



Considerations and recommendations for mHealth interventions for substance use among Sexual and Gender Minority (SGM) individuals: A narrative review of the past 5 years

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Abstract

Purpose of Review The prevalence of problematic substance use is disproportionately higher among sexual and gender minority (SGM) adults compared to adults in the general population. mHealth as a treatment modality could reduce barriers to accessing substance use treatments among SGM populations. Through a qualitative literature search, the current narrative review aimed to understand the lived experiences of SGM individuals who use substances and to synthesize recommendations made in the literature to inform future mHealth interventions.

Recent Findings Positive and negative reinforcement motives were prominent reasons for substance use, which included SGM identity expression and conformity motives. Individual- and system-level treatment barriers included a lack of safe and nonjudgmental environment, shame and stigma, and limited knowledge about treatment options. Barriers were directly linked to the reported substance use treatment needs in this population.

Summary On-demand app features, real-time intervention and assessment, and anonymity should be considered in future mHealth trials.

Keywords Sexual and gender minority · LGBTQ · Addiction · Substance use · Treatment · mHealth

Introduction

Sexual and gender minority (SGM) individuals are those who identify as, but not limited to, lesbian (L), gay (G), bisexual (B), queer, and/or asexual (i.e., sexual minority), transgender (T), and/or nonbinary (i.e., gender minority) [1, 2]. The most recent Gallup survey in 2022 reported that

7.2% of the adults in the United States (US) self-identified as lesbian, gay, bisexual, transgender (LGBT), or something else other than heterosexual [3]. The prevalence of substance use is disproportionately higher among SGM adults compared to general population. For example, in the National Survey on Drug Use and Health 2020, the prevalence of having a substance use disorder was twice as high for LGB adults versus the general population (34.2% vs 15.4%, respectively) [4]. Further, substance use (i.e., not just those with substance use disorders) is associated with several other physical and behavioral health concerns among SGM individuals, such as unprotected sex [5, 6], nonadherence to HIV medication [7], and partner abuse [8]. Therefore, there is a critical need to develop interventions to reduce problematic substance use among this vulnerable population.

Previous studies have found promising results when using behavioral interventions for the treatment of problematic substance use in the SGM population [9••]. However, the majority of extant studies have focused on specific substances such as alcohol, tobacco, or methamphetamine, and most study samples have consisted of

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sexual minority men [9••]. Further, multiple factors may hinder enrollment in substance use treatment for SGM individuals, such as a lack of substance use programs tailored to the needs of the SGM population [10]. SGM individuals anticipate discrimination and rejection in treatment [11]. This finding is aligned with the Minority Stress Model that posits that behavioral health disparities in SGM populations are explained by the experience of repeated prejudicial events, expectations of discrimination and rejection, concealment of SGM status, and internalized stigma [12]. Indeed, a previous study reported that SGM individuals suffer discrimination while undergoing substance use treatment, which in turn negatively impacted recovery [13]. Moreover, the stigma associated with both SGM identity and substance use may explain why confidentiality is a major concern for this population [14, 15••]. Given these multiple barriers, satisfaction and retention in traditional substance use programs is lower among SGM individuals as compared to non-SGM individuals [16]. In this context, interventions provided through mobile devices (e.g., mHealth) may be suitable to address the needs of this vulnerable population to increase access. Indeed, a recent review on virtual and web-based digital health interventions targeting mental health issues or tobacco use demonstrated a preference for digital treatment programs among SGM individuals [15••]. Comparable treatment adherence rates were reported between SGM and non-SGM individuals, and significant improvement in the indices of emotional difficulties (e.g., depression) and tobacco use among SGM individuals were also found [15••], further supporting the potential for mHealth modality.

There are only a few mHealth trials that have been conducted to address problematic substance use among SGM individuals. A three-arm randomized control trial that examined the efficacy of a text-based methamphetamine intervention found a reduction in the frequency of having unprotected sex and having sex under the influence of methamphetamine among those randomized to active treatment conditions (from baseline to 9-months post randomization) [17]. In a small pilot mHealth study for alcohol use among 8 men who have sex with men (MSM), sending text messages to increase safe sex practices and reduce alcohol use led to reduced heavy drinking frequency and an increase in self-efficacy related to safe sex [18]. However, mHealth substance use intervention trials among other SGM subpopulations who use various types of substance are extremely limited. Technology could be leveraged to address the diversity of SGM subpopulations enrolling in treatment, improve retention rates, and maximize treatment effectiveness. Although its efficacy and acceptability have been supported in the general population [19••], mHealth substance use interventions among SGM individuals remain scant [15••].

Understanding the needs of SGM populations regarding substance use treatment could inform the development of future treatments, including interventions that leverage mHealth. This narrative review aims to better understand the lived experiences of SGM individuals who use substances and to identify potential targets that could be addressed in an mHealth intervention for substance use tailored to this population. To the best of our knowledge, there is no known mHealth literature that critically assesses and synthesizes perspectives, processes, and contextual factors of substance use and treatment needs among SGM individuals that can be effectively captured via a qualitative approach [20]. Thus, we reviewed the literature of qualitative studies published in the last few years to summarize extant qualitative findings on the SGM adults' unique needs for substance use treatment and recommendations made in the literature to identify areas of improvement. We also discuss considerations for future mHealth interventions targeted to this group. The goal of this narrative review is to answer the following: (1) What are the contextual factors associated with problematic substance use among SGM adults with lived experiences? (2) What are the unique needs of SGM adults who engage in problematic substance use? Problematic substance use was broadly defined as the use of any illicit substances and/or use of other substance for different reasons other than as prescribed or that led to adverse intrapersonal or interpersonal consequences.

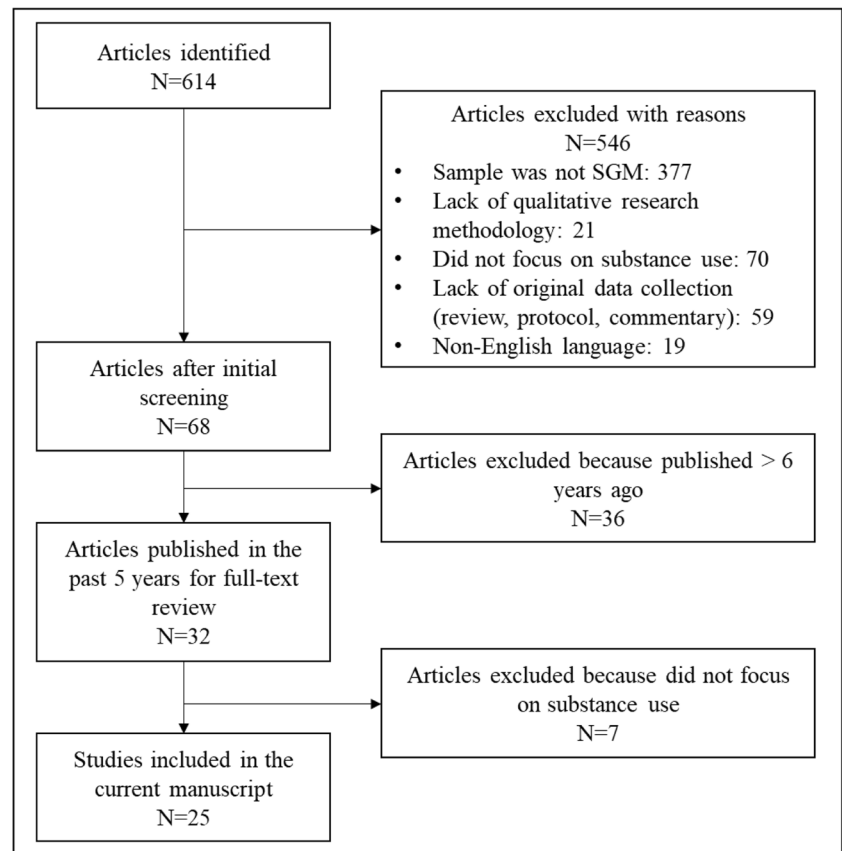
Method

Search strategy

A medical librarian at the H. Lee Moffitt Cancer Center & Research Institute developed a search strategy to capture the following key concepts: Sexual and gender minorities, substance use, and qualitative research. The bibliographic search was conducted on August 18, 2022 in Ovid MEDLINE® ALL (i.e., 1946 to August 17, 2022) to capture any scientific papers, as we were unsure how many qualitative articles there would be in this domain. Full search terms using Medical Subject Headings (MeSH) and keywords are presented in Supplementary Material 1.

Eligibility criteria and selection process

The inclusion criteria were: (1) SGM adults (≥ 18 years old) as the target study population, (2) using any modality of qualitative research methods (e.g., qualitative in-depth interviews/questions or focus groups), and (3) the

Fig. 1 PRISMA flow diagram

studies' primary outcome was substance use behavior and/or experiences with substance use treatment. Studies with no original data collection (e.g., commentaries, protocols) and those in a language other than English were excluded. Following the identification of the articles, titles and abstracts were screened for inclusion by the first author (MJY). Selected articles that were published within the past 5 years were subjected to full-text review to capture most up-to-date qualitative findings in the literature. We also reviewed the articles published between 2012 and 2016 ($n = 9$ that met the inclusion criteria) to determine if any different/new themes would emerge. After a thorough review, no different/new themes were identified from the articles published between 2012 and 2016. Additionally, we included two articles on smoking that were not retrieved in our initial search but we became aware of through hand search during the review process. Thus, a total of 25 articles published between 2017 and 2022 were included in our review. During the review of the 25 articles, we focused on content that was exclusively relevant to problematic substance use and/or substance use treatment reported by SGM adults and did not include information irrelevant to the aim of the current review or those reported by providers. The PRISMA flow diagram presents the overview of the selection process (Fig. 1).

Results

Study Characteristics

Table 1 contains the study characteristics of the 25 articles included in this narrative review. No qualitative studies were found on mHealth for substance use among SGM adults. Regarding qualitative research methods, 17 studies (68%) conducted semi-structured interviews, 6 studies (24%) conducted focus groups, 1 study (4%) conducted a problem-centered interview, and 1 study (4%) asked participants open-ended qualitative questions as part of a survey. In terms of gender identity,¹ 16 studies (64%) exclusively included individuals who identified as male, 6 studies (24%) included those who identified as female, and 8 studies (32%) recruited transgender individuals in their sample (3 studies with transgender men, 6 studies with transgender women, and 2 studies did not specify). Regarding sexual orientation, 15 studies (60%) reported sexual orientation as part of their sample characteristics whereas 10 studies (40%)

¹ Note that the studies counted for each category are not mutually exclusive. For example, some studies recruited both those identifying as female and transgender.

Table 1 Study characteristics of the articles reviewed (N = 25)

Author (Year)	Study questions/Aim	Qualitative methodology	Study Population: SGM status	Sample size	Age range	Type of substance	Location of study
Baguso et al. (2022) [41]	To assess barriers to mental health and substance use services	Individual semi-structured interview	Transgender women living with HIV	3	Not reported	Not specified	USA
Bochicchio et al. (2021) [35]	To assess experiences and perceptions of alcohol and marijuana use related to the COVID-19 pandemic	Individual semi-structured interview	Sexual minority women who reported regular alcohol use for the past 30 days	16	33–71	Alcohol, Marijuana	USA
Brown et al. (2017) [34]	To examine the understanding of the relationship between drinking on sexual risk-taking, medication adherence, and on the potential for receiving treatment to inform future clinical trial	Focus group	Men who have sex with men (MSM) and transgender women who have sex with men with alcohol use disorder (defined by AUDIT score ≥ 8) [†]	26	20–40	Alcohol	Peru
Burgess et al. (2018) [44]	To evaluate the outcome of a methamphetamine use program	Individual semi-structured interview	MSM who use methamphetamine	8	Not reported	Methamphetamine	Australia
Buttram & Kurtz (2017) [45]	To examine the experience with assessments and interventions in a sexual and substance use risk reduction intervention trial	Individual semi-structured interview	Black MSM who use substance and completed the intervention	21	20–52	Varying (alcohol, marijuana, or any other drugs)	USA
Dangerfield et al. (2020) [26]	To explore age-related differences in opioid and stimulant use	Individual semi-structured interview	Black sexual minority men who used any opioid or stimulant in the previous 30 days	30	25–63	Opioid and stimulant (e.g., marijuana, heroin)	USA
Emslie et al. (2017) [31]	To explore alcohol use experience and the role of LGBT identity	Focus group	LGBT individuals with alcohol use	33	18–52	Alcohol	UK
Felner et al. (2020) [38]	To assess the experiences of substance use in relation to LGBTQ identities	Individual semi-structured interview	LGBTQ-identified young adults with probable substance use disorder	59	21–34	Not specified	USA
Freestone et al. (2022) [21]	To explore Gamma-hydroxybutyrate (GHB) use experiences and harm reduction strategies	Individual semi-structured interview	Individuals who identified as LGBTQ who used GHB ≥ 3 occasions in the past 12 months	31	18–64	GHB	Australia

Table 1 (continued)

Author (Year)	Study questions/Aim	Qualitative methodology	Study Population: SGM status	Sample size	Age range	Type of substance	Location of study
Graf et al. (2018) [29]	To assess drug use in sexual settings	Problem-centered interview	MSM who use drugs	89	22–64	Not specified	Germany
Hawkins et al. (2020) [27]	To explore the roles of substance use	Individual semi-structured interview	Gay, Bisexual and other MSM (GBMSM)	20	21–66	Not specified	Canada
Herrijgers et al. (2020) [40]	To understand the chemsex experiences and care needs for chemsex	Individual semi-structured interview	GBMSM engaging in chemsex	20	26–69	Chemsex drugs (e.g., GHB, crystal methamphetamine, ketamine)	Belgium
Hsiang et al. (2018) [43]	To assess knowledge, behaviors, and attitudes on pharmacotherapy for alcohol use disorder	Focus group	MSM who used alcohol in the past year	39	23–66	Alcohol	USA
Maiorana et al. (2021) [24]	To explore lived experiences of methamphetamine use, intimate partner violence, and history of incarceration that may contribute to the risk of HIV	Individual semi-structured interview	Young Black MSM	30	19–29	Methamphetamine	USA
Masterson et al. (2021) [39]	To assess experiences and risk factors of recreational intracavernosal injectable medications (ICI)	Individual semi-structured interview	MSM suffering from ischemic priapism due to recreational ICI	14	24–59	Recreational ICI	USA
Matthews et al. (2017) [37]	To explore general and LGBT-specific barriers to cessation	Focus group	LGBT adults who were currently smoking and interested in quitting smoking	31	Mean age reported: 37.1	Smoking	USA
Ogunbajo et al. (2021) [25]	To understand the relation between minority stress, mental health, substance use, and HIV risk	Individual semi-structured interview	GBMSM	30	Mean age reported: 27.9	Alcohol and other recreational drugs	Nigeria
Smith & Tasker (2018) [30]	To examine chemsex experiences and survival stories	Individual semi-structured interview	Gay men who attended the chemsex recovery program	6	30–60	Varying (e.g., crystal methamphetamine)	UK
Stanton et al. (2022) [22••]	To explore motives for and perceptions of substance use in the context of sexual activity	Individual semi-structured interview	MSM living with HIV and who recently used substances	33	26–68	Varying substances in addition to tobacco	USA

Table 1 (continued)

Author (Year)	Study questions/Aim	Qualitative methodology	Study Population: SGM status	Sample size	Age range	Type of substance	Location of study
Tan et al. (2021) [23••]	To understand trauma history and its relevance to substance use	Individual semi-structured interview	GBMSM with a history of chemsex	33	21–50	Not specified	Singapore
Tan et al. (2021) [36]	To examine experiences of smoking risk and protective factors	Focus group	Transgender and gender-expansive individuals who were currently smoking and interested in quitting	47	Mean age reported: 26	Smoking	USA
Tan et al. (2018) [28]	To explore perceptions and motives for chemsex and barriers to seek help for chemsex and drug use	Individual semi-structured interview	GBMSM	30	18–39	Not specified	Singapore
Tomkins et al. (2018) [42]	To understand chemsex engagement and access to support services	Qualitative survey	MSM	52	25–64	Varying (e.g., crystal methamphetamine)	UK
Vagenas et al. (2017) [32]	To examine perceptions of drinking, drinking behaviors, and related sexual risk behaviors	Focus group	MSM and transgender women who have sex with men and met criteria for alcohol use disorder [†]	26	20–40	Alcohol	Peru
Weatherburn et al. (2017) [33]	To examine the motives for chemsex	Individual semi-structured interview	Gay men who engaged in chemsex in the past 12 months	30	21–53	Primarily crystal meth, UK mephedrone or GHB/GBL	UK

Note. [†] These two studies shared the same study population as the original parent study to report different findings

Some acronyms were fully spelled for the presentation purpose in this table. AUDIT = Alcohol Use Disorders Identification Test

did not report information on sexual orientation (although 4 included individuals with diverse sexual orientation per their eligibility criteria). It is notable that the study populations in 9 of those 10 studies were solely composed of MSM. Regarding types of substance use, 9 studies (36%) focused on a single substance (4 studies on alcohol; 2 studies on cigarette smoking; 2 studies on methamphetamine; 1 study on Gamma-hydroxybutyrate [GHB]), 12 studies (48%) addressed polysubstance use, and 4 studies (16%) did not specify the type of substance. In addition, 9 studies (36%) focused on chemsex (substance use as part of sexual activity) and 8 studies (32%) focused on chemsex among gay, bisexual, and/or other men who have sex with men (GBMSM). The majority of studies were conducted in the United States ($n = 11$; 44%) and the United Kingdom ($n = 4$; 16%). The age range was 18 to 71, but 2 studies did not report the age of their samples and 3 studies did not report the age range. Below, we summarize observed themes from the literature review and also note unique themes relevant to GBMSM and/or chemsex given their significant representations in the reviewed studies.

Lived Experiences of Problematic Substance Use

Four categories regarding the lived experiences of problematic substance use were identified: (1) Reasons/Motives for using substances, (2) Awareness of the negative consequences of substance use, (3) Barriers to substance use treatment, and (4) Needs for future substance use treatment (Table 2).

Reasons/Motives for using substances Positive and negative reinforcement were two of the main motives identified within the reviewed articles for substance use. In terms of positive reinforcement, participants from 15 studies (60%) reported social facilitation as a main motive for substance use [21, 22••, 23••, 24–34]. Specifically, SGM individuals noted that substance use is a typical social activity in the SGM communities [23••, 24, 27–29, 31, 32, 34] and that it helps with enhancing belongingness and participation in SGM social circles [22••, 23••, 25, 27, 28, 30, 32, 33]. In particular, GBMSM or individuals who engage in chemsex reported that substance use helps with finding sexual partners [27, 30] and maintaining relationships with partners [21, 22••, 26]. One study reported that the COVID-19 pandemic increased their alcohol and marijuana use as a social facilitator under shelter-in-place orders [35]. Enhancement motives were reported in 8 studies (32%) such that substance use helped enhance positive affect and sensations (e.g., relaxation, peace; [21, 23••]), perceived partner's attractiveness [33], sexual arousal [33], sexual experiences (e.g., sexual pleasure; [21, 22••, 25, 27–29, 33]), and sexual performance [29, 33]. These enhancement motives were evident

among GBMSM, in particular, individuals who engage in chemsex. Participants from 8 studies (32%) stated that substance use helped them express their SGM identity [31, 36] by increasing the perceived connection to their own SGM identity [21], self-esteem [25], and confidence [21, 30, 32, 34].

Negative reinforcement was another prominent motive. SGM individuals from 11 studies (44%) reported that substance use helped them cope with general stress [36, 37] and SGM-related stress such as negative affect (e.g., shame, inadequacy, emotional pain [22••, 23••, 25, 26, 33, 36–38]), internalized/societal stigma [23••, 28, 33, 38], identity concealment [36, 38], fear of identity disclosure [37, 38]/rejection [33], lack of social support (e.g., rejection, [26, 28, 38]), and intersection of stress from SGM identity and social rejection [36–38]. Further, GBMSM participants reported that substance use helped manage stress from mental health concerns [26] and HIV status [24, 33]. One study reported that SGM individuals consumed alcohol and used marijuana to cope with stress and boredom during the COVID-19 pandemic [35]. Conformity motives were also reported in 6 studies (24%) [25, 31, 37–40]. In particular, SGM individuals reported using substances to conform with peer pressure, such as expectations on substance use in social settings [25, 31, 40] or to “fit in” [37, 38]. Among GBMSM, peers' expectation on sexual performance was reported as one of the conformity motives [39].

Other contextual factors that influence using substances also emerged. Two studies (8%) reported that SGM individuals, who engage in chemsex, used substances because of their perceived confidence in the ability to use substances safely. For example, they felt they were knowledgeable about implementing safety and harm reduction measures, such as preplanning to reduce any complications after substance use (e.g., schedule chemsex to limit interferences with work, logistics of substance use; [40]), using hygienic measures (e.g., use clean needles; [40]), knowing what to do when someone is in “GHB sleep” [21], being careful with dosing and timing [21], and using substances only when with reliable people [21, 40]. Two other studies (8%) among GBMSM reported contextual factors that promote drug use such as different types of substances being preferred in different generations (e.g., those older than 35 years use crack/heroin [26]) and social circumstances regarding route of substance use administration (e.g., intravenous use of heroin/methamphetamine not being acceptable at a nightclub or bar but allowable to use in private places, [27]). Participants in one study noted cue-provoked urge to use substances in their environment (e.g., usual context of smoking, [36]). One study reported how the COVID-19 pandemic could have contributed to increased use, as individuals had more time to use/explore alcohol and marijuana after losing daily routines because of a stay home order [35]. Lastly, one study

among GBMSM reported that substance use behaviors (e.g., decrease in the use frequency) change over time given the shifts in their life priorities and social circle [27].

Awareness of the negative consequences of substance use SGM individuals reported being aware of possible negative consequences following substance use, as indicated by participants from 11 studies (44%) [21, 22••, 24, 25, 29, 30, 32, 34, 35, 39, 40]. For example, individuals who engage in chemsex reported that safety practices were put in place when using substances to avoid the risk of overdose, in particular, when using more than one drug concurrently [21]. Among GBMSM who engage in chemsex, scheduling drug use accounting for a time to recover from lingering negative effects to minimize the interference with other responsibilities was also part of the safety practices [40]. GBMSM and/or individuals who engage in chemsex acknowledged the various costs associated with substance use, such as missing out on enjoyable activities [22••] that they used to enjoy [30], having unstable interpersonal relationships resulting in distress (e.g., feeling used, [22••, 24]), engaging in polysubstance use [39], sexual risk behaviors (e.g., HIV transmission, condomless sex [24, 25, 29, 32]), and other unintended negative consequences (e.g., sexual violence, black out, [21, 32]). Interference with day-to-day activities was noted as a marker of problematic drinking [34]. Two studies among GBMSM (8%) also noted a lack of knowledge on how to minimize negative consequences [39, 40].

Barriers to substance use treatment Many studies assessed and/or identified perceived barriers to substance use treatment. Eight studies (32%) identified system-level barriers such as low accessibility to adequate treatment for SGM individuals due to too high burden in navigating substance use referrals [29, 37, 41], safety concerns regarding the location of the clinics [41], high treatment cost [37], and difficulty finding providers trained in and services that meet the need of SGM individuals [26, 29, 40, 42]. In particular, among GBMSM who engage in chemsex, lack of a safe and nonjudgmental environment to openly discuss their substance use and/or chemsex [40] was also mentioned as a system-level barrier, given limited laws and policies to support the rehabilitation of these individuals [23••, 28]. At the individual-level, seven studies (28%) noted shame and stigma associated with drug use [28] and SGM status [41] such as fear of disclosing their sexual practices [40, 42] in particular among GBMSM who engage in chemsex, low self-efficacy for abstinence [37], and pharmacotherapy for substance use perceived as a replacement of one substance for another [34, 43]. Two studies (8%) noted limited knowledge about available treatment options with a harm reduction approach [43] and pharmacological treatment [34, 43], and concerns about the pharmacotherapy (e.g., side effects,

[34]). Other barriers identified by a few studies included the social norms surrounding the use of certain substances [23••, 35, 37], fear of losing perceived gains from substance use (e.g., self-confidence) [30], and beliefs that one should be motivated to be treated [34].

Needs for future substance use treatment Unmet needs in current substance use treatment for SGM were assessed in some studies. One prominent theme was provision of psychoeducation on harm reduction, short/long-term negative consequences of substance use, and coping strategies, which emerged in 6 studies (24%) [28, 34, 36, 37, 40, 43]. GBMSM were interested in learning how to use drugs safely as an alternative to complete abstinence [34, 43]. Participants suggested providing psychoeducation on various options of substance use treatment (e.g., harm reduction, pharmacotherapy) [37, 43] and potential drug interactions for transgender individuals receiving hormone therapy [43] as well as reliable harm reduction guidelines (e.g., dosing, safe chemsex, what to do in emergency, [40]). Providing psychoeducation to teach coping skills [36, 37] and to promote awareness of the negative consequences of substance use was also recommended (e.g., cost or changes in health associated with continuous substance use [36, 37]) by using places where SGM individuals socialize (e.g., social media, bars, [28]). Four studies (16%) [28, 37, 40, 42] noted that key needs in substance use treatment were enhancing treatment accessibility. For example, participants suggested having providers and clinic staff with a nonjudgmental attitude and extensive knowledge in SGM health, and providing a safe environment, given shame and stigma that challenge getting appropriate care (e.g., sexual health while using drugs, [28, 36, 37, 40]). Societal support to promote a change in the norm regarding substance use and for safe drug use and harm reduction within SGM communities (e.g., peer support) arose as another key component of substance use treatment among 5 studies (20%) [34, 36, 37, 44, 45]. For example, GBMSM who completed treatment reported having peers to share long-term perspectives on various harms associated with substance use (e.g., HIV infection) and making connections to peers who support their behavior change were helpful [45].

Recommendations for Substance Use Treatment for SGM Individuals made in the Reviewed Studies

Here, we summarize the recommendations made in the reviewed studies over the past 5 years, for substance use treatment for SGM individuals, which fall into two categories: (1) Eliminating treatment barriers and (2) Treatment approach and components. These recommendations combined with the themes above were synthesized to make recommendations for future mHealth trials in the Discussion.

Table 2 Overview of the results on the lived experiences of problematic substance use and recommendations

Primary Theme	Subtheme	Recommendations for Future mHealth Trials
Reasons and motives for using substances	Positive reinforcement (social facilitation, enhancement, SGM identity expression)	<ul style="list-style-type: none"> • Just-in-time adaptive intervention (JITAI) to differentially target general (e.g., craving) and SGM-specific (e.g., salience of SGM identity) cognitive-affective processes of substance use
	Negative reinforcement (cope with negative affect, minority stress, conformity)	<ul style="list-style-type: none"> • On-demand support to branch to specific coping strategies based on momentary needs (e.g., reduce craving, regulate emotion, reminder of treatment goal)
	Other contextual factors (e.g., perceived confidence in safe substance use)	<ul style="list-style-type: none"> • On-demand support to branch to specific coping strategies (see above)
Awareness of the negative consequences of substance use	[No subtheme]	
Barriers to substance use treatment	System-level (low accessibility to adequate treatment, lack of safe/non-judgmental environment)	<ul style="list-style-type: none"> • Deliver education on treatment options and safe substance use on-demand and/or in real-time
	Individual-level (shame and stigma, fear of disclosing sexual practice, pharmacotherapy being replaced with another substance)	<ul style="list-style-type: none"> • Make information on safety measures, treatment options, and resources for relevant treatment available on the app
	Limited knowledge about available treatment options	<ul style="list-style-type: none"> • Send a direct link to relevant resources (e.g., safe sex, peer support) via app or text messages
	Other barriers (e.g., substance use being social norm)	<ul style="list-style-type: none"> • Deliver information on the safety measures or support in advance before individuals are at the places and times when heavy substance use is expected as tracked through various modalities of assessment (e.g., ecological momentary assessment)
Needs for future substance use treatment	Psychoeducation (harm reduction approach, negative consequences of substance use, coping strategies)	<ul style="list-style-type: none"> • Deliver education on treatment options and safe substance use on-demand and/or in real-time (see above)
	Enhance treatment accessibility (nonjudgmental and safe environment, treatment cost, point-of-care)	<ul style="list-style-type: none"> • Keep confidentiality and anonymity via implementation of protection of smartphone application access (e.g., password protection)
	Societal support to harm reduction (peer support, shift in norms)	<ul style="list-style-type: none"> • Provide a welcoming environment by using SGM-friendly images and language on the app • Have a space for an anonymous support group on the app

Eliminating treatment barriers Several studies provided recommendations to eliminate potential barriers to access substance use treatment: (1) Creating a safe and nonjudgmental environment to destigmatize substance use, in particular, for transgender individuals [43]. Specific suggestions included having SGM-related images, SGM-identified staff, SGM-inclusive procedures such as including questions on sexual orientation, gender identity, pronouns, and using SGM-friendly language (e.g., “relationship status vs marital status”) [38]. Having a nonjudgmental attitude was specifically highlighted for chemsex (e.g., acknowledging complex contextual factors leading to substance use). Studies also recommended validating the role that minority stress plays in substance use and addressing sexual wellness so that SGM individuals can openly discuss their substance use in the context of sexual practices [22••, 40]. Promoting anonymity and confidentiality was recommended as a key component to alleviate treatment barriers and create a safe welcoming environment [38, 40]. (2) Studies also recommended improving the referral network to substance use treatment [29, 41], providing brief interventions at the patient encounter (e.g., motivational interviewing, [32, 37]) and having a peer navigator [41] to overcome barriers related to a complicated health care system. (3) Providing and developing peer/social support as part of the substance use treatment were also recommended to facilitate behavior change [24–26, 45]. Other recommendations included holding community events without promoting substance use [27] and sending text messages or having advertisements on social media to promote health behaviors when mass events (e.g., music festivals) with high substance use take place (e.g., safety measures for chemsex [28]).

Treatment approach and components Common themes arose across studies regarding treatment approach. (1) Given the perceived gains from engaging in substance use [22••], a harm reduction approach to promote safe use [21, 28, 37, 45] was recommended as opposed to complete abstinence [27, 29, 43] with the aim of preventing or mitigating negative consequences such as overdose, HIV, or sexually transmitted infections [21, 28, 45]. (2) Several studies recommended including educational modules as part of substance use treatment programs or relevant services that address the negative consequences of substance use (e.g., overdose, violence, [21], medical emergency, [39]), safe sex (e.g., sexual health, [27]), and pharmacotherapy options [37, 43]. Additionally, this information should come from reliable sources and be easily accessible [40], in particular, in places and times in which heavy substance use is expected [28, 42]. (3) Several studies recommended that the complexity of factors (e.g., contextual factors, unique pathways) leading to substance use

among SGM individuals should be acknowledged in treatment [34]. For example, perceived gains from engaging in substance use [22••, 33], trauma history [23••], negative affect [35], minority stress [24, 35, 37], intersectionality of multiple identities [24, 31], pain [26], and sexual behavior [24] should be taken into consideration in substance use treatment. In particular, assessing sexual activity and discussing sexual concerns are crucial for SGM individuals who engage in chemsex [22••]. (4) Some studies also recommended reinforcing protective and resilient factors (e.g., optimism, supportive relationships, [24]) to mitigate minority stress [25] and affirm SGM identity [38]. (4) Teaching coping skills to manage minority stress and seeking appropriate social support was also recommended [22••, 36, 37].

Discussion

mHealth for substance use among SGM individuals is still in its infancy. To inform future mHealth interventions targeted to this population, the current manuscript reviewed the literature on the lived experience of SGM adults regarding problematic substance use as well as recommendations made for substance use treatment based on qualitative studies published between January 2017 and August 2022. Of note, our literature search did not identify any qualitative mHealth studies among SGM individuals regarding substance use. Our review did not include studies among SGM adolescents.

Based on this review of the literature, we believe that serious consideration should be given to the potential of mHealth interventions for the SGM population. Given concerns about confidentiality and minority stress, mHealth has the ability to expand reach and uniquely address such needs. Indeed, the vast HIV literature has reported that SGM individuals perceive mHealth interventions to be useful in addressing barriers to appropriate health care services and in obtaining basic health education [46] and a preference has been reported for online/smartphone apps over in-person interventions for HIV prevention [47]. Evidence shows that mHealth social media and mobile networking apps are more effective in reaching and enrolling diverse SGM individuals for broad clinical research [48] including those who use substances, as compared to in-person approaches [49].

Early mHealth substance use trials in this population have implemented some of the recommendations made in the literature (e.g., peer support, HIV prevention messages) by using text messages [17, 18]. To consider ways to address this population’s needs by leveraging technology, we list several considerations and recommendations for future mHealth research (Table 2). First, education on treatment options and safe substance use can be effectively delivered in various ways, on-demand or in real-time. For

example, using a smartphone app, safety measures, treatment options, and resources for relevant treatment could be provided whenever needed. In particular, a direct link to a phone number or to relevant resources, as provided on the app or via text messages, could increase substance use treatment reach, since it would take only one click to access appropriate services (e.g., safe sex, needle use, peer support, [50]). Second, some treatment barriers could be easily addressed given their immediate availability. Information on safety measures or support could be provided in advance, either via texts or messages within an app, before individuals are at the places and times when heavy substance use is expected. Tracking technology such as ecological momentary assessments (EMA) or GPS might serve such purpose, although its acceptability should be assessed through future qualitative studies. A welcoming environment by using SGM-affirming images and language as well as a space for an anonymous support group could also be provided on the app.

Third, just-in-time adaptive interventions (JITAIs) could be effectively applied for substance use treatment among this population. Micro-randomized trial designs could be applied to examine the unique effect of general (e.g., craving) and SGM-specific (e.g., minority stress [12], salience of SGM identity, [51]) interventions on proximal outcomes related to substance use when SGM individuals report heightened craving or SGM-specific cognitive-affective processes. Also, on-demand support that branches to specific coping strategies based on the participants' momentary needs could be available. For example, when experiencing high craving, an individual can initiate the on-demand process by indicating high craving, which could subsequently trigger assessment of their momentary need (e.g., reduce craving, reminder of their treatment goal) and then relevant coping strategies (e.g., emotion regulation [52]). Lastly, given confidentiality and anonymity in treatment are concerns among SGM individuals, additional protection should be implemented. For example, the app should be password locked and the language used in notifications should be carefully written. Indeed, within the context of existing HIV literature on mHealth, SGM individuals suggested clarifying privacy and confidentiality upfront including visual aspects of the app (e.g., icon of the app) and password protection, which may affect willingness to engage in the intervention [46].

Limitations of the current review include the majority of the studies being focused on men and chemsex, as well as not including quantitative studies, which was outside the scope of this narrative review. Although the current review aimed to identify unique needs of SGM adults by reviewing the qualitative literature on this population, there are likely some overlapping needs identified here that are broadly applicable to other populations. As such, future studies may

include a comparison group of non-SGM adults to disentangle the SGM-specific needs from more general needs in substance use treatment, as well as SGM adolescents (e.g., [53, 54]). It is notable that a few studies had a small sample size ($N < 10$), however the themes observed in these studies were consistent with the other studies reviewed. We also want to highlight the limitations in the extant qualitative literature that we reviewed. Overall, this area of research is limited to certain types of drugs and sexual behaviors, and certain subtypes of SGM individuals. For example, most papers were focused on HIV prevention, and sexual minority women and gender minority individuals were not well represented. Some papers did not report sexual orientation or distinguish sexual orientation from gender identity. Idiosyncrasies among SGM subpopulations has been recognized given, for example, bisexual individuals are more prone to experience minority stress and emotional difficulties than lesbian/gay individuals [55, 56], highlighting the importance of correctly identifying the population. Given the large representation of GBMSM in this review, caution is needed when considering the current findings for future treatment development.

Conclusions

The current review identified the lived experiences of problematic substance use among SGM adults and their needs in substance use treatment. Based on the recommendations made in the literature, we presented considerations in study methodologies for future mHealth substance use treatments. If mHealth-based substance use treatment is found effective, its potential in scalability and public health benefit would be immense.

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Declarations

Informed Consent Not applicable.

Conflicts of Interest Matthew B. Schabath, Ph.D. is a consultant for Bristol Myers Squibb.

Human and Animal Rights This article does not contain any studies with human or animal subjects performed by any of the authors.

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