet (n=1)</p> <p>Scruff (n=1)</p> <p>Jack'd (n=1)</p> <p>Blued (n=1)</p> <p>YouTube (n=1)</p> <p>Weibo (n=1)</p> <p>QQ (n=1)</p> <p>Growlr (n=1)</p> <p>Gaymobileapps (n=1)</p>

Table 3 Content of Social Media Intervention, Study Outcomes, and Limitations

Content of social media intervention	Study outcomes	Study limitation
Sexual health ¹⁸	Sex acts protected by condoms	<ul style="list-style-type: none"> - Relied on self-report instrument. - Lack of linking social media pages to a clinic delivery of sexual health. - Retention declined over time.
Promotion of HIV testing ²⁷	HIV testing	<ul style="list-style-type: none"> - Overestimation of the rate of social media use. - Low response and completion rates. - Results are not necessarily applicable for rural areas.
Social support and HIV-related knowledge and treatment literacy to promote retention in HIV care ¹⁹	Retained in treatment, HIV-related knowledge, ART adherence, and social support.	<ul style="list-style-type: none"> - Limited in generalization. - The context of HIV service delivery changed during the study implementation.
Cognitive behavioral stress management ²⁰	Depressive symptoms	<ul style="list-style-type: none"> - Limited in generalization - Intervention contamination. - Low completion rates.
Recruitment for study participant ³⁸	Participation in RCT study	<ul style="list-style-type: none"> - Convenience sampling affects. - Fastly moving online technology.

(Continued)

Table 3 (Continued).

Content of social media intervention	Study outcomes	Study limitation
Advertising to reach participant for clinical trial study ²²	Participation in the clinical trial.	- Unrecognized the time spent for discussion, composing the ads, and creating photos.
HIV prevention intervention ²⁴	Drug and alcohol use, anal sex without a condom, and HIV knowledge.	- Small sample size - Lack of a control group. - Undetermined the durability of the intervention effects.
Peer education based on Information-Motivation-Behavioral Skills (IMB) that included safe sex knowledge, motivation, and behavioral skills ²⁵	Condom use and behavioral skills	- Rely on self-reports. - Short time of intervention - Lacks follow-up assessments. - Contamination issue
Communication, messages, chats, and wall posts about HIV prevention and testing ²⁶	HIV testing	- Limited in generalization - Self-reported items - Low power of the study.

Discussion

The main purpose of this study was to review the utilization of social media for the prevention and control of HIV. This review describes the broad usage of social media related to HIV prevention and treatment for the global population, especially for MSM, youth, and individuals with HIV or who are at risk for HIV infection. To our knowledge, this is the first review to evaluate the state of research on social media utilization for HIV prevention and control in the context of the general population; these methods are sustainable and cost-effective ways to increase behavioral change and may also reach hidden populations.^{41,42}

Most related studies have used social network sites (eg, Facebook pages and Twitter) as tools for seeking and sharing information and support. Facebook is the most widely used online social network and could be highly relevant for people who seek and share information about health, which influences health behavior.⁴³ Facebook has exceeded 2.98 billion monthly active users as of the first quarter of 2023.⁴⁴ Facebook has been used by several health organizations to brand, advertise, and promote health.⁴⁵ Despite Facebook having great potential as a communication tool, understanding the features offered by Facebook and its benefits to organizations and users is needed. Facebook and YouTube have been found to be effective at facilitating intervention and education to improve health behavior, and Twitter and Instagram have been used more to observe trends in changes in health behavior.⁴⁶ One review study also suggested that Facebook was effective as a social network intervention for increasing physical activity in young Chinese adults.⁴⁷

The internet and social media have been increasingly utilized by the population, particularly youth worldwide,⁴⁸ including in low-middle income nations. The Pew Research Center reported that internet and social media use have continued to rise in low- and middle-income countries from 2013 to 2018, while in advanced economies, countries have remained flat.⁴⁹ Hagg suggested that social media has been used for health-related purposes and has been used to facilitate disease surveillance, mass communication, health education, knowledge translation, and collaboration among health providers in low- and middle-income countries.⁵⁰ To the purpose of HIV prevention, social media offers the ability to deliver HIV prevention programs to young people in a cost-effective manner through a medium they already utilize. Social media platforms enable public health campaigns to reach more varied audiences, reduce total costs, create possibilities for recurrent exposure to messages, collect real-time feedback, and promote direct engagement with messaging materials.⁵¹

Studies have demonstrated that social media could encourage engagement.⁵² According to our review of the literature, social media could increase social support and HIV prevention and control information. This increase in health access is especially important for PLWH, who might encounter barriers to in-person care or prevention, as well as rural populations or young MSM.^{53,54} For example, people who engage in social media use in relation to HIV testing might receive extensive information about the testing site, hours of operation, and available services, which may

encourage HIV testing.⁵⁵ In the context of Pre-exposure prophylaxis (PrEP), social media has promoted and encouraged PrEP usage, which influenced HIV-related tweets about other messages on other social media platforms and provided a variety of methods for communicating and disseminating accurate PrEP information and services to certain groups.^{29,56}

As a challenge, numerous stakeholders, including patients, healthcare professionals, the general population, and government and nongovernmental groups, are increasingly using social media for health-related objectives in low- and middle-income countries (LMICs). In LMICs, governmental and nongovernmental groups have been the primary providers of social media for health, although end-users were often young or marginalized.⁵⁰

With the rise of digital and mobile technologies, interactions on a large scale became easier for individuals than ever before. One individual can now speak to many, and instant feedback is a possibility. With social networks in digital spaces, there are increased possibilities to promote the prevention and control of HIV/AIDS massively, which could be integrated into a wider community strategy. One of the great promises of social media interventions is the potential to reach geographically diverse and isolated individuals.⁵⁷

Considering that HIV prevention and control are influenced by multiple variables, we also assessed the intervention's effect on these variables. The presence of people on social media may be related to avoiding stigma, even though the social media intervention did not directly address this variable. Given that stigma is associated with HIV risk behavior, such as homosexuality, our findings offer relevant directions for further research. Importantly, participation in social media was related to an increase in knowledge regarding sex and drug use risks but was still insufficient because of self-reported willingness on self-efficacy for change.

Study Limitations

This review has its own limitations. First, it was limited to English-language publications and could not include foreign-language studies. Second, the majority of the included studies were descriptive and exploratory. Finally, due to the diversity of intervention types and outcome measures, we found it difficult to combine certain data. Furthermore, further research should investigate the effects of social media interventions through clinical trials.

Conclusion

Social media has been widely used for sharing information, seeking information and support, and networking. Facebook was the most type of social media used to extend a social network community. Activities in social media have produced a large amount of data that can be analyzed and utilized to understand people's health behavior. The contents of the social media health interventions were mostly related to sexual health, HIV prevention, and HIV testing. Social media-based health interventions could help both health care providers and health researchers to develop interventions and initiatives to improve the health outcomes of hard-to-reach populations, such as PLWH. Although a number of studies in this field have been growing recently, much evidence regarding the utilization of social media to address HIV prevention and control issues as well as to improve the health outcome of this particular population is still needed.

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References

1. UNAIDS. fact sheet 2021: Global HIV statistics; 2021.

2. UNAIDS. COVID-19 and HIV: Moment, epidemics, opportunities, how to seize the moment to learn, leverage and build a new way forward for everyone's health and rights; 2020.
3. The Global Fund. The impact of covid-19 on HIV, TB and Malaria services and systems for health: A snapshot from 502 health facilities across Africa and Asia; 2021.
4. What people living with HIV need to know about HIV and COVID-19; 2020.
5. Magnani RJ, Wirawan DN, Sawitri AAS, et al. The short-term effects of COVID-19 on HIV and AIDS control efforts among female sex workers in Indonesia. *BMC Womens Health*. 2022;22(1):21. doi:10.1186/s12905-021-01583-z
6. Pandya A, Lodha P. Social connectedness, excessive screen time during COVID-19 and mental health: A review of current evidence. *Front Hum Dyn*. 2021;3:684137. doi:10.3389/fhumd.2021.684137
7. Smith M-K, Denali DL. Social media in health education, promotion, and communication: reaching rural Hispanic populations along the USA/Mexico border region. *J Racial Ethnic Health Disp*. 2014;1(3):194–198. doi:10.1007/s40615-014-0025-3
8. Young People NA. *Social Media, and Impacts on*. Well-being: Clark University; 2020.
9. Sai M, Sreekanth K. Influence of social media on millennials. *J Pos School Psych*. 2022;6(4):6996–7004.
10. European Centre of Disease Prevention Programmes and Control. *Utilising Social Media for HIV/STI Prevention Programmes Among Young People for Public Health Programme Managers*. Stockholm: European Centre of Disease Prevention Programmes and Control; 2017.
11. Dol J, Tutelman PR, Chambers CT, et al. Health researchers' use of social media: Scoping review. *J Med Internet Res*. 2019;21(11):e13687. doi:10.2196/13687
12. Cao B, Gupta S, Jiangtao W, et al. Social Media Interventions to Promote HIV Testing, Linkage, Adherence, and Retention: systematic Review and Meta-Analysis. *J Med Internet Res*. 2017;19(11):e394. doi:10.2196/jmir.7997
13. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. *Int J Soc Res Methodol*. 2005;8(1):19–32. doi:10.1080/1364557032000119616
14. Ouzzani M, Hammady H, Fedorowicz Z, Elmagarmid A. Rayyan-a web and mobile app for systematic reviews. *Syst Rev*. 2016;5(1):210. doi:10.1186/s13643-016-0384-4
15. Tricco AC, Lillie E, Zarin W, et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): checklist and Explanation. *Ann Intern Med*. 2018;169(7):467–473. doi:10.7326/M18-0850
16. Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol*. 2006;3(2):77–101. doi:10.1191/1478088706qp063oa
17. Broadbudd MR, DiFranceisco WJ, Kelly JA, St Lawrence JS, Amirkhanian YA, Dickson-Gomez JD. Social media use and high-risk sexual behavior among black men who have sex with Men: A three-city study. *AIDS & Behav*. 2015;19:S90–S7. doi:10.1007/s10461-014-0980-z
18. Bull SS, Levine DK, Black SR, Schmiede SJ, Santelli J. Social media-delivered sexual health intervention: a cluster randomized controlled trial. *Am J Prev Med*. 2012;43(5):467–474. doi:10.1016/j.amepre.2012.07.022
19. Dulli L, Ridgeway K, Packer C, et al. A social media-based support group for youth living with HIV in Nigeria (SMART Connections): randomized controlled trial. *J Med Internet Res*. 2020;22(6):e18343. doi:10.2196/18343
20. Guo Y, Hong YA, Cai W, et al. Effect of a WeChat-Based intervention (Run4Love) on depressive symptoms among people living with HIV in China: a randomized controlled trial. *J Med Internet Res*. 2020;22(2):e16715. doi:10.2196/16715
21. Jaganath D, Gill HK, Cohen AC, Young SD. Harnessing online peer education (HOPE): integrating C-POL and social media to train peer leaders in HIV prevention. *AIDS Care Psych Socio-Med Aspects*. 2012;24(5):593–600.
22. Jones R, Lacroix L, Porcher E. Facebook advertising to recruit young, Urban Women into an HIV prevention clinical trial. *AIDS & Behav*. 2017;21(11):3141–3153. doi:10.1007/s10461-017-1797-3
23. Krueger EA, Chiu CJ, Menacho LA, Young SD. HIV testing among social media-using Peruvian men who have sex with men: correlates and social context. *AIDS Care Psych Socio-Med Aspects*. 2016;28(10):1301–1305.
24. Lelutiu-Weinberger C, Pachankis JE, Gamarel KE, Surace A, Golub SA, Parsons JT. Feasibility, Acceptability, and Preliminary Efficacy of a Live-Chat Social Media Intervention to Reduce HIV Risk Among Young Men Who Have Sex With Men. *AIDS Behav*. 2015;19(7):1214–1227. doi:10.1007/s10461-014-0911-z
25. Sun WH, Wong CKH, Peer-Led WWCWA. Social Media-Delivered, Safer Sex Intervention for Chinese College Students: randomized Controlled Trial. *J Med Internet Res*. 2017;19(8):e284. doi:10.2196/jmir.7403
26. Young SD, Cumberland WG, Nianogo R, Menacho LA, Galea JT, Coates T. The HOPE social media intervention for global HIV prevention in Peru: a cluster randomised controlled trial. *Lancet HIV*. 2015;2(1):e27–32. doi:10.1016/S2352-3018(14)00006-X
27. Cao B, Liu C, Durvasula M, et al. Social Media Engagement and HIV Testing Among Men Who Have Sex With Men in China: a Nationwide Cross-Sectional Survey. *J Med Internet Res*. 2017;19(7):e251. doi:10.2196/jmir.7251
28. Cavazos-Rehg P, Grucza R, Krauss MJ, et al. Utilizing social media to explore overdose and HIV/HCV risk behaviors among current opioid misusers. *Drug Alcohol Depend*. 2019;205:107690. doi:10.1016/j.drugalcdep.2019.107690
29. Chan MS, Morales A, Zlotorzynska M, et al. Estimating the influence of Twitter on pre-exposure prophylaxis use and HIV testing as a function of rates of men who have sex with men in the United States. *Aids*. 2021;35(Suppl 1):S101–S109. doi:10.1097/QAD.0000000000002838
30. Li Y, Cai M, Qin S, Lu X. Depressive Emotion Detection and Behavior Analysis of Men Who Have Sex With Men via Social Media. *Front Psych*. 2020;11:11. doi:10.3389/fpsy.2020.00011
31. Manciu C, Levandowski BA, Muir E, Radulescu A, Barbosu M, Dye TD. Access to digital and social media among Romanian HIV/AIDS clinical providers. *Global Health Action*. 2018;11(1):1513445. doi:10.1080/16549716.2018.1513445
32. Nielsen R, Luengo-Oroz M, Mello M, Paz J, Pantin C, Erkkola T. Social Media Monitoring of Discrimination and HIV Testing in Brazil, 2014-2015. *AIDS & Behav*. 2017;21:114–120. doi:10.1007/s10461-017-1753-2
33. Ovalle A, Goldstein O, Kachuee M, et al. Leveraging social media activity and machine learning for HIV and substance abuse risk assessment: development and validation study. *J Med Internet Res*. 2021;23(4):e22042. doi:10.2196/22042
34. Patel V, Maszyukova M, Sutton D, Horvath K, Patel VV, Horvath KJ. Social Media Use and HIV-Related Risk Behaviors in Young Black and Latino Gay and Bi Men and Transgender Individuals in New York City: implications for Online Interventions. *J Urban Health*. 2016;93(2):388–399. doi:10.1007/s11524-016-0025-1
35. Cai M, Shah N, Li J, et al. Identification and characterization of tweets related to the 2015 Indiana HIV outbreak: a retrospective infoveillance study. *PLoS One*. 2020;15(8):e0235150. doi:10.1371/journal.pone.0235150

36. Cuomo RE, Cai M, Shah N, et al. Characterising communities impacted by the 2015 Indiana HIV outbreak: a big data analysis of social media messages associated with HIV and substance abuse. *Drug Alcohol Rev.* 2020;39(7):908–913. doi:10.1111/dar.13091
37. Yun K, Xu J, Leuba S, et al. Development and Validation of a Personalized Social Media Platform-Based HIV Incidence Risk Assessment Tool for Men Who Have Sex With Men in China. *J Med Internet Res.* 2019;21(6):e13475. doi:10.2196/13475
38. Iribarren SJ, Ghazzawi A, Sheinfl AZ, et al. Mixed-method evaluation of social media-based tools and traditional strategies to recruit high-risk and hard-to-reach populations into an HIV prevention intervention study. *AIDS & Behav.* 2018;22(1):347–357. doi:10.1007/s10461-017-1956-6
39. Patel VV, Sutton D, Stein M. Social media use and HIV risk behaviors in young men who have sex with men of color in New York city: Implications for outreach and prevention. *J Gen Intern Med.* 2013;28:S183–S4.
40. van Heerden A, Young S, Park CS. Use of social media big data as a novel HIV surveillance tool in South Africa. *PLoS One.* 2020;15(10). doi:10.1371/journal.pone.0239304
41. Latkin CA, Davey-Rothwell MA, Knowlton AR, Alexander KA, Williams CT, Boodram B. Social Network Approaches to Recruitment, HIV Prevention, Medical Care, and Medication Adherence. *J Acquired Immune Deficiency Synd.* 2013;63:S54–S8.
42. Ghosh D, Krishnan A, Gibson B, Brown SE, Latkin CA, Altice FL. Social network strategies to address HIV prevention and treatment continuum of care among at-risk and HIV-infected substance users: A systematic scoping review. *AIDS Behav.* 2017;21(4):1183–1207. doi:10.1007/s10461-016-1413-y
43. Nabi RL, Prestin A, So J. Facebook friends with (health) benefits? Exploring social network site use and perceptions of social support, stress, and well-being. *Cyberpsychol Behav Soc Netw.* 2013;16(10):721–727. doi:10.1089/cyber.2012.0521
44. Dixon SJ Facebook: Quarterly number of MAU (monthly active users) worldwide 2008-2023: Meta Platforms Statista; 2023 Available from: <https://www.statista.com/statistics/264810/number-of-monthly-active-facebook-users-worldwide/>. Accessed May 8, 2024.
45. Park H, Rodgers S, Stemmler J. Health Organizations' Use of Facebook for Health Advertising and Promotion. *J Interact Adve.* 2011;12(1):62–77. doi:10.1080/15252019.2011.10722191
46. Ghahramani A, de Courten M, Prokofieva M. "The potential of social media in health promotion beyond creating awareness: an integrative review". *BMC Public Health.* 2022;22(1):2402. doi:10.1186/s12889-022-14885-0
47. Lau PWC, Wang JJ, Ransdell LL, Shi L. The effectiveness of Facebook as a social network intervention to increase physical activity in Chinese young adults. *Front Public Health.* 2022;10:912327. doi:10.3389/fpubh.2022.912327
48. Villanti AC, Johnson AL, Ilakkuvan V, Jacobs MA, Graham AL, Rath JM. Social Media Use and Access to Digital Technology in US Young Adults in 2016. *J Med Internet Res.* 2017;19(6):e196. doi:10.2196/jmir.7303
49. Poushter J, Bishop C, Chwe H Social Media Use Continues To Rise in Developing Countries, but Plateaus Across Developed Ones; 2018.
50. Hagg E, Dahinten VS, Currie LM. The emerging use of social media for health-related purposes in low and middle-income countries: a scoping review. *Int J Med Inform.* 2018;115:92–105. doi:10.1016/j.ijmedinf.2018.04.010
51. Heldman AB, Schindelar J, Weaver JB III. Social media engagement and public health communication: Implications for public health organizations being truly "Social". *Public Health Rev.* 2013;13(35).
52. Health Resources and Services Administration HIV/AIDS Bureau. *Training Manual: Innovative Approaches to Engaging Hard-to-Reach Populations Living with HIV/AIDS into Care.* U.S. Department of Health and Human Services.; 2013.
53. Christopoulos KA, Das M, Colfax GN. Linkage and retention in HIV care among men who have sex with men in the United States. *Clin Infect Dis.* 2011;52(Suppl 2):S214–22. doi:10.1093/cid/ciq045
54. Mugavero MJ, Amico KR, Horn T, Thompson MA. The state of engagement in HIV care in the United States: from cascade to continuum to control. *Clin Infect Dis.* 2013;57(8):1164–1171. doi:10.1093/cid/cit420
55. Chen L, Shi J. Social support exchanges in a social media community for people living with HIV/AIDS in China. *AIDS Care.* 2015;27(6):693–696. doi:10.1080/09540121.2014.991678
56. Kudrati SZ, Hayashi K, Taggart T. Social Media & PrEP: a Systematic Review of Social Media Campaigns to Increase PrEP Awareness & Uptake Among Young Black and Latinx MSM and Women. *AIDS Behav.* 2021;25(12):4225–4234. doi:10.1007/s10461-021-03287-9
57. Chandler R, Hernandez N, Guillaume D, Grandoit S, Branch-Ellis D, Lightfoot M. A community-engaged approach to creating a mobile HIV prevention app for black women: focus group study to determine preferences via prototype demos. *JMIR Mhealth Uhealth.* 2020;8(7):e18437. doi:10.2196/18437