Qualitative Study

DIGITAL HEALTH

DIGITAL HEALTH
Volume 10: 1–9

DOI: 10.1177/20552076241302250
journals.sagepub.com/home/dhj

Sage

The perception of HIV self-testing and willingness to use mHealth for HIV prevention among Black men who have sex with men in Iowa, United States: A qualitative study

Oluwaseun Abdulganiyu Badru[1] and **Oluwafemi Atanda Adeagbo**[1,2]

Abstract

Objective: The World Health Organization approved HIV self-test (HIVST) to break the barriers to HIV testing. Black men who have sex with men (Black MSM) in the United States are less likely to test for HIV or link to care due to several factors, such as stigma and distance. We explored Black MSM's knowledge of HIVST and their willingness to use a mobile application (mHealth) to link to HIV care and engage with health providers.

Methods: Between March and September 2023, we interviewed 12 Black MSM in small urban areas and explored HIVST awareness and willingness to use mHealth. Participants were recruited through purposive and snowball sampling. The data were analyzed inductively.

Results: The age range was 20–42 years. Participants had mixed knowledge of HIVST. The barriers to HIVST uptake are poor knowledge of HIVST, lack of adequate medical insurance to access HIVST kits, and concerns about the efficacy of HIVST kits. Black MSM were willing to link to care via mHealth but expressed concerns related to safety, confidentiality, and the risk of HIV stigma. Participants recommended wider awareness via social media and that the proposed mobile application has a simple interface for ease of use.

Conclusion: To encourage uptake among Black MSM, the Iowa Department of Health and Human Services should make HIVST accessible (low-cost or free). The proposed mHealth should be developed with a simple and interactive interface, including images and videos to guide HIVST and linkage to health professionals for assistance.

Keywords

BMSM, black MSM, HIV self-test, HIVST, mHealth, Iowa

Submission date: 1 June 2024; Acceptance date: 7 November 2024

Introduction

Men who have sex with men (MSM) accounted for 7.7% of the 39.9 million people living with HIV (PLWH) globally in 2023, according to the Joint United Nations Programme on HIV/AIDS (UNAIDS).[1] For instance, MSM accounted for 70% of new HIV diagnoses ($n = 37{,}981$) in 2022 in the United States despite accounting for only 2% of the population.[2] Particularly, Black MSM accounted for 34% of new

[1]Department of Community and Behavioral Health, University of Iowa, USA
[2]Department of Sociology, University of Johannesburg, Johannesburg, South Africa

Corresponding author:
Oluwafemi Atanda Adeagbo, Department of Community and Behavioral Health, University of Iowa, N467 College of Public Health, Iowa City, IA, 52242-1002, USA.
Email: oluwafemi-adeagbo@uiowa.edu

HIV diagnoses among all MSM in 2022.[2] Similarly, in Iowa, MSM accounted for 73% of the 120 new HIV diagnoses and 54% of the estimated 3228 PLWH in 2022. Notably, Black Iowans are over 10 times more likely to be diagnosed with HIV than non-Hispanic white Iowans.[3]

The United States is working towards ending HIV by 2030 with its several initiatives, such as the 'Ending the HIV Epidemic' (EHE), to achieve this goal. The most crucial strategies of the EHE initiative are HIV diagnosis and expansion of pre-exposure prophylaxis (PrEP) – an evidence-based intervention to prevent the transmission of HIV, especially among priority populations.[4,5] However, Black MSM are less likely to test for HIV compared to the general population and their white MSM counterparts.[6,7] HIV testing is crucial for HIV care, and the UNAIDS has proposed that 95% of people living with HIV should know their status by 2030.[8] Globally in 2022, 86% of people living with HIV were aware of their status; the United States was not part of the five countries (Botswana, Eswatini, Rwanda, Tanzania, and Zimbabwe) who have achieved the 95-95-95 UNAIDS goals, underscoring the need for continued HIV testing in the United States.[8] Several factors impede HIV testing among MSM, including HIV stigma and identity, poor HIV knowledge and HIV testing knowledge, and lack of health insurance.[9–11] HIV self-test (HIVST) is one of the strategies now available to improve HIV testing among MSM.[12]

In an attempt to break the barriers to traditional HIV testing (i.e., hospital-based or provider-initiated testing), the United States Food and Drug Administration (FDA) approved the OraQuick In-Home HIV Test in 2012 so that people can test for HIV privately.[13] HIVST involves an individual privately testing for HIV infection through an oral/saliva-fluid or fingerstick blood test kit, and they can view their results approximately 20 min after the test has been properly conducted.[14] HIVST has the potential to increase HIV testing among priority populations, including Black MSM.[15,16] It represents a shift from provider-initiated HIV testing to self-testing to promote autonomy and reduce some of the barriers (e.g., stigma or distance) associated with traditional HIV testing.[12]

The World Health Organization (WHO) in 2016 recommended and provided a guideline for HIVST kits as part of the strategies to end the HIV epidemic by 2030.[14] Interestingly, many Black MSM in the United States are not aware of HIVST kits.[17] The common barriers to HIVST knowledge and uptake among Black MSM include structural barriers, the cost of HIVST, concerns around its efficacy, and HIV-related stigma.[15,18,19] Although the HIVST kit has the potential to increase testing, especially among priority populations, Black MSM have also expressed concerns about engaging healthcare professionals for adequate care after self-testing.[20] Thus, linking MSM to health providers via a mobile application (mHealth) following HIVST is one effective strategy documented in the literature to reduce privacy concerns and HIV-related stigma.[21–24]

Although mHealth—a mobile application that links clients to healthcare providers—has the potential to reduce barriers to HIV preventive strategies, some studies have reported MSM's concerns about mHealth, such as privacy concerns and the safety of their data.[16,25] Notwithstanding, institutions have employed mHealth interventions to improve linkage to care to reduce HIV among MSM.[25–27] Recognizing the potential of telehealth intervention, the Iowa TelePrEP program was established and expanded statewide between 2017 and 2019 through a partnership between the University of Iowa and the Iowa Department of Health and Human Services (IDHHS) to improve access and facilitate retention in PrEP care. It is a direct-to-client telehealth model developed mainly to overcome the barriers of distance and stigma in rural and small urban areas. The TelePrEP delivery model includes referrals of public health (PH) facilities clients to a centralized telenavigation for client linkage to TelePrEP or community PrEP providers and telehealth visits (including PrEP counseling and prescribing), laboratory testing and PrEP medication delivery by mail or through local pharmacies. The TelePrEP delivery model is distinct because it is embedded within the current health systems and was implemented in PH facilities across Iowa.[28]

However, we are not aware of any study focusing on Black MSM awareness of HIVST and PrEP in Iowa and whether they are willing to link to care via mHealth, which can provide linkage to other HIV care continuum. The present study bridges this gap by interviewing Black MSM in Iowa to (1) assess what they know about HIVST, (2) barriers and facilitators to uptake of HIVST, (3) willingness to link to care and engage health providers via mHealth, and the potential barriers and facilitators to using such an application, and (4) we also explored their awareness of the Iowa TelePrEP and perceived barriers to its use.

Methods

Setting and study design

This is a qualitative study that sought to explore issues (via in-depth interviews) around HIVST and willingness to use mHealth among Black MSM in Iowa, United States. Iowa is Midwestern and the 26th largest state in the United States.[3] The state had 99 Counties, including Johnson and Black Hawk Counties, and a population of more than 3.1 million as of December 2022, of which 4% are Blacks.[3] Specifically, the study was conducted in Johnson and Black Hawk counties due to their high HIV prevalence and the presence of the African American population.[3]

To ensure rigor and credibility, our study adheres to the eight criteria of quality in qualitative research (i.e., worthy

topic, rich rigor, sincerity, credibility, resonance, significant contribution, ethical, and meaningful coherence) suggested by Tracy (2010).[29] For instance, we investigated a topic that has not been previously interrogated among Black MSM, who are more likely to be living with HIV in Iowa.[3] Also, to ensure rich rigor, we interviewed Black MSM in the Counties most burdened with HIV in Iowa and spent sufficient time interviewing them. Furthermore, we were sincere and transparent about the researchers' positionality and how it could affect how the interviews were conducted. Moreover, we believe that the findings of this study are significant to the HIV care continuum in Iowa. Also, we ensure credibility through a thick description of the study process to show what works and what does not.[30] Finally, the reporting of this study conforms to the consolidated criteria for reporting qualitative research (COREQ) checklist.[31]

Participants and recruitment

Using purposive and snowball samplings, we interviewed those who self-identified as Black MSM, aged 18 and above, living in Johnson, Linn, or Black Hawk County, and not living with HIV; these criteria were part of the recruitment advert. We advertised on and leveraged mass email, dating apps (e.g., Grindr), and LGBTQ+ events and clinics to recruit Black MSM. A total of 125 responses were received, and 20 were contacted, but only 12 Black MSM met the study's eligibility criteria. There were no eligible participants for Linn County; hence, we presented participants' feedback from Black Hawk and Johnson Counties. The recruitment and sampling methods were discussed extensively elsewhere.[30]

Data collection

We conducted semi-structured, in-depth interviews with 12 Black MSM between March and September 2023. The interviews were conducted by the principal investigator (PhD in Sociology), who identifies as a black male with more than a decade of experience with qualitative interviews with sexual and gender minorities, and a trained black female graduate research assistant (MPH student). Interviewers' positionalities were made known before the interviews, and they ensured reflectiveness during and after the interviews to ensure their positionality did not affect how they asked or probed the participants. All interviews were conducted in English and audio-recorded following written or verbal consent from participants.

The interviews were face to face ($n = 2$) and virtual ($n = 10$) because some of the Black MSM preferred to be interviewed virtually (Zoom). The interviews lasted between 23 and 93 minutes. All the participants agreed to be audio-recorded. The Black MSM used pseudonyms to conceal their identity and ensure anonymity, and they were compensated with a $30 gift card for their time.

The pilot-tested interview guide focused on awareness and knowledge of HIVST (e.g., Have you heard of HIVST before?) and their awareness of the existing Iowa TelePrEP program that links clients to PrEP virtually (e.g., Have you heard about Iowa TelePrEP program?). We also asked questions related to mHealth and linkage to care. We described and asked the participants their opinion on a hypothetical mobile application that can link them to healthcare providers following HIV self-testing, the features they would like to see, and potential concerns for such an application (see Supplementary material). Study participants had no knowledge about the researchers except for the principal investigator's contact information (email address and office telephone number) in the recruitment materials.

Data analysis

The audio files were transcribed verbatim into text in English by Rev.com and were checked by three researchers experienced in a qualitative study. We thematically and inductively analyzed the data using the following phases suggested by Braun and Clarke[32]: (1) familiarization with the data, (2) initial code generation, (3) identification of possible themes, (4) theme review, (5) defining theme, and (6) produce the report. Data saturation was reached after an initial analysis of 10 participants' interview transcripts, followed by two other interviews to test the stopping criterion, as recommended by Francis et al.[33] Furthermore, co-coding and an audit trail were used to improve study rigor.

Ethical approval

The study protocol was approved by the University of Iowa Institutional Review Board (#202301186). All participants provided written or verbal informed consent.

Results

The participants' age range was 20–42 years, and the majority resided in Johnson County ($n = 10$) at the time of the interview, while a few were based in Black Hawk County ($n = 2$).

Awareness and knowledge of HIVST

Mixed knowledge of HIVST: A few Black MSM reported that they were unaware of HIVST. One participant said: "*No, I hadn't. Can you please explain more about self-testing?*" (Participant 1). We also found that some were aware of the HIVST, and a few of them provided evidence of adequate HIVST knowledge. An example is provided below:

> I believe HIV self-testing allows people to take an HIV test and get to find out about the result at the comfort of your home, at your own private location, without someone else knowing about it. I just feel it has to do with having your own HIV test at the comfort of your home. (Participant 2)

Barriers to HIVST use

Two themes emerged from the questions around barriers and facilitators of HIVST uptake: the cost associated with medical insurance and doubts over the efficacy of HIVST.

HIVST cost and lack of medical insurance: Participants highlighted the cost of an HIVST kit as a barrier to its usage for some Black MSM, and not having insurance can further make it difficult to get HIVST kits. The participant below reported the cost of HIVST as a barrier to its use:

> …it might be of high cost. Limited insurance coverage… That would be the barriers I consider in the community. (Participant 3)

Efficacy of the HIVST kit: The interviewees had doubts about the efficiency of the HIVST kits; some perceived them to be less accurate than the conventional blood-based test. One participant remarked:

> But one thing is the accuracy of it because you have to understand that HIV has a window period of three months before the antibodies would be showing up in a test. And then sometimes those home tests are not really accurate, and so I think that, yes, it is an option to know about your status, but rather, I feel like people should be more encouraged to get blood drawn instead of the home test…. (Participant 5)

Facilitators of HIVST uptake

Effective communication was the theme that emerged when we probed the factors that could stimulate HIVST uptake.

Effective communication: When we asked the participants how HIVST can be promoted for use among Black MSM, the responses were centered around effective communication of HIVST-related information through various social media and societal groups:

> …sensitization and education of people on how to use stocks like this. We don't just introduce a new thing into the society and actually don't teach people how to actually use it. So, if you can sensitize, majority of the group of the society on how to use it and use it properly. (Participant 1)

Another participant gave insight into how Black MSM can be further encouraged to utilize HIVST. He suggested that their social media platforms should have a review section to boost the self-efficacy of Black MSM who were not familiar with HIVST:

> …there is room for others to make comments about the usage of self-testing. So that, those who have not made use of it who likely are going to use after going through these reviews. Maybe, let's say, towards all the reviews. And then, let me say 90% of the reviews are all positive, yeah. It's working, it's working. (Participant 4)

The potential of mHealth in linking Black MSM to HIV care

The participants indicated potential barriers and facilitators to mHealth usage.

Potential barriers to mobile application usage

It was important to understand what the Black MSM would perceive as barriers to mobile application usage. Three themes emerged from the question: concerns about safety and confidentiality, unsolicited advertisement within mobile application, and fear of HIV stigma.

Concerns about safety and confidentiality: Participants expressed concerns about the approval and safety of the online clinical pathway. They want the mobile application to be approved by a relevant government agency and for it to be secured to protect their privacy: "*So I would love that they have inscription which proves that this is government-approved in whatever states or locality where one might find himself. Those are my concerns.*" (Participant 4). Another participant mentioned the issue of privacy: "*Yeah, most of the conscious sense you're going to get is the privacy concerns.*" (Participant 9)

Unsolicited advertisement within mobile application: Some participants were concerned about unsolicited advertisements within mobile applications. Drawing from a recent experience with another health mobile application, one participant said:

> My only concern is there are too many ads. There can be ads but just not too many. The blood pressure one I used yesterday, there were just too many ads. Every step had an ad. It makes sense that they had those ads, to make it free. But I feel like that would be the only problem that people would have. As long as there are not so many ads. (Participant 8)

Fear of HIV stigma: HIV-related stigma was another perceived barrier to the mobile application; some participants were concerned that they could experience stigma if the application is seen by someone else. One participant sums this up:

> And so, I think someone might just see an app on your phone about this, and the person might feel skeptical. Say a colleague in your office will just see this application on your phone. Then, certain questions begin to crop up in their head. Because they begin to ask you some kind of questions like, what's this app for? What does it really mean? Does it mean you're infected?" And then you can't actually begin to tell them stories of you not being infected or you being infected. So, it's going to spark a lot [of] skeptical thinking in their memories, and there's going to be a withdrawal from you. …there's a stigma being attached to HIV generally. (Participant 6)

Potential facilitators to the mobile application usage

Three themes emerged when we asked about the potential facilitators of the proposed application: mHealth can be helpful and useful, wider application awareness for specific groups, and simple with other features.

mHealth can be helpful and useful: There was a consensus among the study participants when we asked their opinion on developing an application to link them to healthcare providers for HIV services, particularly PrEP service. One participant said, "*It's wonderful. Absolutely, it's wonderful."* (Participant 6)

Another participant concluded:

> Well, I think it's cool. With something like that a person could sit down at the comfort of his home or at the office and access this kind of services, I feel is a great idea… I think it's going to be a great technology. (Participant 12).

Furthermore, Black MSM perceived that a mobile application that links them to health providers can make easy access to PrEP and refill when needed:

> …it could be made easy from an application where those who need access to PrEP, they do not need to go to a store. Maybe if actually the first dosage which was given to them is almost exhausting and maybe they need a refill, and also for just for security purposes, and go there in case any testing occurs, just to be sure that it's not a fake identity. (Participant 4)

Wider application awareness for specific groups: We found that many of the Black MSM were willing to use the mobile application; we then sought their opinion on how the application can reach the Black MSM community. Many of the Black MSM opined that a massive campaign and awareness through seminars and focus group discussions are strategies to get the mobile application to its intended users.

> Okay, like I said, targeting a specific group that you feel maybe to a survey, or you feel the demographic they might have imputed that that particular community is underrepresented. Let's say the older community, let's say the Black, let's say maybe even the Asians are underrepresented. In terms of using the app, you can target them and try to reach out, like I said, through focus groups, through webinars. (Participant 7)

Simple with other features: We further probed what features they wanted to see on the mobile application. They want a simplified mobile application that would accommodate other medication services while protecting their data. A participant said, "*Okay. Well, you just want to have a very simple interface. It would really help to have a simple interface."* (Participant 11). Another participant wants the application to have a reminder feature that would prompt users to test for HIV and take PrEP medication: "*Reminders to do HIV testing. Reminders for new… Hospitals do it too, and remind you for your next PrEP medication"* (Participant 8)

Some want the mobile application to provide more than just PrEP services, such that other medications can be accessed with the aid of the application:

> I think one of those features is that it shouldn't be an application created just for PrEP. I believe that there are some various medications where people of my community have difficulty into accessing it. So, I think there should be a list of various medications in which the thing that's being that there is difficulty into accessing this medication by people of this community, so that whatsoever you need, whatsoever you think you want, you can select it there from the list of the medications available on technology. (Participant 4)

Knowledge of the existing Iowa TelePrEP program

Lack of Iowa telePreP knowledge

We found evidence that some Black MSM may not be aware of the Iowa PrEP program. None of the study participants knew about the Iowa TelePrEP program, but some showed interest in learning about it. When we asked the following participant if he knew about it, he responded, "*No, no, no, not at all.*" (Participant 10). However, some of them were willing to know more about the program. One participant who showed interest in Iowa PrEP said, "*Maybe I'll go on further research. Yes.*" (Participant 4)

We then described Iowa TelePrEP to the participants to see whether they would be interested. All of the participants who were not aware of the program showed an interest and expressed why they thought it was a good program to be in.

For example, the participant below felt that the program was important and was willing to learn more about it.

> Yes. I think what I like about it is, from the description you have given to me, it feels a bit welcoming. I think it's being assessed by members of the community of Iowa. I think people or professionals in that field, they won't seem to discriminate so far, you are going through the session and what your guys' mandate has been given to you. That's the reason I love it. After decision, as I understood your explanation, and you do get PrEP, and at some point where it's being given to you. Yes, so I think that's why I love it. It's a scenario because I believe that you'll be educated on how to make use of these things and when to use them. So, thank you… (Participant 4)

Potential barriers to the Iowa TelePrEP program

After the interviewers provided a brief description of the Iowa TelePrEP program to the study participants, we probed for potential barriers that may likely affect the effective uptake of the program, and the following key themes emerged:

Positionality of Iowa TelePrEP providers: An interesting theme that emerged as a potential barrier is the providers' race or ethnicity. Black MSM appeared to prefer to be attended to by Black health workers.

> …to avoid individual prejudices and bias that staff of this organization, the TelePrEP, I think they should be Blacks as well, whereby the members of the Black MSM community, they do not love by themselves being attended to by a white person. They don't always feel comfortable. You would like to be attended to by other Black doctors or providers. (Participant 4)

Lack of Iowa TelePrEP awareness: Iowa PrEP appeared unknown to many Black MSM. No participant has heard about it before the interview. One participant offered his view on the program:

> If you're not aware of the program, there's no way you'd be able to engage in it effectively. Just as you being able to explain it to me right now, I think I have an understanding, and I still need more information and more knowledge. So, a lot of people who do not have this information, there's no way they can actually engage in it maximally. So, I still think it has to do with the knowledge of the program on how beneficial it will be. (Participant 6)

Another participant echoed this lack of Iowa PrEP program awareness: "…the thing is it's not advertised, so that creates a barrier for people to have services to PrEP. Those are the barrier; it's not well advertised." (Participant 5)

Discussion

We explored the perception of HIVST and the willingness to use mHealth for HIV prevention among Black MSM in Iowa. In the present study, some Black MSM were aware of HIVST, while others had never heard about HIVST. Other studies in Australia, Brazil, Peru, Mexico, the Philippines, and the United States have reported that MSM can be unaware of HIVST.[20,34,35] For example, Bilardi and colleagues reported that most of the MSM they interviewed had never heard, seen, or read about HIVST.[20] The possible reason for some Black MSM not being aware of HIVST could be that they visit health facilities less than other MSM, partly due to structural racism.[36]

Our study participants echoed HIVST cost associated with the lack of adequate medical insurance as barriers to HIVST uptake, which aligned with past studies conducted with MSM in New York[37] and outside the United States, including Australia, Mexico, and China.[20,35,38] Similarly, a global systematic review of HIVST among priority populations, including MSM, reported the HIVST kit's high cost as a major barrier to HIVST utilization.[18] The concern for Black MSM is that the HIVST kit is expensive and only available to those who can afford it.[18,39] Black MSM in New York opined that $40 for HIVST is on the high side and that most Black MSM will purchase and utilize it if it was between $10 and $15,[37] similar to the AUS $10 to $20 proposed by MSM in Australia.[20] Nonetheless, MSM are more willing to use HIVST kits if they are available or at least as cheap as pregnancy test kits.[20]

There were concerns about the accuracy of the HIVST kits. Many studies have reported false positive and negative results, buttressing our findings.[18,20,35] Evidence shows that the HIVST error or false positive results are largely from the inaccurate processes by MSM.[40] Some common errors include wiping swabs on teeth, not squeezing oral swabs adequately, and not knowing how to read the results, which reduce the sensitivity of the HIVST.[40] This implies that Black MSM need to be adequately trained on HIVST kit use, particularly the provision of videos that show the step-by-step guide on HIVST kit usage.

The Black MSM opined that effective communication through sensitization and education and leveraging social media are ways to ensure that HIVST awareness and uptake increase. American Indians in South Carolina have proposed similar strategies and suggested that messages are tailored to the target population while the delivery of HIVST should be discreet to prevent HIV-related stigma.[41] In addition, Blacks in North Carolina have called for an increase in HIV and HIVST awareness to help Blacks make better sexual health decisions.[42] This is equally needed in Iowa to prevent HIV among Black MSM.

We found that Black MSM were comfortable with the idea of linking to care via a mobile application. A qualitative study conducted among MSM in China has reported a similar finding.[16] Adults (98.7%) surveyed in South Africa have shown interest in linkage to care via mobile application following HIVST.[43] HIV testing is a key entry point to the HIV continuum, including PrEP initiation and condom utilization,[44] and the willingness to link to care following HIVST is crucial for HIV reduction among priority populations.[45]

Black MSM highlighted that data safety, confidentiality, and HIV-related stigma were potential barriers to the proposed mobile application use. Our study participants were concerned that being seen using the mobile application could lead to HIV-related stigma. MSM in China and Malaysia have expressed a similar concern with mHealth.[16,25] The plausible reasons may be related to the fear of HIV identity, i.e., Black MSM are being cautious of being labeled as a person living with HIV.[12] We found Black MSM to be skeptical about their information on the application. Zhao et al.[16] have also reported concerns over identifying data such as names and phone numbers. Again, this shows that MSM are so cautious about their identity being leaked to others as it could spark HIV-related stigma.

Most Black MSM opined that the mobile application can reach their community through strategic dissemination, including seminars, webinars, and social media. This is consistent with findings from previous related studies.[34,44] Furthermore, some Black MSM advocated for a simplified interface for ease of use. Previous studies provide credence to this finding.[21–23] Lu and colleagues[21] gave reports of specific demands from MSM, including a blend of images and less text while leaving out sensitive text such as HIV and AIDS to reduce fear. In addition, we also found that Black MSM want the mHealth application to capture other HIV continuum, such as PrEP and HIVST, repeating the observations of MSM in Australia[20] and China.[21]

Black MSM appeared not to be aware of the Iowa TelePrEP program. Many reported that the program lacks adequate publicity, which may explain why it is unpopular in the Black MSM community. The IDHHS may need to intensify efforts to make Iowa TelePrEP reach priority populations who will benefit from the program.

Finally, the study is not without limitations. Some participants were interviewed virtually, making adequate nonverbal cues difficult to note. Also, Black MSM from only two Counties participated in the study, limiting generalizability to other Black MSM in Iowa and other states in the United States. Also, some findings presented in this paper were based on a *hypothetical mHealth intervention* described to participants; therefore, evaluation of actual acceptability and usage of the app for linkage to care needs to be conducted after it has been developed, as this may differ from how people imagined it to be. Furthermore, recruiting through the University of Iowa LGBTQIA + clinic may mean that some participants may be aware of PrEP compared to others recruited outside the clinic setting, confounding the level of awareness. Another limitation is that we did not provide participants with the study findings for validation due to the time difference between data collection and analysis. The major strength of this study is providing HIVST-related information peculiar to Black MSM, which may be the first in Iowa to the best of our knowledge. Participants' responses add nuance to our understanding of their knowledge of HIVST, Iowa Telehealth program as well as the potential to co-develop suitable mHealth intervention to improve Black MSM's PrEP uptake and adherence as well as that of priority populations to arrest the growing HIV incidence in Iowa.

Conclusion and recommendations

Our study participants were not entirely aware of HIVST before the study but showed interest in using HIVST and a mobile application to link to care. Concerns about cost and the accuracy of HIVST were potential barriers to HIVST uptake and utilization. Black MSM in Iowa were willing to link to care via a mobile application. However, their concerns about HIV-related stigma, information privacy, and confidentiality while using the mobile application for HIV care must be addressed. To increase HIV testing and boost self-efficacy, IDHHS must provide tailored HIVST education and awareness to reach Black MSM and other priority populations in Iowa. Given the demographics of Iowa as a predominantly white state, efforts should be made to pair Black MSM with health providers of similar race or ethnicity, as suggested by participants in our study. To achieve the US Ending the HIV Epidemic goals of reducing HIV infection by 90% by 2030 and the UNAIDS goal of 95% HIV status awareness by 2030, efforts should be directed towards engaging and retaining Black MSM and other priority populations in Iowa in the HIV continuum.

Acknowledgments: The authors are grateful to Black Hawk, Johnson, and Linn Counties Public Health Department, Cody Shafer of IDHHS, manuscript anonymous reviewers, and the study participants. We are also thankful to Amber Hawkins for coordinating the study and Profs. Rima Afifi and Mark Vander Weg for their support.

Contributorship: OAA conceived the research idea. All authors contributed to the research design. OAA facilitated data collection. OAB and OAA conducted data analysis. OAB and OAA drafted the manuscript, and all authors critically revised the manuscript. OAA supervised the entire review process.

Availability of data and materials: The qualitative data analyzed for this manuscript is not publicly available. However, the corresponding author can make the data available upon reasonable request.

Declaration of conflicting interests: The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding: The research was funded by the University of Iowa Office of the Vice President for Research Early Career Scholars Program.

Guarantor: OAA.

ORCID iD: Oluwaseun Abdulganiyu Badru https://orcid.org/0000-0003-0076-2745

Supplemental material: Supplemental material for this article is available online.

References

1. UNAIDS. Global HIV & AIDS statistics — Fact sheet, https://www.unaids.org/en/resources/fact-sheet (2023, accessed 9 October 2024).
2. CDC. Fast Facts: HIV in the United States. *HIV*, https://www.cdc.gov/hiv/data-research/facts-stats/index.html (2024, accessed 19 September 2024).
3. State of Iowa Department of Health and Human Services. *State of Iowa HIV disease end-of-year 2022 surveillance report*. 2023.
4. Fauci AS, Redfield RR, Sigounas G, et al. Ending the HIV epidemic: a plan for the United States. *JAMA* 2019; 321: 844–845.
5. Merle JL, Benbow N, Li DH, et al. Improving delivery and use of HIV Pre-exposure prophylaxis in the US: a systematic review of implementation strategies and adjunctive interventions. *AIDS Behav* 2024; 28: 2321–2339.
6. Kuehn B. Gaps in HIV testing for Black men. *JAMA* 2018; 320: 966.
7. Threats M, Boyd DT, Diaz JE, et al. Deterrents and motivators of HIV testing among young black men who have sex with men in North Carolina. *AIDS Care* 2021; 33: 943–951.
8. UNAIDS. AIDS by the numbers, https://www.unaids.org/en/Homepage (2023, accessed 23 November 2023).
9. Adugna DG and Worku MG. HIV Testing and associated factors among men (15–64years) in Eastern Africa: a multilevel analysis using the recent demographic and health survey. *BMC Public Health* 2022; 22: 2170.
10. Lin B, Liu J, Ma Y, et al. Factors influencing HIV testing and counselling services among men who have sex with men in Western China: a cross-sectional study based on Andersen's Behavioral Model. *Environ Health Prev Med* 2022; 27: 21.
11. Zhou J, Yang L, Ma J, et al. Factors associated with HIV testing among MSM in guilin, China: results from a cross-sectional study. *Int J Public Health* 2022; 67: 1604612.
12. Adeagbo O, Herbst C, Blandford A, et al. Exploring people's candidacy for Mobile health–supported HIV testing and care services in rural KwaZulu-natal, South Africa: qualitative study. *J Med Internet Res* 2019; 21: e15681.
13. Stevens DR, Vrana CJ, Dlin RE, et al. A global review of HIV self-testing: themes and implications. *AIDS Behav* 2018; 22: 497–512.
14. WHO. *Guidelines on HIV self-testing and partner notification: supplement to consolidated guidelines on HIV testing services*, https://apps.who.int/iris/handle/10665/251655 (2016).
15. Adeagbo OA, Seeley J, Gumede D, et al. Process evaluation of peer-to-peer delivery of HIV self-testing and sexual health information to support HIV prevention among youth in rural KwaZulu-Natal, South Africa: qualitative analysis. *BMJ Open* 2022; 12: e048780.
16. Zhao Y, Zhu X, Pérez AE, et al. MHealth approach to promote Oral HIV self-testing among men who have sex with men in China: a qualitative description. *BMC public Health* 2018; 18: 1146–1146.
17. Guigayoma J, Becker SJ, Ong JJ, et al. Addressing key issues in HIV self-test program implementation for black and latino sexual minority men in the southern United States: a multiphase study protocol. *Implementation Sci Commun* 2023; 4: 14.
18. Figueroa C, Johnson C, Verster A, et al. Attitudes and acceptability on HIV self-testing among key populations: a literature review. *AIDS Behav* 2015; 19: 1949–1965.
19. Frye V, Nandi V, Paige MQ, et al. TRUST: assessing the efficacy of an intervention to increase HIV self-testing among young black men who have sex with men (MSM) and transwomen. *AIDS Behav* 2021; 25: 1219–1235.
20. Bilardi JE, Walker S, Read T, et al. Gay and bisexual men's views on rapid self-testing for HIV. *AIDS Behav* 2013; 17: 2093–2099.
21. Lu X, Gao P, Wang X, et al. User preferences for an mHealth approach to support HIV self-testing and linkage to HIV prevention or care services for MSM in China. *AIDS Educ Prev* 2021; 33: 534–550.
22. Romero RA, Klausner JD, Marsch LA, et al. Technology-Delivered intervention strategies to bolster HIV testing. *Curr HIV/AIDS Rep* 2021; 18: 391–405.
23. Zapata JP, Hirshfield S, Nelson K, et al. Preferred characteristics for mHealth interventions among young sexual minoritized men to support HIV testing and PrEP decision-making: focus group study. *JMIR Form Res* 2023; 7: e51103.
24. Adeagbo O, Kim H-Y, Tanser F, et al. Acceptability of a tablet-based application to support early HIV testing among men in rural KwaZulu-Natal, South Africa: a mixed method study. *AIDS CARE* 2021; 33: 494–501.
25. Shrestha R, Fisher C, Wickersham JA, et al. Privacy and confidentiality concerns related to the use of mHealth apps for HIV prevention efforts among Malaysian men who have sex with men: cross-sectional survey study. *JMIR Formative Res* 2021; 5: e28311.
26. Njuba L, Gómez-Morantes JE, Herrera A, et al. Health information systems in extreme contexts: using mobile phones to fight AIDS in Uganda. *Electron J Inf Sys Dev Countries* 2024; 90: e12314.
27. Hoth AB, Shafer C, Dillon DB, et al. Iowa TelePrEP: a public-health-partnered telehealth model for human immunodeficiency virus preexposure prophylaxis delivery in a rural state. *Sex Transm Dis* 2019; 46: 507–512.

28. Chasco EE, Shafer C, Dillon DMB, et al. Bringing Iowa TelePrEP to scale: a qualitative evaluation. *Am J Prev Med* 2021; 61: S108–S117.
29. Tracy SJ. Qualitative quality: eight "big-tent" criteria for excellent qualitative research. *Qual Inq* 2010; 16: 837–851.
30. Adeagbo O. Barriers and facilitators to pre-exposure prophylaxis uptake among black/African American men who have sex with other men in Iowa: COM-B model analysis. *Ther Adv Infect* 2024; 11: 20499361241267151.
31. Tong A, Sainsbury P and Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *Int J Qual Health Care* 2007; 19: 349–357.
32. Braun V and Clarke V. Using thematic analysis in psychology. *Qual Res Psychol* 2006; 3: 77–101.
33. Francis JJ, Johnston M, Robertson C, et al. What is an adequate sample size? Operationalising data saturation for theory-based interview studies. *Psychol Health* 2010; 25: 1229–1245.
34. Dinglasan JLG, Rosadiño JDT, Pagtakhan RG, et al. Bringing testing closer to you': barriers and facilitators in implementing HIV self-testing among Filipino men-having-sex-with-men and transgender women in National Capital Region (NCR), Philippines – a qualitative study. *BMJ Open* 2022; 12: e056697.
35. Elorreaga OA, Torres TS, Vega-Ramirez EH, et al. Awareness, willingness and barriers to HIV Self-testing (HIVST) among Men who Have Sex with Men (MSM) in Brazil, Mexico, and Peru: a web-based cross-sectional study. *PLOS Global Public Health* 2022; 2: e0000678.
36. Bowleg L, Malekzadeh AN, Mbaba M, et al. Ending the HIV epidemic for all, not just some: structural racism as a fundamental but overlooked social-structural determinant of the US HIV epidemic. *Curr Opin HIV AIDS* 2022; 17: 40–45.
37. Frye V, Wilton L, Hirshfield S, et al. Just because it's out there, people aren't going to use it." HIV self-testing among young, black MSM, and transgender women. *AIDS Patient Care STDS* 2015; 29: 617–624.
38. Zhang C, Li X, Heilemann MV, et al. Facilitators and barriers of HIV self-testing among Chinese men who have sex with men: a qualitative study. *J Assoc Nurses AIDS Care* 2021; 32: 599–609.
39. Frye V, Wilton L, Hirshfield S, et al. Preferences for HIV test characteristics among young, Black Men Who Have Sex With Men (MSM) and transgender women: implications for consistent HIV testing. *PloS one* 2018; 13: e0192936–e0192936.
40. Marley G, Kang D, Wilson EC, et al. Introducing rapid oral–fluid HIV testing among high risk populations in shandong, China: feasibility and challenges. *BMC Public Health* 2014; 14: 422.
41. Prescott MR, Montoya JL, Perry C, et al. Community-identified implementation strategies for promoting the adoption of HIV self-testing in a Southern California American Indian community: a rapid qualitative analysis. *AIDS Behav* 2024; 28: 2101–2112.
42. Mathews A, Conserve D, Mason H, et al. Informed and empowered': a mixed-methods study of crowdsourcing contests to promote uptake of HIV self-testing kits among African Americans. *J Virus Erad* 2020; 6: 74–80.
43. Gous N, Fischer AE, Rhagnath N, et al. Evaluation of a mobile application to support HIV self-testing in Johannesburg, South Africa. *South Afr J HIV Med* 2020; 21: 1–7.
44. Steehler K and Siegler AJ. Bringing HIV Self-Testing to Scale in the United States: a Review of Challenges, Potential Solutions, and Future Opportunities. *J Clin Microbiol* 2019; 57. 10.1128/jcm.00257-19
45. Adeagbo OA, Badru OA, Nkfusai CN, et al. Effectiveness of linkage to care and prevention interventions following HIV self-testing: a global systematic review and meta-analysis. *AIDS Behav* 2024; 28: 1314–1326.