FY 2025 Houston EMA/HSDA Ryan White Part A Service Definition **Substance Abuse Services - Outpatient** (Last Review/Approval Date: 6/3/16)	
HRSA Service Category Title: **RWGA Only**	Substance Abuse Services Outpatient
Local Service Category Title:	Substance Use Treatment/Counseling
Budget Type: **RWGA Only**	Fee-for-Service
Budget Requirements or Restrictions: **RWGA Only**	Minimum group session length is 2 hours
HRSA Service Category Definition (**do <u>not</u> change or alter**): **RWGA Only**	***Substance abuse services outpatient*** is the provision of medical or other treatment and/or counseling to address substance abuse problems (i.e., alcohol and/or legal and illegal drugs) in an outpatient setting, rendered by a physician or under the supervision of a physician, or by other qualified personnel.
Local Service Category Definition:	Treatment and/or counseling individuals with HIV with substance abuse disorders delivered in accordance with State licensing guidelines.
Target Population (age, gender, geographic, race, ethnicity, etc.):	Persons living with HIV and substance abuse disorders, residing in the Houston Eligible Metropolitan Area (EMA/HSDA).
Services to be Provided:	Services for all eligible HIV patients with substance abuse disorders. Services provided must be integrated with HIV-related issues that trigger relapse. All services must be provided in accordance with the Texas Department of Health Services/Substance Abuse Services (TDSHS/SAS) Chemical Dependency Treatment Facility Licensure Standards. Service provision must comply with the applicable treatment standards.
Service Unit Definition(s): **RWGA Only**	**Individual Counseling:** One unit of service = one individual counseling session of at least 45 minutes in length with one (1) eligible client. **A single session lasting longer than 45 minutes qualifies as only a single unit** – no fractional units are allowed. Two (2) units are allowed for initial assessment/orientation session. **Group Counseling:** One unit of service = 60 minutes of group treatment for one eligible client. A single session must last a minimum of 2 hours. Support Groups are defined as professionally led groups that are comprised of HIV-positive individuals, family members, or significant others for the purpose of providing Substance Abuse therapy.
Financial Eligibility:	Refer to the RWPC's approved *Current FY Financial Eligibility for Houston EMA/HSDA Services*.
Client Eligibility:	Individuals living with HIV with substance abuse co-morbidities/disorders.
Agency Requirements:	Agency must be appropriately licensed by the State. All services must be provided in accordance with applicable Texas Department of State Health Services/Substance Abuse Services (TDSHS/SAS) Chemical

	Dependency Treatment Facility Licensure Standards. Client must not be eligible for services from other programs or providers (i.e. MHMRA of Harris County) or any other reimbursement source (i.e. Medicaid, Medicare, Private Insurance) unless the client is in crisis and cannot be provided immediate services from the other programs/providers. In this case, clients may be provided services, as long as the client applies for the other programs/providers, until the other programs/providers can take over services. All services must be provided in accordance with the TDSHS/SAS Chemical Dependency Treatment Facility Licensure Standards. Specifically, regarding service provision, services must comply with the most current version of the applicable Rules for Licensed Chemical Dependency Treatment. Services provided must be integrated with HIV-related issues that trigger relapse. Provider must provide a written plan annually no later than March 31st documenting coordination with local TDSHS/SAS HIV Early Intervention funded programs if such programs are currently funded in the Houston EMA.
Staff Requirements:	Must meet all applicable State licensing requirements and Houston EMA/HSDA Part A/B Standards of Care.
Special Requirements: **RWGA Only**	Not Applicable.

FY 2026 RWPC "How to Best Meet the Need" Decision Process

Step in Process: **Council**		Date: **06/12/2025**
Recommendations:	Approved: Y:_____ No: _____ Approved With Changes:_____	If approved with changes list changes below:
1.		
2.		
3.		

Step in Process: **Steering Committee**		Date: **06/05/2025**
Recommendations:	Approved: Y:_____ No: _____ Approved With Changes:_____	If approved with changes list changes below:
1.		
2.		
3.		

Step in Process: **Quality Improvement Committee**		Date: **05/13/2025**
Recommendations:	Approved: Y:_____ No: _____ Approved With Changes:_____	If approved with changes list changes below:
1.		
2.		
3.		

Step in Process: **HTBMTN Workgroup #2**	Date: **04/15/2025**
Recommendations:	Financial Eligibility:
1.	
2.	
3.	

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FY 2020 PERFORMANCE MEASURES HIGHLIGHTS

RYAN WHITE GRANT ADMINISTRATION

HARRIS COUNTY PUBLIC HEALTH (HCPH)

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HCPH is the local public health agency for the Harris County, Texas jurisdiction. It provides a wide variety of public health activities and services aimed at improving the health and well-being of the Harris County community.

Highlights from FY 2020 Performance Measures

Measures in this report are based on the *2021-2022 Houston Ryan White Quality Management Plan*, *Appendix B. HIV Performance Measures*. The document can be referenced here: https://publichealth.harriscountytx.gov/Services-Programs/Programs/RyanWhite/Quality

Substance Abuse Treatment

- During FY 2020, 9 (50%) clients utilized primary medical care after accessing Part A substance abuse treatment services.
- Among clients with viral load tests, 89% were virally suppressed during this time period.

Ryan White Part A
HIV Performance Measures
FY 2020 Report

Substance Abuse Treatment
All Providers

HIV Performance Measures	FY 2019	FY 2020	Change
*A minimum of 70% of clients will utilize Parts A/B/C/D primary medical care after accessing Part A-funded substance abuse treatment services	17 (70.8%)	9 (50.0%)	**-20.8%**
80% of clients for whom there is lab data in the CPCDMS will be virally suppressed (<200)	19 (82.6%)	16 (88.9%)	**6.3%**
90% of clients will complete substance abuse treatment program	See data below		

***Overall, the number of clients who received primary care in FY 2020 was 11, with 9 receiving the services through Ryan White and 2 receiving the services through other insurance such as Medicare.**

Number of clients engaged in substance abuse treatment program during FY20: **18**

Number of clients completing substance abuse treatment program during FY20 (March 2020 to February 2021): **7**

Number of clients completing substance abuse treatment during FY20 who entered treatment in FY19: **3**

Number of FY20 substance abuse treatment clients who are receiving primary care through other insurance, such as Medicare: **2**

Number of FY20 clients engaged in substance abuse treatment who completed treatment after FY20: **2**

PLOS ONE

RESEARCH ARTICLE

Provider perspectives on screening and treatment for opioid use disorder and mental health in HIV care: A qualitative study

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Data Availability Statement: A de-identified dataset may be made available upon request from the corresponding author after obtaining an appropriate data transfer agreement. Requests

Abstract

Background

HIV, opioid use disorder (OUD), and mental health challenges share multiple syndemic risk factors. Each can be effectively treated with routine outpatient appointments, medication management, and psychosocial support, leading implementers to consider integrated screening and treatment for OUD and mental health in HIV care. Provider perspectives are crucial to understanding barriers and strategies for treatment integration.

Methods

We conducted in-depth qualitative interviews with 21 HIV treatment providers and social services providers (12 individual interviews and 1 group interview with 9 participants) to understand the current landscape, goals, and priorities for integrated OUD, mental health, and HIV care. Providers were purposively recruited from known clinics in Mecklenburg County, North Carolina, U.S.A. Data were analyzed using applied thematic analysis in the NVivo 12 software program and evaluated for inter-coder agreement.

Results

Participants viewed substance use and mental health challenges as prominent barriers to engagement in HIV care. However, few organizations have integrated structured screening for substance use and mental health into their standard of care. Even fewer screen for opioid use. Although medication assisted treatment (MAT) is effective for mitigating OUD, providers struggle to connect patients with MAT due to limited referral options, social barriers such as housing and food insecurity, overburdened staff, stigma, and lack of provider training. Providers believed there would be clear benefit to integrating OUD and mental health treatment in HIV care but lacked resources for implementation.

may be directed to the corresponding author. The data may also be made available upon request to the Center for Nursing Research at the Duke University School of Nursing at doche002@mc.duke.edu or 919-668-3836. Sharron L. Docherty, Vice Dean of the Center for Nursing Research, is the primary point of contact for the Center for Nursing Research.

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Conclusions

Integration of screening and treatment for substance use and mental health in HIV care could mitigate many current barriers to treatment for all three conditions. Efforts are needed to train HIV providers to provide MAT, expand resources, and implement best practices.

Introduction

In 2021, opioid overdose contributed to 80,816 deaths in the United States, making it the leading cause of injury death in the nation [1, 2]. In addition, opioid misuse can impact well-being, increasing the risk for homelessness, unemployment, mental health challenges, and sexually transmitted infections, including HIV [3–7]. Relationships between HIV, opioid use disorder (OUD), and mental health challenges are complex and syndemic. People living with HIV (PLWH) are more likely to experience chronic pain compared to uninfected people, even when their HIV is well managed, likely due to chronic inflammation and social challenges that are more common among PLWH; one study found that nearly half (48.7%) of PLWH struggle with daily pain [8].

Because of challenges with chronic pain, PLWH are more likely to be treated with opioids, creating increased risk for addiction [9, 10]. Simultaneously, PLWH who use opioids are more likely to experience challenges across the HIV care continuum, including delayed entry into care, suboptimal linkage to treatment, and lower adherence to antiretroviral therapy [11]. HIV and OUD also share multiple social determinants–including low health literacy, poverty, and exposure to violence–that can contribute to poor treatment outcomes such as increased disability, morbidity, and mortality [12, 13].

States in the U.S. South have been disproportionately impacted by both HIV and opioid use disorder [14]. Mecklenburg County, North Carolina (NC) is designated as a priority jurisdiction in the national plan for Ending the HIV Epidemic (EHE) [15], with HIV prevalence nearly three times higher than state and national rates [16]. The county also faces a considerable burden in the opioid epidemic, with an estimated 165 opioid overdose deaths in 2020, which is by far the greatest of any substance measured [17]. Yearly opioid overdose deaths in North Carolina more than quadrupled from 2012 to the end of 2021, including a dramatic spike during the COVID-19 pandemic [17]. Mecklenburg is a large county that includes the greater Charlotte metropolitan area, surrounding suburban areas, and several rural communities, each of which faces unique challenges in improving access to screening and treatment for both HIV and OUD.

The most effective intervention for OUD is medication-assisted treatment (MAT) combining medications for opioid use disorder such as buprenorphine, naltrexone, and methadone, along with psychosocial therapy [18–21]. HIV and OUD are both chronic conditions that are treatable with daily medication, with outcomes enhanced by strong psychosocial support [22, 23]. Further, both HIV and OUD have frequently been linked to mental health challenges. For example, experiencing prior trauma is a risk factor for both HIV and OUD [24]. Other mental health conditions, including depression and anxiety, may be present before HIV infection or the onset of opioid use, often with a worsening or progression, or may develop after an HIV or OUD diagnosis [25, 26].

The common comorbidity of HIV, OUD, and mental health challenges have led implementers to consider integrated treatment for these conditions under one roof, and some efforts have been made to improve access to mental health care in the context of HIV care [27]. The first step toward integration of mental health and OUD treatment in HIV care is effective, universal screening of these conditions at every HIV care appointment [25]. However, several

barriers to screening and integration have been identified, including lack of provider awareness and time and resource constraints [28, 29]. A systematic review identified six studies examining the integration of treatment for OUD in HIV care settings, five of which focused on MAT and one of which offered counseling only [27]. These studies demonstrated several positive clinical benefits for both HIV and OUD, included improved initiation of antiretroviral therapy (ART), decreased opioid use, decreased needle sharing, and improved health-related quality of life [27]. Another recent review identified benefits for HIV viral suppression [30]. However, the integration of OUD treatment in HIV care did require considerable investment, including commitment from leadership to support multidisciplinary care teams, up-to-date provider training, and sufficient pharmacy stock for substance use treatment [30]. Additional barriers included added costs for labor, facilities, and urine toxicology testing, as well as a higher burden of treatment for existing HIV specialists [27]. Although studies have emerged demonstrating the benefits of integrated OUD treatment in HIV care, few have addressed the common comorbidity with mental health challenges.

The objectives of this study were to further explore the current landscape of screening and treatment for OUD and mental health challenges in HIV care, including potential benefits and barriers related to the implementation of integrated screening and treatment. To achieve these objectives, we interviewed HIV treatment providers and social service providers who are currently offering services related to HIV and OUD in Mecklenburg Country, North Carolina.

Methods

The study team conducted in-depth qualitative interviews with a purposive sample of medical and social service providers offering treatment for people living with HIV and OUD in Mecklenburg County, North Carolina. The team first compiled a list of known local providers engaged in HIV-related care and/or OUD treatment, and contacted each to invite them to participate in a group or individual qualitative interview. Preliminary lists were compiled from our experience conducting prior research in the area and online searches of HIV and OUD treatment providers. HIV-related care included HIV testing, antiretroviral medication management for PLWH, and pre-exposure prophylaxis (PrEP) for people with elevated risk of HIV infection. Upon completion of their interviews, recruited participants were asked to name other medical and social services providers in the county and these providers were then contacted and invited to participate. We reached out to 15 medical and social services providers, all of whom either completed an interview or referred us to other professionals within their organization who completed an interview.

A member of the research study team trained in qualitative interviewing conducted 30–60 minute virtual in-depth individual interviews (IDIs) with 12 providers using a semi-structured interview guide on videoconferencing software. Nine additional participants at one large site participated in a 35 minute virtual group interview. Interviews took place between May 3, 2022 and October 24, 2022. Prior to each interview, participants completed a brief verbal questionnaire to collect demographic and background information including their professional experience, current role, and characteristics of their organization. All participants signed an online consent form prior to participating. No compensation was provided for participation.

The interview guide provided language for initial questions and prompts for additional probes, as well as flexibility for the interviewer to probe additional lines of inquiry based on their judgment. In instances where an area of inquiry did not apply to an interviewee, that section was skipped. All interviews were audio recorded, transcribed and de-identified, and uploaded to a secure online database for analysis. The study was determined exempt by the Institutional Review Board of the Duke University Health System.

The qualitative interview guide

The development of the interview guide was informed by the Implementation Research Logic Model (IRLM) [31, 32], which considers contextual determinants, including compatibility with existing care models and stakeholder acceptability, strategies to address identified barriers, and mechanisms for outcome improvement. Data from the study are intended to inform future implementation strategies to improve OUD and mental health care in the context of HIV treatment, which may include OUD/stigma education and harm reduction training for HIV clinic personnel, introducing OUD and mental health screening in HIV care, integrating mental health treatment into care, and training HIV clinic providers to offer MAT. A summary of the components, questions, and prompts explored in the semi-structured interview guide, with associated IRLM elements, can be found in Table 1.

Qualitative analysis

Prior to commencing recruitment, the research team discussed personal reflexivity, including personal attributes and prior knowledge, experience, and assumptions related to HIV, OUD, and mental health. The research team included content experts in each of these areas, and we conducted a one-hour team training on cultural humility, stigma, and harm reduction principles in research. Interviews were analyzed using an applied thematic approach [33] and NVivo 12, a qualitative data software program, to code the data. Thematic data analysis included a combination of deductive and inductive coding, with a priori themes based on the qualitative interview guide utilized for the development of broader categories in the codebook with the emergence of subcodes developed from rereading the collected data transcripts. Two interviews were initially coded by multiple team members, who then came together to discuss and refine the codebook, add emergent theme categories, and resolve any discrepancies of interpretation of the data to ensure validity. The remainder of interviews were then coded using line by line analysis.

The study sample size was determined by the number of eligible providers in Mecklenburg County and considerations of data saturation, the number of new themes emerging in new interviews during preliminary analysis [34].

We randomly selected three individual interviews and the group interview to be re-coded by a second reviewer and evaluated for inter-coder agreement using a pre-established threshold of 80% agreement [35]. Inter-coder agreement on these transcripts was 87.7% (range 85.7–88.9), which exceeded the desired threshold.

Results

Interview participants

Interviews were conducted with 21 health care and social service providers currently offering services related to HIV and/or substance use at 11 unique facilities in Mecklenburg Country, NC. We conducted one group interview with 9 participants and 12 individual interviews with 15 social services providers and 6 medical providers, including outreach workers, social workers, case managers, clinical program coordinators, peer specialists, outreach workers, clinic directors, medical doctors, and a physician assistant. The majority of participants (67%) were ages 30–49 years, with more representation (62%) from people identifying as female than male and two-thirds (67%) identifying as Black/African American. Interviewees had been in their current role for an average of 5 years, with a range of 1 to 15 years (Table 2).

Table 1. Summary of semi-structured interview guide.

Domain	Area of Inquiry	IRLM Core Element(s)	Questions and Prompts
Patient Characteristics	Patient population	Implementation Determinants	• Population served • Mental health among patients • Substance use among patients • Opioid use among patients • Patient interest in MAT • Challenges to treatment accyess
Current Clinic Services Related to HIV, Substance Use, and Mental Health	HIV testing, treatment and services currently offered	Implementation Determinants	• Treatment and services currently offered at the clinic • Treatment and services offered elsewhere in the community • Referral process and challenges
	Screening for substance use	Implementation Strategies and Mechanisms	• Whether screening tool is used • Which patients screened • Who administers screening • Screening follow up • Patient comfort being screened
	Substance use treatment and services currently offered	Implementation Determinants	• Treatment and services currently offered at the clinic (if any) • Treatment and services offered elsewhere in the community • Referral process and challenges
	Mental health treatment and services currently offered	Implementation Determinants	• Screening, treatment, and services currently offered at the clinic (if any) • Treatment and services offered elsewhere in the community • Referral process and challenges
	Strategies and resources needed to improve or expand services	Implementation Strategies and Mechanisms	• Substance use and mental health screening • To improve or expand existing services • To improve referral processes for external services • To offer new services • To support clinic with resources and provider training to offer MAT
Provider experiences related to MAT in the context of HIV-related care		Implementation Mechanisms and Outcomes	• Provider training • Motivation/interest in offering MAT • Challenges to providing MAT • Benefits of providing MAT • Clinic support for offering MAT

Note. MAT: medication-assisted treatment for opioid use disorder

https://doi.org/10.1371/journal.pone.0305174.t001

Table 2. Participant demographics (N = 21).

Demographic Characteristics	n (%)
Gender	
Female	13 (62%)
Male	8 (38%)
Age (in years)	
18–29	1 (5%)
30–49	14 (67%)
50–64	6 (29%)
Race	
Black or African American	14 (67%)
Non-Hispanic white	6 (29%)
Both white and Black or African American	1 (5%)

https://doi.org/10.1371/journal.pone.0305174.t002

Organizational characteristics

Participants provided information on characteristics of the clinic or organization where they work. These included five community nonprofit organizations that provide HIV treatment and prevention services, two Federally Qualified Health Centers (FQHCs), two clinics that provide both primary care and infectious diseases care, one hospital infectious diseases clinic, and the county Health Department. HIV-related care typically included HIV testing, antiretroviral medication management for PLWH, pre-exposure prophylaxis (PrEP) for people with elevated risk of HIV, and management of common comorbid health conditions such as hepatitis. At several clinics, HIV providers also offered primary medical care for conditions unrelated to HIV. All of the clinics work with uninsured patients and almost all accept Medicaid/Medicare.

Only one clinic offered in-house MAT for patients with OUD, in the form of sublingual buprenorphine/naloxone, which was also a clinic that offered both primary care and infectious diseases care. A provider at this clinic noted "increasing amounts of substance use in general and increasing demand for our MAT program," with 30% growth in their MAT patient population in the prior year. As demand has increased, they have hired more providers capable of providing MAT to help meet this need. All of the clinics that did not offer in-house services did offer linkages or referral to outside services such as housing assistance, mental health, substance use treatment, food support, and harm reduction services. No participants reported having peer support workers at their clinic. Roughly half had social workers and/or case managers.

With regard to mental health treatment, three clinics had an in-house provider whereas about half of participants described referring patients with mental health needs to outside clinics or community organizations that can provide needed care. Most participants felt there would be a clear benefit to adding more integrated services within their clinic, including support for substance use mental health treatment, and MAT. The primary barriers to adding these services were lack of financial support and human resources to implement new programs. For example, several participants mentioned actively seeking to hire providers to offer mental health care in-house, but experiencing challenges in finding candidates for these positions. As a result, most clinics currently prioritize providing HIV-related care and treatment specifically.

Substance use among patients engaged in HIV-related care

Nearly all of the study participants described substance use and mental health challenges as common among patients seeking HIV-related care. Most interviewees highlighted alcohol, marijuana, and sometimes methamphetamine and crack or cocaine as substances they see most frequently among the populations they serve, whereas opioids were emphasized less often. When asked specifically about opioid use among their patients, many participants focused their responses on injection opioid use.

> "*In regards to substance abuse, crack and cocaine have always been a thing and heroin has always been a thing. Marijuana has always been a thing. But as the years have gone by, you saw people mixing different drugs together and they're more addictive in less time. So a lot of times, when you're talking to clients, things that they used to be able to pull away from, they can no longer pull away from.*"

When asked about other routes of administration including misuse of prescription opioid medications, many participants acknowledged that this is likely a much more common, but hidden, problem.

Despite the perception that drug use is very common among their patients, more than half of participants stated that they do not assess for substance use during HIV-related appointments or that assessment is not done consistently. Among those who do assess for substance use, most stated they do not use formal assessments, but ask the questions informally or that they only ask about substance use if it seems relevant to the patient's HIV care. For example, one participant stated, it is a "clinician-to-clinician decision about how they like to screen and talk about [treatment] options." More than half of participants identified improving or standardizing their screening procedures as an area for improvement of services.

Among patients who use drugs, participants expressed that there is commonly a lack of awareness and acceptance among patients of the need for treatment to manage their use. When asked whether specific subsets of their patient population are more likely to be experiencing challenges related to substance use, several participants indicated that sexual and gender minority (SGM [LGBTQIA+]) patients (especially men who have sex with men [MSM] and transgender individuals) and unhoused patients are groups that seem to be disproportionately affected by substance use.

Other challenges influencing engagement with HIV-related care

Nearly all of the participants described mental health challenges as common among patients in HIV-related care and reported that mental health challenges often co-occur with substance use. Common mental health challenges included depression, posttraumatic stress, and anxiety. Participants also described seeing patients with cognitive impairment and psychosis, both of which can occur due to chronic drug use.

> "*[Our patients] are very chronic, long-term substance users oftentimes, and these are usually individuals that also may have cognitive, as well as mental health diagnoses, which makes it a lot more challenging for them to manage all of that at the same time.*"

Participants described mental health challenges as having a significant negative impact on HIV care engagement, including disruptions to long-term retention in care, consistency in attending appointments, and adherence to antiretroviral medication and other treatments. This created a cyclical pattern of deteriorating physical health and mental health that, especially when coupled with substance use, could lead to likely increases in morbidity and mortality.

Participants identified several other common barriers to HIV patients' engagement with treatment and overall health, often related to finances and social challenges. One participant described it in this way; "When you take mental health and substance use, you've got the main barriers for our patients, followed by housing insecurity, food insecurity, transportation, and then criminal justice involvement."

Participants noted there is a lack of clinic and community resources available to support individuals with social challenges such as housing insecurity. Some clinics provide support to coordinate and link patients to housing, prevent patients from being evicted from their homes, assist with food, or to cover utility costs. Several interviewees explained that without stable housing, patients with HIV, substance use disorders, and other mental health challenges often struggle to stay consistently engaged in their HIV-related care and to seek substance use or mental health treatment.

> "*The resources [for housing] just aren't there in a lot of cases. . . It's kind of like the hierarchy of needs. Without housing, it's difficult for them to seek mental health services or substance*

use services because their main concern at that point in time is housing. Even their health goes on the back burner because they just want a place to stay."

Many participants also highlighted transportation as a significant barrier to accessing services. Some noted that their clinics can offer transportation vouchers, cover costs using outside funding, or offer services via telemedicine to ameliorate this challenge. Nevertheless, transportation challenges continue to be a common reason provided by patients for missing appointments or falling out of treatment.

Several participants discussed financial barriers to care, noting that some clinics in the area do not accept patients without insurance, do not provide Medicaid/Medicare coverage, or require payment beyond patients' capabilities even with sliding scales. These financial challenges extend to medication prescription coverage, as well as substance use and mental health care. Interview participants explained that though there are a few social services programs in the area that subsidize copays for mental health care or substance use or provide services free of charge, availability is extremely limited and has inclusion criteria for qualification.

Finally, more than half of the participants described a negative impact of stigma related to mental health and substance use that can prevent patients from discussing substance use or mental health challenges with providers or other support systems, or from asking about services that may be available to them. A few interviewees described stigmatizing comments they have heard or behaviors they have seen staff engage in and noted that this can negatively impact patients' experiences in care. Multiple participants identified cultural humility and stigma reduction as areas in which their organizations could benefit from training.

Areas to improve substance use and mental health treatment in HIV-related care

More than half of participants discussed challenges related to referring patients for mental health and/or substance use services. Some of these challenges include long waitlists, difficulty following up with patients to ensure they were able to connect to care, lack of available services to refer to (especially for patients with financial barriers), and the burden of building trust with another provider that patients may engage with when being referred out for care. Given these challenges with referrals, some HIV providers attempted to provide counseling and prescribe psychotropic medications, but they often encountered cases they did not have the expertise or capacity to manage in-house.

"*There is a significant number of people with untreated mental health issues, and our providers are not comfortable treating anything more than like minor depression. They're okay putting them on like a low dose SSRI. They're not doing any kind of full psychiatric evaluation and they're definitely not prescribing anti-psychotic drugs."*

Participants acknowledged that the lack of referral options was a complex problem that required large scale, systems-level interventions, such as increased government support to increase the availability of substance use and mental health services and improve access to existing treatment options.

With limited external referral options, several interviewees noted how beneficial it is when a clinic can provide HIV-related care, primary care, mental health, and substance use treatment all under one roof.

"*It would be great if substance use [treatment] was in-house for us, because when we have a client that is interested in treatment that tends to be where we lose them, because they don't*

want to have to go to this agency and that agency and this place and that place. If they could just come to a central location with us, I think that we would have a bit more success in getting clients to engage."

Nearly all of the participants discussed the need for more provider training to enhance knowledge on how to treat addiction, raise awareness of services available in the community, increase cultural humility, and reduce stigma when working with patients experiencing substance use and/or mental health challenges.

"*More training. That is definitely needed. Sensitivity training, especially towards substance use. I hear a little undercurrent every now and then where people make comments about drug use, as if it is some deliberate diagnosis that they have a choice in. Everybody needs it."*

Participants felt that providers would be open to more education. However, many interviewees also expressed concern about current staff workloads and the need for more staff to take on new initiatives focused on improving linkage to substance use and mental health treatment.

Several participants explained that having peer navigators to support patients would be beneficial for facilitating trust, helping patients to access needed services, and successfully referring patients for mental health and substance use care.

"*I think that [patients] would be definitely more comfortable talking to people in outreach or somebody who's a peer that can just talk about their experiences. . .I think that people are more likely to open up if it's somebody who they know is in the community as well."*

Discussion

In these interviews with healthcare and social services professionals providing HIV-related care, there was general agreement about the challenges of comorbid substance use and mental health challenges, the need for improved services in these areas, and the benefit of integrated HIV, substance use, and mental health treatment under one roof. There is an emerging evidence base demonstrating the value of integrated substance use treatment in HIV care [27, 30]; however, efforts at implementing these findings in routine clinical care remain nascent and little attention has been paid to syndemic patterns of HIV, substance use, and other mental health challenges.

The U.S. government's plan for Ending the HIV Epidemic (EHE), introduced in 2019, includes a goal of a 90% reduction of new HIV infections in the U.S. by 2030 [15]. To achieve this goal, the plan includes an emphasis on priority populations and jurisdictions with high HIV prevalence, increases in funding for HIV prevention and treatment, and addressing key barriers to progress in ending the epidemic, "including trends in injection and other drug use; HIV-related stigma; homonegativity and transnegativity; lack of access to HIV prevention, testing, and treatment; and a lack of awareness that HIV remains a significant public health threat" [15]. The site of this research, Mecklenburg County, North Carolina, was identified as one of 48 counties with the highest number of new HIV diagnoses to be prioritized in the EHE plan [15].

In the current research, substance use was described as extremely common among patients seeking HIV-related services when screening did occur, with an increasing burden of OUD in this population. However, few of the participants' clinics conducted standardized evidence-

based screening for substance use with valid psychometric scales, and only one clinic provided in-house substance use treatment and MAT. Providers who did not conduct routine screening rarely asked about opioid use in their informal substance use assessments, reinforcing OUD's status as a hidden epidemic in many healthcare settings [36].

These findings add to a large and growing body of literature highlighting the challenge of OUD in HIV care and failures of the health system to adequately respond by improving access to OUD treatment [11, 37, 38]. MAT is an effective treatment for OUD, involving daily medication to reduce opioid cravings, supplemented by behavioral support, adherence counseling, and education [39, 40]. Prior to 2023, providers required specific training and an associated waiver to prescribe medications for OUD, such as buprenorphine; however, these requirements have now been waived, removing a crucial barrier to providers in all settings offering these safe and effective treatments [41]. It will be crucial in the coming months to capitalize on the improved regulatory environment by seeking to bring evidence-based models for OUD treatment to scale within HIV treatment settings.

Mental health treatment is another crucial aspect of care that can improve quality of life, reduce risk of acquiring HIV or initiating substance use, and improve outcomes of PLWH and people who use opioids [42, 43]. In the current study, participants reported barriers to mental health care that hinder treatment for HIV and substance use, with few clinics offering formal mental health screening and limited in-house options for treatment. These challenges were further exacerbated by poor external referral options for mental health care, including a lack of providers, long wait times, and high costs of treatment. Further, participants expressed concerns about HIV stigma that might occur in the health system and the desire to know and trust providers before sending referrals to them. For PLWH who are also struggling with a substance use disorder and/or another mental health disorder, each condition brings the potential for stigma that can impact social support, disclosure, care engagement, and health outcomes [44, 45].

Participants identified several common social concerns that often co-occurred with HIV, substance use, and mental health challenges, including housing insecurity, food insecurity, and criminal justice involvement. Whether these challenges existed prior to receiving an HIV diagnosis or arise afterward, they must be addressed to increase the likelihood of long-term treatment adherence and positive health outcomes [46–48]. Both HIV care and OUD treatment rely strongly on attention to behavioral health, daily medication adherence, health education, and addressing social determinants to maximize the potential for treatment success [47, 48]. Therefore, it is logical, resource efficient, and imperative to combine treatment approaches for HIV and OUD under one roof [27, 30, 49].

Participants in our study identified integrated treatment for HIV, OUD, and mental health as valuable and desirable, but also difficult to implement due to current providers and staff feeling overburdened and lacking resources to develop new programs. At the national level, some important steps have been made to open the door for improved treatment integration. These include the elimination of the waiver requirement for prescribing medication for OUD [41], new government funding and drug company settlements to address the opioid epidemic [50], and increased support for HIV treatment through the EHE plan [15]. However, sustained efforts are needed to ensure this support reaches providers and patients through evidence-based interventions, and integrated treatments among high-risk groups should be at the top of this list. This will require investments at all levels of the healthcare workforce to increase treatment capacity, including the task-sharing, task-shifting, to peer navigators and community health workers [51]. Telehealth treatment may also be a promising direction to maximize resources [27, 39, 51].

Findings from this study should be interpreted in light of the following limitations. We recruited participants from diverse organizations providing HIV-related services in Mecklenburg County, North Carolina; however, perspectives may not be representative of the broader professional community in the state or elsewhere. Future analyses may wish to assess differences in service provision based on size and type of facility. Researchers may also wish to examine potential differences in themes observed in individual versus group interview formats. As care providers were the subjects of these interviews, information related to HIV and OUD treatment participation for community members who are not engaged in care were not represented. Additionally, this analysis did not include the perspectives of people with lived experience related to HIV-related care, opioid use, or mental health or from primary opioid treatment providers, which will be crucial for the next phase of this research.

Conclusions

In this study, HIV care providers identified a high burden of comorbid substance use disorders and mental health challenges, but experienced multiple barriers in connecting patients to care for these challenges. These included syndemic social challenges faced by patients such as housing insecurity and difficulties with transportation, lack of appropriate referrals, and stigma within the health system. Few clinics offered integrated, in-house treatment options for OUD or mental health, often due to high burdens placed on current providers and lack of resources for new services. Future efforts must emphasize identifying strategies to overcome these barriers and implement evidence-based strategies for HIV, OUD, and mental health treatment integration.

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Combined effects of smoking and HIV infection on the occurrence of aging-related manifestations

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Both HIV-1 infection and smoking may contribute to the development of ageing-related manifestations affecting the prognosis of people living with HIV, but it is unclear whether HIV and smoking exert their effects independently or interact by potentiating each other. We conducted a cross-sectional study in 192 people living with HIV aged- and gender-matched with 192 HIV-uninfected controls, assessing the relative effect of HIV-1/smoking status on lung function (FEV1), bone mineral density (BMD), appendicular skeletal muscle mass index (ASMI), aortic pulse-wave velocity (PWV), insulin resistance (HOMA-IR) and renal function. In both unadjusted and adjusted analyses, FEV1, BMD and ASMI significantly differed according to smoking/HIV status, with the worst parameters found in HIV-1 infected patients currently smoking, and BMD and ASMI decreased to a lesser extent in HIV-1 infected patients formerly smoking (> 10 pack-years). Values in people living with HIV with < 10 pack-years exposure were of similar magnitude to those from controls. Regarding PWV, HOMA-R and eGFR, no significant differences were found, with the exception of eGFR values which were globally lower in HIV-1 infected patients. In conclusion HIV infection and smoking acted synergistically and were associated with a wasting phenotype combining muscle mass and bone mineral reduction.

Clinical Trial Registration (registrar, website, and registration number), where applicable: CPP 10-023, 09-027, 10-034.

With the advent of combined antiretroviral therapy (ART), people living with HIV (PLWH) live longer, currently reaching a median age higher than 50 years[1]. However, PLWH still die earlier than non-infected patients, mainly due the development of aging related comorbidities that adversely affect the prognosis of the disease, such as chronic obstructive pulmonary diseases, cardiovascular diseases, diabetes, renal insufficiency, or osteoporosis. These comorbidities are each individually associated with worse quality of life or increased mortality[2–7]. Decreased limb muscle and increased central adiposity are associated with 5-year all-cause mortality in HIV infection[8]. However, whether such systemic effects are ascribable directly to HIV disease and ART, or to other factors such as aging, environmental or behavioral determinants is still in debate. Among these factors, several are modifiable risk factors for comorbidities and it is crucial to determine whether actions reducing these risk factors may be sufficient to prevent or reverse the development of these comorbidities.

Tobacco smoking is the main modifiable risk that has a strong impact on age related comorbidities in the general population, in particular regarding lung and cardiovascular disease or osteoporosis. The systemic effects of smoking are mainly represented by pulmonary alterations such as emphysema and chronic obstructive pulmonary disease[9–12]. The higher prevalence of smoking among PLWH compared to the general population has led to an increasing cumulative exposure to tobacco in this population[13,14]. However, whether smoking is the main driver of age related diseases and comorbidities in PLWH is still a subject of debate[14,15]. If the relationship between smoking and cardiovascular diseases such as atherosclerosis and myocardial infarction, may be stronger

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in PLWH than in uninfected subjects[16], we do not know how HIV affects the relationship between smoking and the other systemic manifestations associated with cigarette smoke exposure. Similarly, we do not know whether HIV and smoking may exert their effects independently or may interact by potentiating each other.

To further our understanding of the impact of tobacco smoking to the age-related systemic manifestations in HIV-infected individuals, we investigated the association between smoking and several parameters such as arterial stiffness, bone mineral density, muscle mass, insulin resistance and kidney function, in PLWH and uninfected individuals and determined whether these relationships differed depending on HIV status. Because smoking may gradually exert its potential systemic effects within a continuum, relevant associations may be overlooked when only focusing on clinically established diseases. We consequently investigated these complex associations using continuous biological and functional parameters operating also at earlier stages of disease development.

Methods

Study design and participants

Participants living with HIV were recruited from the CARDAMONE study, a cross-sectional monocentric study of adult PLWH enrolled from the HIV outpatient clinic of the Henri Mondor Teaching hospital, France, between 2009 and 2012. To be included, patients had to have plasma HIV RNA below 50 copies/ml under c-ART and no past major cardiovascular event (i.e. myocardial infarction/chronic heart failure). HIV-uninfected individuals were recruited from the Clinical Investigation Center of the Henri Mondor Teaching hospital, as previously described[9,10,17]. For the present analysis, HIV-infected patients were 1:1 gender- and age-matched (using 5-years classes) to HIV-uninfected patients. A comparison of the main characteristics of subjects matched with those unmatched and discarded from the present analysis is shown in Supplemental Tables 1 and 2, indicating notable age-related differences between (un)matched subjects, with the youngest PLWH and the oldest controls being left out of the analysis. All studies were approved by the ethical committee of the Henri-Mondor Teaching Hospital (CARDAMONE: CPP 10-023; uninfected individuals: CPP 09-027 and 10-034). All participants provided written informed consent before inclusion. All research was performed in accordance with the Declaration of Helsinki.

Variables and data measurement

Demographic, clinical and lifestyle factors were collected for all participants from medical records, including age, gender, smoking, body mass index, waist circumference and blood pressure. Smokers were defined as individuals who had smoked more than 100 cigarettes in their lifetime[18], distinguishing between current and former (≥ 1 year) smokers who had quit smoking at the time of the study.

Each participant underwent spirometry, plethysmography measurement according to ATS/ERS consensus guidelines[19]. In each participant, arterial stiffness (aortic pulse-wave velocity, PWV) was measured as the carotid-femoral pulse-wave velocity using the Complior Analyse device (Alam Medical, Vincennes, France). Bone mineral density (BMD) at the hip (femoral neck) and lumbar spine was determined using dual-energy X-ray absorptiometry (Lunar iDXA, GE Healthcare, UK). BMD is reported as the absolute value (g/cm^2). T-scores were computed to classify participants as having normal BMD or osteoporosis (defined as T-score < -2.5 at either site). To assess muscle mass, appendicular skeletal muscle mass (ASM) was measured as the fat-free soft-tissue masses of the arms and legs divided by height squared and ASM index (ASMI) was then computed as ASMM divided by height squared. The cutoff for defining sarcopenia was two standard deviations below the mean sex-specific ASMI values in the Rosetta Study of young adults (5.45 for females and 7.26 for males), as proposed by Baumgartner et al.[20]. Insulin resistance was assessed by calculating the homeostasis model assessment of insulin resistance (HOMA-IR) (insulin·glucose)/22.5), and renal function by estimating the glomerular filtration rate (eGFR) using the Cockcroft-Gault formula. Other biological data included hemoglobin, white blood cell count (WBC), fasting glycemia, Hba1c, cholesterol (total, HDL, LDL), triglycerides, CRP and specifically in PLWH T lymphocytes parameters (i.e. Nadir $CD4^+$ cell count, $CD4^+$ and $CD8^+$ cell counts, $CD4^+/CD8^+$ ratio).

Statistical analysis

Qualitative variables are reported as numbers and percentages, and quantitative variables as means (± standard deviation, SD) or medians [interquartile range, IQR], depending on the normality of variable distributions as assessed by Shapiro–Wilk tests. Unadjusted between-groups comparisons were performed by means of mixed effects regression models to account for the 1:1 matching between PLWH and HIV-uninfected patients, using linear regression for continuous parameters and logistic regression for binary variables. Mixed effects linear multivariate models adjusted for age and gender were secondarily conducted to assess the relative effects of smoking and HIV-infection on aging-related systemic manifestations (i.e. arterial stiffness, bone mineral density, muscle mass, insulin resistance and kidney function). To assess the potential effect of the combination between smoking status and HIV, a composite 6-categories variable was entered in to the model, as follows: controls who were (i) never smokers or < 10 pack-years, (ii) former smokers with > 10 pack-years or (iii) current smokers with > 10 pack-years; and HIV-1-infected patients who were (iv) never smokers or < 10 pack-years, (v) former smokers with > 10 pack-years or (vi) current smokers with > 10 pack-years. No adjustment for multiple testing was done in the present study. Analyses of the effects of smoking and HIV-1 status were exploratory by nature and performed on prespecified ageing parameters of interest.

For illustrative purposes, a Gabriel's biplot was created to project the subjects along the principal components axes from a principal components analysis (PCA) based on their individual aging-related characteristics[21]. HIV/smoking 6-categories status was then mapped on the biplot by attributing different colors to patient's groups. Missing data for the main outcomes and covariates ranged from 0 to 13% (ASMI); all analyses were performed on complete cases using Stata v16.0 (StataCorp, College Station, TX, USA) and data visualizations using R v3.6.2 (R Foundation, Vienna, Austria).

Ethics approval and consent to participate

All studies were approved by the ethical committee of the Henri-Mondor Teaching Hospital (CARDAMONE: CPP 10-023; uninfected individuals: CPP 09-027 and 10-034). All participants provided written informed consent before inclusion.

Results

HIV-infected and matched controls differed on key baseline characteristics

From an initial total of 629 patients (N = 239 PLWH and N = 390 HIV-uninfected controls), 1:1 age- and gender-matching was possible for 378 patients (189 patients in each subgroup). Main characteristics of the participants are described in Table 1. In addition to age (overall mean 49.8 ± 8.2 years) and gender (overall 21.2% women), matched participants were also comparable regarding systolic blood pressure, pulse-wave velocity, HOMA-IR, and the ratio forced expiratory volume in one second (FEV1)/forced vital capacity (FVC). Overall, PLWH were characterized by a higher proportion of current smokers and sarcopenia, lower body mass index (BMI), eGFR

	N completed	Controls N = 189	People living with HIV N = 189	p-value*
Age, years	378	50.0 ± 8.4	49.6 ± 8.0	0.644
Gender, women (%)	378	40 (21.2%)	40 (21.2%)	1.000
Smoking status	378			0.043
Never smoker (%)	180	100 (52.9%)	80 (42.3%)	
Former smoker (%)	78	40 (21.2%)	38 (20.1%)	
Current smoker (%)	120	49 (25.9%)	71 (37.6%)	
Pack-years of cigarettes	378	12.7 (± 18.3)	12.3 (± 14.9)	0.793
Smoking/Pack-years status	378			0.445
Never smokers or < 10 Pack-years	214	111 (58.7%)	103 (54.5%)	
> 10 Pack-years, former smokers	61	32 (16.9%)	29 (15.3%)	
> 10 Pack-years, current smokers	103	46 (24.3%)	57 (30.2%)	
BMI, kg/m^2	376	26.9 (± 3.6)	24.1 (± 3.9)	< 0.001
Obesity	376	35 (18.6%)	18 (9.6%)	0.013
Dyslipidemia	355	53 (30.5%)	76 (42.0%)	0.024
Diabetes	369	3 (1.6%)	8 (4.4%)	0.126
Systolic blood pressure, mmHg	346	120.3 (± 14.4)	121.7 (± 14.2)	0.392
Diastolic blood pressure, mmHg	346	78.4 (± 8.6)	76.7 (± 9.7)	0.080
HTA	345	19 (11.7%)	27 (14.8%)	0.387
FEV1, % predicted	347	101.5 (± 15.3)	98.4 (± 17.3)	0.078
FEV1/FVC	347	81.8 (± 6.5)	81.5 (± 7.8)	0.750
Pulse-wave velocity, m/s	341	10.5 (9.4; 11.6)	10.2 (9.5; 11.6)	0.892
BMD total lumbar, g/cm^2	348	1.2 (± 0.2)	1.1 (± 0.2)	0.002
BMD hip (lowest), g/cm^2	347	1.0 (± 0.2)	1.0 (± 0.2)	0.002
ASMI, kg/m^2	330	8.2 (± 1.3)	7.7 (± 1.3)	0.001
Sarcopenia (%)	330	4 (2.7%)	41 (22.8%)	< 0.001
HOMA-IR	353	2.0 (1.3; 3.5)	2.3 (1.5; 3.3)	0.593
Glomerular flow rate, mL/min	362	98.2 (86.5; 116.1)	92.5 (81.4; 110.9)	0.026
Time since HIV diagnosis, years	189	–	12.6 (8.7; 18.4)	–
History of AIDS (%)	189	–	51 (27.0%)	–
Nadir CD4$^+$ cell count, cells/mm^3	185	–	142.0 (35.0; 244.0)	–
CD4$^+$ cell count, cells/mm^3	174	–	237.5 (79.0; 404.0)	–
CD8$^+$ cell count, cells/mm^3	188	–	645.0 (478.0; 842.0)	–
CD4$^+$/CD8$^+$ ratio	188	–	0.8 (0.6; 1.1)	–
ART use at enrollment	182			
PI-based therapy		88 (48.4%)		–
INI-based triple therapy		10 (5.5%)		–
RTI-based triple therapy		77 (42.3%)		–
Others		3 (1.6%)		
No treatment		4 (2.2%)		–

Table 1. Baseline characteristics of the study population. *p-values from mixed effects linear or logistic regression model accounting for matching between HIV-infected and HIV-uninfected patients. Results are mean (± standard deviation), median (interquartile range) or N (%).

and musculoskeletal parameters (i.e. hip and lumbar BMD, ASMI) compared to non HIV-infected subjects. No statistically significant difference was found between groups regarding mean past cigarette smoke exposure as expressed in pack-years.

All PLWH had plasma HIV RNA below 50 copies/ml, of whom 98% were receiving ART. The median nadir $CD4^+$ T-cell count was 142 cells/mm^3 (IQR, 35; 244 cells/mm^3), the current $CD4^+$ T-cell count was 237.5 (IQR, 79; 404), the baseline median $CD4^+/CD8^+$ ratio was 0.82 (IQR 0.58; 1.14) and 27% had a history of AIDS.

Effects of combined smoking and HIV status on ageing-related parameters

Results from unadjusted and age–gender adjusted linear regression modeling are shown in Table 2 (FEV1, BMD, ASMI) and Table 3 (PWV, HOMA-R, eGFR).

In both unadjusted and adjusted analyses, FEV1, BMD and ASMI significantly differed according to smoking/HIV status (Table 2), with the worst parameters significantly found in PLWH currently smoking (adjusted regression coefficients compared to controls never smokers or < 10 pack-years: FEV1 − 8.03, p = 0.003; BMD − 0.12, p < 0.0001; ASMI − 1.05, p < 0.0001). BMD and ASMI were also significantly decreased in HIV-1 infected patients formerly smoking, but to a lesser extent (BMD − 0.08, p = 0.014; ASMI − 0.72, p = 0.001). Of note, values for these parameters did not substantially differ in controls according to smoking status. Likewise, values in PLWH who were never smokers or with < 10 pack-years were of similar magnitude to those from controls.

Regarding PWV, HOMA-R and eGFR (Table 3), no significant differences were found between smoking/HIV categories in all unadjusted and adjusted analyses, to the exception of eGFR values which were substantially lower in PLWH to those from controls.

To further illustrate these findings, Fig. 1 shows as boxplots the age–gender adjusted comparisons of the ageing-related parameters values according to the composite smoking-HIV status, confirming the decreased FEV, BMD and ASMI values found in PLWH currently smoking and, to a lesser extent, formerly smoking for BMD and ASMMI. Detailed statistics including raw and adjusted means are given in Supplemental Table 3.

Figure 2 shows the 2-dimensional biplot representation of patients' characteristics according to the composite smoking and HIV+ status variable. PLWH currently or, to a lesser extent, formerly smoking were distinctively projected in the left area of the plot, indicating lower values in ASMI and BMD, while controls and PLWH who were never smokers or with < 10 pack-years were all closely located in the middle-right area, indicating a global overlap in characteristics.

Conclusion

The main finding of this study is that HIV infection and smoking interact by potentiating each other's negative effects on ageing. This deleterious effect concerns lung function, bone mineral density and muscle mass, with worse parameters found in PLWH currently smoking. Our findings strongly suggest that smoking acts synergistically with HIV infection to develop aging-related complications.

The synergic effect of cigarette smoke and HIV infection is particularly observed on bone mineral density and muscle mass, that is also linked with low BMI. As others, we observed that bone density and muscle mass were lower in PLWH[22–25]. In large cohort studies, HIV infection was shown to be independently associated with low

Ageing-related parameter	Group			Unadjusted analysis			Adjusted analysis*		
				Beta coefficient (CI 95%)	p-value	p-value (overall)	Beta coefficient (CI 95%)	p-value	p-value (overall)
FEV_1	Controls	< 10 PY		0 (ref)	–	**0.044**	0 (ref)	–	0.054
		> 10 PY	Former smokers	1.53 (− 5.36; 8.43)	0.663		1.31 (− 5.62; 8.23)	0.712	
			Current smokers	− 1.83 (− 7.64; 3.98)	0.537		− 1.83 (− 7.75; 4.10)	0.545	
	HIV	< 10 PY		− 1.47 (− 5.92; 2.98)	0.518		− 1.39 (− 5.86; 3.08)	0.542	
		> 10 PY	Former smokers	− 0.26 (− 7.00; 6.49)	0.940		− 0.56 (− 7.37; 6.24)	0.871	
			Current smokers	− 8.11 (− 13.36; − 2.85)	**0.003**		− 8.03 (− 13.29; − 2.77)	**0.003**	
BMD Hip	Controls	< 10 PY		0 (ref)	–	**0.0002**	0 (ref)	–	**< 0.0001**
		> 10 PY	Former smokers	0.00 (− 0.07; 0.07)	0.999		0.01 (− 0.06; 0.07)	0.868	
			Current smokers	− 0.05 (− 0.10; 0.01)	0.110		− 0.02 (− 0.07; 0.04)	0.524	
	HIV	< 10 PY		− 0.03 (− 0.07; 0.01)	0.180		− 0.03 (− 0.07; 0.02)	0.230	
		> 10 PY	Former smokers	− 0.09 (− 0.15; − 0.02)	**0.007**		− 0.08 (− 0.14; − 0.01)	**0.015**	
			Current smokers	− 0.11 (− 0.16; − 0.06)	**< 0.0001**		− 0.12 (− 0.17; − 0.07)	**< 0.0001**	
ASMI	Controls	< 10 PY		0 (ref)	–	**< 0.0001**	0 (ref)	–	**< 0.0001**
		> 10 PY	Former smokers	0.26 (− 0.31; 0.83)	0.363		0.27 (− 0.23; 0.77)	0.285	
			Current smokers	− 0.44 (− 0.89; 0.00)	0.051		− 0.09 (− 0.48; 0.31)	0.659	
	HIV	< 10 PY		− 0.31 (− 0.64; 0.01)	0.061		− 0.23 (− 0.53; 0.07)	0.136	
		> 10 PY	Former smokers	− 0.68 (− 1.17; − 0.19)	**0.007**		− 0.72 (− 1.16; − 0.28)	**0.001**	
			Current smokers	− 0.96 (− 1.34; − 0.58)	**< 0.0001**		− 1.05 (− 1.40; − 0.70)	**< 0.0001**	

Table 2. Effects of smoking and HIV-1 status on aging-related parameters: FEV1, BMD and ASMMI. *Mixed effects linear regression model adjusted for age and gender. Significant values are in bold.

Ageing-related parameter	Group			Unadjusted analysis			Adjusted analysis*		
				Beta coefficient (CI 95%)	p-value	p-value (overall)	Beta coefficient (CI 95%)	p-value	p-value (overall)
PWV	Controls	< 10 PY		0 (ref)	–	0.148	0 (ref)	–	0.684
		> 10 PY	Former smokers	0.64 (− 0.14; 1.43)	0.108		0.42 (− 0.33; 1.16)	0.274	0
			Current smokers	0.38 (− 0.30; 1.07)	0.272		0.19 (− 0.47; 0.85)	0.576	
	HIV	< 10 PY		0.22 (− 0.31; 0.74)	0.414		0.19 (− 0.32; 0.70)	0.472	
		> 10 PY	Former smokers	0.94 (0.14; 1.74)	**0.022**		0.60 (− 0.17; 1.37)	0.126	
			Current smokers	− 0.07 (− 0.70; 0.55)	0.820		0.06 (− 0.54; 0.66)	0.836	
HOMA-R	Controls	< 10 PY		0 (ref)	–	0.101	0 (ref)	–	0.193
		> 10 PY	Former smokers	0.96 (− 0.28; 2.20)	0.129		0.82 (− 0.41; 2.06)	0.192	
			Current smokers	− 0.63 (− 1.76; 0.49)	0.271		− 0.72 (− 1.86; 0.41)	0.212	
	HIV	< 10 PY		− 0.14 (− 0.97; 0.70)	0.748		− 0.15 (− 0.98; 0.69)	0.730	
		> 10 PY	Former smokers	0.77 (− 0.48; 2.02)	0.226		0.55 (− 0.71; 1.81)	0.393	
			Current smokers	− 0.66 (− 1.65; 0.33)	0.191		− 0.62 (− 1.60; 0.36)	0.217	
eGFR (Cockcroft)	Controls	< 10 PY		0 (ref)	–	0.110	0 (ref)	–	**0.027**
		> 10 PY	Former smokers	6.67 (− 3.10; 16.44)	0.181		7.40 (− 1.49; 16.29)	0.103	
			Current smokers	3.07 (− 5.89; 12.03)	0.502		7.56 (− 0.66; 15.78)	0.071	
	HIV	< 10 PY		− 5.24 (− 11.49; 1.01)	0.100		− 3.50 (− 9.46; 2.47)	0.250	
		> 10 PY	Former smokers	− 2.14 (− 11.92; 7.65)	0.668		0.43 (− 8.70; 9.57)	0.926	
			Current smokers	− 2.72 (− 10.35; 4.91)	0.485		− 4.00 (− 11.11; 3.11)	0.270	

Table 3. Effects of smoking and HIV status on aging-related parameters: PWV, HOMA-R and eGFR. *Mixed effects linear regression model adjusted for age and gender. Significant values are in bold.

bone mineral density, and this association remained despite adjustment for traditional risk factors, in particular smoking status[23]. However, whether smoking and HIV-1 infection effects are cumulative and/or whether smoking effects may differ between PLWH and HIV non-infected individuals was not determined in these different studies. We observed that low bone density and low muscle mass are features of the same group of patients, suggesting a common phenomenon leading to a progressive wasting of muscle tissue and bone minerals, and a wasting profile[26,27]. This observation may be due to the lower BMI observed in PLWH compared to the others and may depend on the choice of the control population that has higher BMI. Moreover, as in smokers with or without chronic obstructive pulmonary disease (COPD), low bone mineral density and muscle mass are associated with a lower diffusion capacity and probably with emphysema[11].

Our results are a new piece of evidence of the synergistic effect of HIV-1 and cigarette smoke on lung function as suspected by the multiple biological changes described along the pulmonary tree when these two factors are combined[28]. This may partially explain the higher decline of lung function described in HIV current smokers than HIV non-smokers[29], in a population of patient with an already known higher prevalence of airways obstruction than non-HIV infected subjects[30,31].

Regarding arterial stiffness, no differences were found between smoking and HIV categories in all unadjusted and adjusted analyses. Arterial stiffness assessed by PWV is a sub-clinical marker of atherosclerosis that is associated with increased of cardiovascular events and death both in the general population and in PLWH[3]. Whether people chronically living with HIV have a higher level of pulse wave velocity than non-HIV subjects is object of debate and may depend on the population[32]. However, patients receiving ART and with a suppressed viral replication at the time of pulse wave velocity measurement as in our study, did not present a higher arterial stiffness than non-infected individuals[32]. Our data contrasts with previous studies showing that smoking was more strongly associated with carotid intima-media thickness and myocardial infarction in PLWH compared with HIV-uninfected subjects[16,33]. These differences may be essentially linked to our inclusion criteria: we explored our population at a preclinical stage under the level of cardiovascular disease, since none of the PLWH had presented any cardiovascular events.

One of the strengths of our study is the evaluation of several systemic manifestations concomitantly and objectively quantified. To date, most studies on the impact of comorbidities in PLWH used data on self-reported concurrent chronic conditions or assessed individually. Most systemic manifestations have been studied separately, whereas most HIV infected patients may have two or more chronic morbidities[15]. Interestingly we observed that the expression of manifestations induced by cigarette smoking differed depending on the HIV status, some were amplified and other were not modulated by the chronic infection. More interestingly, smoking combined with HIV was mainly associated with a special cluster of systemic manifestations combining a bone and muscle wasting profile with lung alterations. Similarly, bone, muscle and lung profile in response to cigarette smoke exposure seemed not to be associated with increase arterial stiffness suggesting a different pathophysiological process leading to this alteration in this population, and that different mechanism may be involved in this different manifestation. Our study has also limitations worth mentioning. Sample sizes in HIV/smoking subgroups were somewhat low (ranging from 29 to 111), thus potentially limiting the statistical power of the study to identify statistically significant relationships. It should also be noticed that PLWH included in our study were restricted to those patients with undetected viral load and without overt cardiac comorbidity, and that some

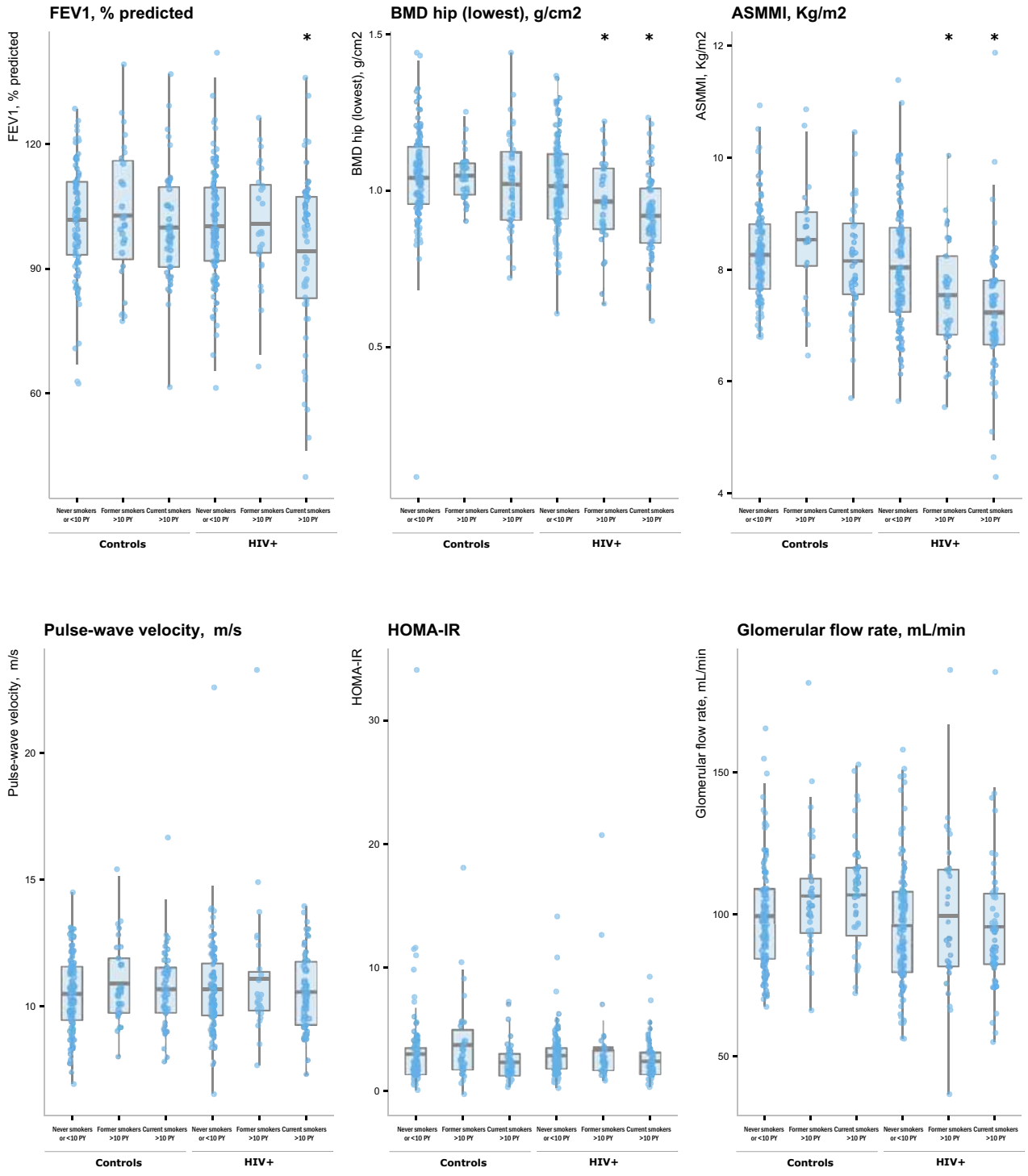

Figure 1. Boxplots of ageing-related parameters according to smoking and HIV+ status. Results are shown as boxplots, with each box representing the interquartile range (1st to 3rd quartile, IQR), the line within the box indicating the mean, and the whiskers extending to 1.5 times the IQR above and below the box; the dots represent individual values for each subject as predicted from mixed effects linear regression modeling adjusted for age and gender. Asterisks (*) indicate subgroups statistically significantly different from never smoker controls.

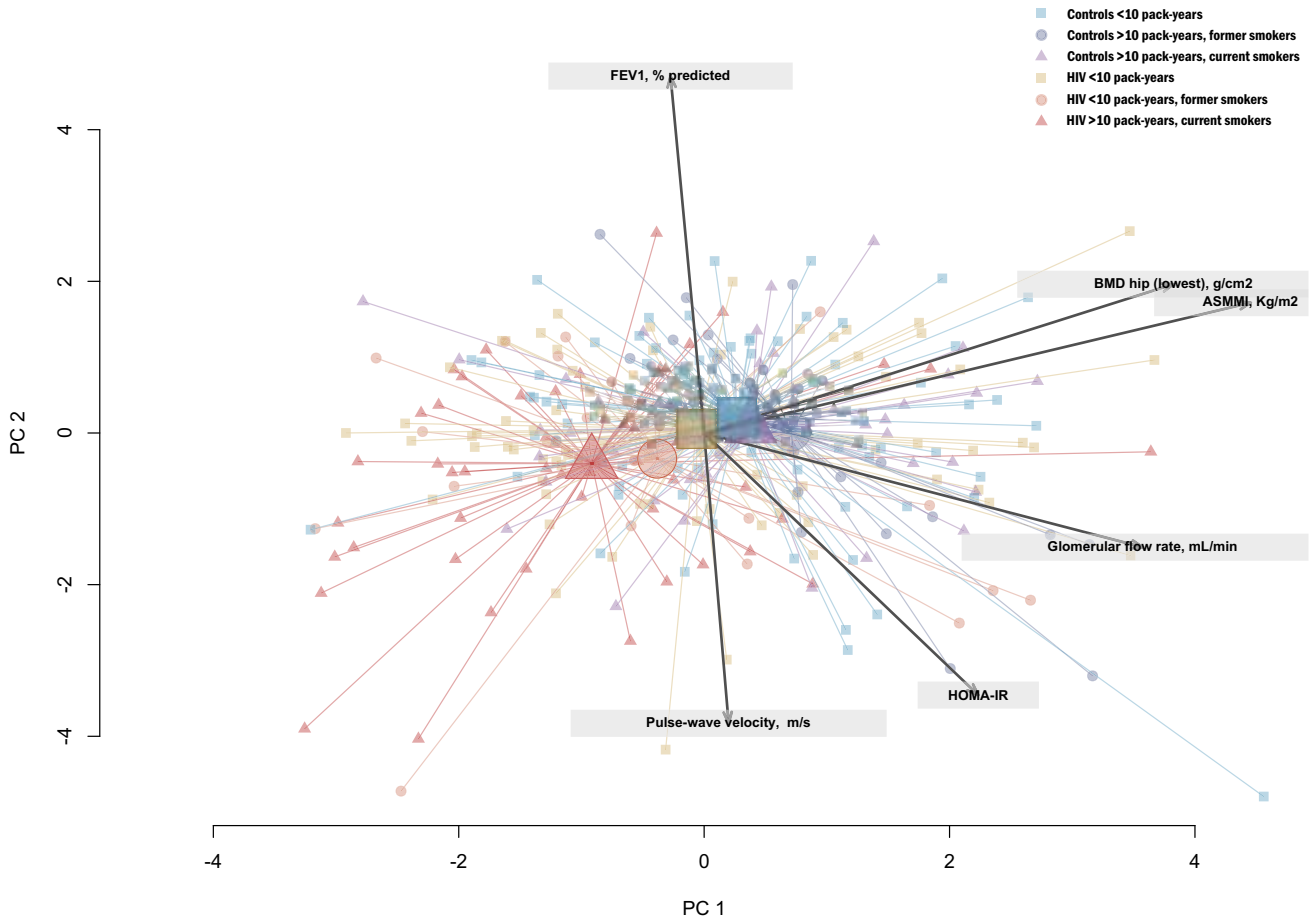

Figure 2. 2-dimensional biplot representation of patients' characteristics according to smoking and HIV+ status. Biplot representation allows the visualization of relationships between ageing parameters (arrows) while simultaneously displaying the patients (dots), based on their individual characteristics. Results are projected onto the two first dimensions generated by principal component analysis. Colors for observations correspond to one of the six groups according to HIV and smoking status (i.e. controls who were (i) never smokers or < 10 pack-years, (ii) former smokers with > 10 pack-years or (iii) current smokers with > 10 pack-years; and people living with HIV who were (iv) never smokers or < 10 pack-years, (v) former smokers with > 10 pack-years or (vi) current smokers with > 10 pack-years). Highlighted markers of increased size within each group represent the group centroid of the group.

individuals from the youngest and oldest age groups were discarded from the analysis due to the age–gender matching procedure, thus potentially limiting the generalizability of our results to broader populations. Finally, adjustment for BMI or other cardiovascular risk factors was not performed considering their potential high level of correlations with ageing parameters (e.g. BMI and ASMMI/sarcopenia; HOMA-IR and diabetes. Given their potential intermediate role in the causal chain between smoking/HIV and ageing parameters, a mediation analysis would have been of interest but was not performed due to the limited sample size of our study to test such more complex relationships.

In conclusion, we find a combined effect of smoking and HIV infection on age related systemic manifestations and HIV appeared as an additive risk factor for some cigarette smoke induced systemic manifestations. Smoking and HIV may be mainly associated with a wasting phenotype associated with lung alterations in HIV infected individuals. These data emphasize again the need to integrate actively smoking cessation in health policies for PLWH, but also to personalize the HIV smoker's health management with nutrition and exercise to prevent or reverse the bone and muscle loss.

More globally, these emphasize the need to target modifiable risk factors to prevent comorbidities in PLWH. Given the high prevalence of tobacco use in people living with HIV in both high-income and low or middle-income countries, policies and practices to promote tobacco cessation have to be a central strategy to improve the health outcomes in this population.

Data availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

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Author contributions

L.B., J.D.L., B.R.B., S.A., S.H., S.G., E.A., S.Z. contributed to the study design. L.M., F.Z., J.-L.L.-Z., S.A., L.B., J.D.L., S.G. contributed to the data acquisition. S.Z., E.A., L.B., J.D.-L., S.G. contributed to the data analysis and interpretation. L.B., S.Z., E.A., J.D.-L. participated in the initial drafting and all authors substantially revised the manuscript. All authors have approved the manuscript prior to submission.

Competing interests

The authors declare no competing interests.

Additional information

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INCLUSIVITY IN PEOPLE, METHODS, AND OUTCOMES
RESEARCH ARTICLE

E-Cigarette Use Among Persons With Diagnosed HIV in the U.S.

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Introduction: E-cigarettes emerged in the U.S. market in the late 2000s. In 2017, E-cigarette use among U.S. adults was 2.8%, with higher use among some population groups. Limited studies have assessed E-cigarette use among persons with diagnosed HIV. The purpose of this study is to describe the national prevalence estimates of E-cigarette use among persons with diagnosed HIV by selected sociodemographic, behavioral, and clinical characteristics.

Methods: Data were collected between June 2018 and May 2019 as part of the Medical Monitoring Project, an annual cross-sectional survey that produces nationally representative estimates of behavioral and clinical characteristics of persons with diagnosed HIV in the U.S. Statistically significant differences ($p<0.05$) were determined using chi-square tests. Data were analyzed in 2021.

Results: Among persons with diagnosed HIV, 5.9% reported currently using E-cigarettes, 27.1% had ever used them but were not using them currently, and 72.9% had never used them. Current use of E-cigarettes was highest among persons with diagnosed HIV who currently smoke conventional cigarettes (11.1%), those with major depression (10.8%), those aged 25–34 years (10.5%), those who reported injectable and noninjectable drug use in the past 12 months (9.7%), those diagnosed <5 years ago (9.5%), those who self-reported sexual orientation as other (9.2%), and non-Hispanic White people (8.4%).

Conclusions: Overall, findings suggest that a greater proportion of persons with diagnosed HIV used E-cigarettes than the overall U.S. adult population and that higher rates were observed among certain subgroups, including those who currently smoke cigarettes. E-cigarette use among persons with diagnosed HIV warrants continued attention because of its potential impact on HIV-related morbidity and mortality.

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INTRODUCTION

In the late 2000s, E-cigarettes emerged in the U.S. market and were initially advertised as a cessation aid to those who smoke cigarettes.[1] These battery-powered devices deliver nicotine, flavoring, and other additives through an inhaled aerosol.[1] Since the emergence of E-cigarettes in the U.S. and world markets, minimal information exists about potential long-term health effects.

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However, there are studies on the short-term effects of E-cigarettes.[2] Studies have linked E-cigarette use to adverse cardiovascular and respiratory outcomes.[3,4] Notably, ingredients in E-cigarettes vary, including various nicotine concentrations, carcinogens, and toxic substances found in tobacco cigarettes.[1] Although there are some common carcinogens in E-cigarettes and cigarettes, overall, E-cigarettes appear to contain fewer amounts of carcinogens[5–8] and may benefit those trying to quit smoking, if used as a complete substitute for combustible tobacco products.[9]

Over time, the use of E-cigarettes has increased among various population groups, especially youth (aged 13–18 years), young adults (aged 18–24 years), and those who currently smoke cigarettes.[10,11] During 2018–2019, E-cigarette use among U.S. adults was 2.3% and was higher among some population groups.[12] About 39% of adults who currently use E-cigarettes also currently smoke cigarettes (dual users),[12,13] which may lead to increased nicotine dependency and higher risks of tobacco-related morbidity and mortality.[3,14]

Since 2009, cigarette smoking among persons with diagnosed HIV (PWH) has decreased; however, usage remains significantly higher, and PWH are less likely to quit than the general U.S. population (33.6% vs. 16.8%).[15] Risks of HIV- and non-HIV–related morbidity and mortality due to cigarette smoking are higher for PWH, including those taking antiretroviral medications (ARTs).[16] Even though E-cigarettes can serve as a bridge to tobacco cessation among persons who currently smoke cigarettes, the health effects, such as lung diseases, associated with their use may pose similar health risks among PWH, similar to that of the general population.[3,6,14] At present, estimates of E-cigarette use among PWH are scarce. The purpose of this study is to describe the national estimates of E-cigarette use among PWH by selected sociodemographic, behavioral, and clinical characteristics.

METHODS

Study Population

Data were obtained from the Medical Monitoring Project (MMP), an annual cross-sectional survey designed to produce nationally representative estimates of behavioral and clinical characteristics of U.S. adults diagnosed with HIV. Briefly, the 2018 and 2019 MMP data cycles used a 2-stage sampling method that has been described elsewhere.[17] MMP data collection has been determined to be nonresearch.[18] Participating states or territories obtained local IRB approval, when necessary, on the basis of local requirements to collect data and obtained informed consent from all participants. Data were weighted on the basis of known probabilities of selection at state/territory and person levels and to adjust for person-level nonresponse and were poststratified to National HIV Surveillance System population totals.[17] Data were combined from participant interviews and medical record abstraction collected during MMP's 2018 and 2019 data cycles (n=8,150) to assess the prevalence of E-cigarette use among PWH.

Measures

Persons who currently use E-cigarettes were defined as persons who reported having used ≥1 E-cigarettes in their lifetime and in the past 30 days. *Persons who have ever tried E-cigarettes* were defined as individuals who had used ≥1 E-cigarettes in their lifetime but not in the past 30 days. *Persons who have never tried E-cigarettes* were defined as individuals who had never used an E-cigarette.

Self-reported information on sociodemographic and behavioral characteristics from participants was included. Sociodemographic variables included sex, sexual orientation, race/ethnicity, age, educational attainment, health insurance or other coverage for medical expenses, and annual household income. Household income and the number of household dependents were used to determine participants' poverty level on the basis of guidelines and thresholds published by the HHS, Census Bureau for 2017–2019.[19] Health insurance was categorized on the basis of participant's self-report regarding the type of coverage during the 12 months before the interview. Behavioral characteristic variables included the use of cigarettes, alcohol, and other substances as well as diagnosis of depression. Utilizing an established definition for smoking,[15] persons who currently smoke were individuals who smoked at least 100 cigarettes in their lifetime and currently smoked daily, weekly, monthly, or less than monthly. Persons who formerly smoked were individuals who reported that they had smoked ≥100 cigarettes in their lifetime and currently did not smoke, whereas persons who never smoke were individuals who reported that they had smoked 0 to <100 cigarettes in their lifetime. *Any alcohol use* was defined as having consumed ≥1 alcoholic beverage during the 12 months before the interview. *Any drug use* was defined as having used injected or noninjected drugs during the past 12 months. Drugs assessed include both illicit and prescription drugs. Prescription drugs could have been nonprescribed or prescribed but taken more than directed. As described elsewhere, self-reported responses to the Patient Health Questionnaire depression scale were used to determine whether participants had major, other, or no depression.[20]

Also included were HIV clinical variables abstracted from participants' medical records. These variables included time since HIV diagnosis, HIV disease stage at diagnosis, prescribed ART, and recent or sustained viral suppression. *Recent viral suppression* was defined as the most recent viral load measurement in the past 12 months <200 copies/mL. *Sustained viral suppression* was defined as having viral load measurements <200 copies/mL on all viral load measurements in the past 12 months.

Statistical Analysis

Weighted percentages and associated 95% CIs were computed. Statistical estimations were suppressed if the sample size was <30 or the relative coefficient of variation was >0.30. Statistically significant differences (p<0.05) were determined using chi-square tests. All analyses accounted for complex sample design and unequal selection probabilities and were conducted using SAS, Version 9.4. Data were analyzed in 2021.

Table 1. Sociodemographic and HIV Clinical Characteristics of Adults With Diagnosed HIV, MMP, 2018–2019

Demographics	n[a]	%[b] (95% CI[c])
Sex		
Male	5,888	74.7 (73.0, 76.5)
Female	2,090	23.3 (21.6, 25.1)
Transgender[d]	165	2.0 (1.6, 2.3)
Sexual orientation		
Heterosexual or straight	3,866	46.3 (43.6, 49.0)
Homosexual or gay	3,266	41.3 (38.6, 43.9)
Bisexual	715	9.3 (8.3, 10.2)
Other	238	3.1 (2.5, 3.7)
Race/ethnicity[e]		
White, non-Hispanic	2,320	29.1 (25.1, 33.2)
Black, non-Hispanic	3,459	41.4 (34.8, 48.0)
Hispanic/Latino	1,816	22.3 (16.8, 27.9)
Other	555	7.1 (5.8, 8.4)
Age at the time of interview (years)		
18–24	173	2.2 (1.7, 2.6)
25–34	1,109	14.5 (13.3, 15.6)
35–44	1,364	18.4 (17.2, 19.5)
45–54	2,265	27.6 (26.6, 28.6)
≥55	3,239	37.5 (36.0, 38.9)
Education		
Less than HS, no diploma	1,403	16.6 (15.4, 17.8)
HS diploma or GED	2,191	26.9 (25.6, 28.2)
More than HS	4,533	56.5 (54.6, 58.4)
Combined yearly household income ($)[d]		
0–19,999	3,965	52.0 (50.1, 53.9)
20,000–39,999	1,625	22.7 (21.4, 24.0)
40,000–74,999	1,035	14.6 (13.6, 15.6)
≥75,000	822	10.7 (9.2, 12.2)
Poverty guidelines[d]		
Above poverty level	4,200	57.8 (55.6, 59.9)
At or below poverty level	3,244	42.2 (40.1, 44.4)
Time since HIV diagnosis (yr)		
<5	1,132	14.5 (13.5, 15.5)
5–9	1,416	17.9 (16.9, 19.0)
≥10	5,594	67.6 (66.5, 68.7)
Health Insurance or coverage type[d]		
Private insurance	2,771	34.1 (32.0, 36.2)
Public insurance (excluding RW/ADAP only)	4,507	54.3 (51.2, 57.4)
RW/ADAP only or no insurance coverage	769	11.2 (9.1, 13.3)
Unspecified insurance	46	0.5 (0.2, 0.7)
HIV clinical characteristics[d]		
HIV disease Stage 3 (AIDS)	4,734	55.8 (54.3, 57.2)
Prescribed ART	7,032	81.9 (80.6, 83.2)
Currently taking ART	7,758	93.7 (92.8, 94.6)
Viral suppression		
Sustained viral suppression	5,409	61.6 (58.9, 64.2)
Recent viral suppression	5,974	67.7 (64.7, 70.6)
Had at least one VL (past 12 months)	6,603	75.3 (71.9, 78.7)
Geometric mean CD4 count ≥200	6,037	92.4 (91.6, 93.1)

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Table 1. Sociodemographic and HIV Clinical Characteristics of Adults With Diagnosed HIV, MMP, 2018–2019 (*continued*)

Demographics	n[a]	%[b] (95% CI[c])
Behavioral characteristics		
Cigarette use[f]		
Never	3,751	47.0 (44.6, 49.4)
Former	1,756	21.0 (19.5, 22.6)
Current	2,563	32.0 (30.0, 33.9)
E-cigarette use[g]		
Never	5,982	72.9 (70.3, 75.4)
Ever	2,105	27.1 (24.6, 29.7)
Current	448	5.9 (5.2, 6.5)
Any alcohol use (past 12 months)[d]		
No alcohol use	3,091	37.9 (35.8, 40.1)
Alcohol use	4,991	62.1 (59.9, 64.2)
Any drug use (past 12 months)[h]		
No injection or noninjection drug use	5,395	67.0 (65.0, 69.1)
Injection or noninjection drug use	2,659	33.0 (30.9, 35.0)
Depression[d]		
No depression	6,664	83.2 (82.0, 84.3)
Other depression	605	7.5 (6.8, 8.1)
Major depression	742	9.4 (8.5, 10.3)
Total	8,150	

[a]Numbers are unweighted. Numbers might not add to total because of missing data.
[b]Percentages are weighted column percentages. Percentages might not sum to 100 because of rounding.
[c]CIs incorporate weighted percentages.
[d]Variable definition has been described in detail in the study Centers for Disease Control and Prevention. Behavioral and Clinical Characteristics of Persons with Diagnosed HIV Infection: Medical Monitoring Project, United States 2016 Cycle (June 2016 – May 2017). In: HIV Surveillance Special Report 21; Revised edition. https://www.cdc.gov/hiv/library/reports/hiv-surveillance.html. Published June 2019.
[e]Non-Hispanic White: participants who self-identify as non-Hispanic and White only. Non-Hispanic Black: participants who self-identify as non-Hispanic and Black/African American only—Hispanic participants who self-identify as Hispanic, even if other race/ethnicity categories were selected. Other participants include those who selected Asian, Native Hawaiian/other Pacific Islander, American Indian/Alaska Native, or multiple race/ethnicity categories.
[f]Never smoker: respondents who said that they have not smoked at least 100 cigarettes in their entire life. Current smokers: respondents who said that they have smoked at least 100 cigarettes in their entire life and who now smoke daily, weekly, monthly, and less than monthly. Former smoker: respondents who said that they have smoked at least 100 cigarettes in their entire life and who now never smoke.
[g]*E-cigarette ever use* was defined as respondents who said that they have used an E-cigarette even just 1 time in their entire life. *Current E-cigarette use* was defined as respondents who said that they have used an E-cigarette even just 1 time in their entire life and have used E-cigarettes during the past 30 days.
[h]Includes all drugs that were injected and not injected (i.e., administered by any route other than injection), including legal drugs that were not used for medical purposes.
ART, antiretroviral therapy; HS, high school; MMP, Medical Monitoring Project; RW/ADAP, Ryan White HIV/AIDS or AIDS Drug Assistance Coverage; VL, viral load.

RESULTS

Descriptive data for the 8,150 MMP participants included in this analysis are shown in Table 1. During 2018–2019, 74.7% of the study population was male (CI=73.0, 76.5), 46.3% were heterosexual (CI=43.6, 49.0), and 41.4% were Black Americans (CI=34.8, 48.0). The median age was 50 years, and 54.3% had public insurance (CI=51.5, 57.0) other than Ryan White HIV/AIDS or AIDS Drug Assistance Coverage. In addition, 67.6% had HIV for >10 years (CI=66.5, 68.7), 93.7% were currently taking ART (CI=92.8, 94.6), 67.7% were virally suppressed at the time of their most recent viral load test (CI=64.7, 70.6), and 61.6% had sustained viral suppression (CI=58.9, 64.2). At least 32% of the study population were persons who currently smoke cigarettes (CI=30.0, 33.9), 62.1% used alcohol in the last 12 months (CI=59.9, 64.2), and 33.0% used injection or noninjection drugs in the last 12 months (CI=30.9, 35.0). In the study population, 5.9% currently used E-cigarettes (CI=5.2, 6.5), 27.1% ever used (but not currently) an E-cigarette (CI=24.6, 29.7), and 72.9% had never used E-cigarettes (CI=70.3, 75.4).

Current E-cigarette use among PWH was about 2 times higher among males (6.7%, CI=5.9, 7.5) than among females (3.3%, CI=2.3, 4.2). Current E-cigarette use among PWH was also about 2 times higher among those who reported being homosexual or gay (8.0%,

CI=6.8, 9.1) or bisexual (6.4%, CI=4.4, 8.4) than among those who reported being heterosexuals (3.7%, CI=2.9, 4.5) (Table 2). Current E-cigarette use was about 2 times higher among White Americans and others than among Black Americans (8.4%, CI=7.3, 9.6, 7.3% and CI=5.0, 9.6 vs 3.9%, CI=3.0, 4.7, respectively). Estimates of current E-cigarette use decreased with age; among the age groups with sufficient sample size for robust statistical estimation, use was highest among those aged 25−34 years (10.5%, CI=8.5, 12.5). Estimate of current E-cigarette use increased with education attainment; use was highest among those with more than a high school diploma (6.5%, CI=5.7, 7.4, $p<0.05$). Current E-cigarette use was also highest among participants whose HIV diagnosis was <5 years ago (9.5%, CI=7.6, 11.4) compared with among those who were diagnosed >10 years ago (4.7%, CI=4.0, 5.4).

Among the HIV clinical characteristics, current E-cigarette use was almost 2 times higher among PWH who were not in HIV disease Stage 3 than among those who were (7.1%, CI=6.1, 8.0 vs. 4.9%, CI=4.1, 5.7). Current E-cigarette use was also high among PWH who did not have sustained viral suppression (6.7%, CI=5.6, 7.8, $p<0.05$).

Current E-cigarette use was about 5 times higher among those who currently smoke cigarettes (11.1%, CI=9.7, 12.4) and 2 times higher among those who formerly smoked cigarettes (6.5%, CI=5.1, 7.9) than among those who never smoked cigarettes (2.0%, CI=1.4, 2.7). Current E-cigarette use was higher among people who used substances than among people who did not. Among persons who had used any alcohol or who used injectable and noninjectable drugs in the past 12 months, E-cigarette use was 7.2% (CI=6.3, 8.0) and 9.7% (CI=8.5, 11.0), respectively. Current use of E-cigarettes was higher among PWH who had major depression (10.8%, CI=8.1, 13.6) and other forms of depression (6.1%, CI=3.7, 8.6) than among PWH who did not have depression (5.3%, CI=4.6, 6.0).

Demographic characteristic estimates for persons who have ever tried E-cigarettes mimicked estimates for persons who are currently using E-cigarettes. These estimates can be found in Table 2. Ever use of E-cigarettes was higher among PWH whose diagnosis was not at disease Stage 3 (31.8%, CI=28.8, 34.7) than among those who were (23.4%, CI=23.8, 26.0). Ever use of E-cigarettes among PWH who were not prescribed (30.7%, CI=27.0, 34.4) or not currently taking ART (34.3%, CI=28.8, 39.8) was higher than among those who were prescribed (26.3%, CI=23.7, 28.9, $p<0.05$) or currently taking ART (26.6%, CI=24.1, 29.2, $p<0.05$). Ever use of E-cigarettes was higher among those who did not have sustained viral suppression (31.4%, CI=27.8, 35.0) than among those who had sustained viral suppression (24.5%, CI=22.2, 26.7). Ever use was higher among persons who had not achieved viral suppression (31.0%, CI=27.2, 34.9) than among those who had (25.3%, CI=23.1, 27.5) (Table 2).

Ever E-cigarette use was higher among persons who currently smoke cigarettes (51.0%, CI=47.2, 54.8) and persons who formerly smoked cigarettes (30.2%, CI=27.4, 32.9) than among persons who never smoked cigarettes (9.5%, CI=8.1, 11.0). Ever E-cigarette use was higher among people who used substances than among people who did not. Among persons who had used any alcohol or who used injectable and noninjectable drugs in the past 12 months, E-cigarette use was 31.7% (CI=29.2, 34.1) and 44.8% (CI=42.0, 47.6), respectively. Ever use of E-cigarettes was higher among those who had major depression (41.9%, CI=37.5, 46.4) than among those who had no depression (25.0%, CI=22.4, 27.6).

DISCUSSION

To our knowledge, these are the first nationally representative prevalence estimates of E-cigarette use among U.S. PWH. These findings suggest that current and ever use of E-cigarettes among PWH is higher than among the general U.S. population.[12] Findings showed that nearly 1 in 4 PWH had tried using E-cigarettes and that 1 in 20 PWH were current users. Even though E-cigarettes have only been in the U.S. market for about 10 years, evidence is emerging that E-cigarette use may cause deleterious health effects, especially for young users.[3,4]

Although this study group was an older cohort, with a median age of 50 years, only 2% were between the ages of 18 years and 24 years; we also found that current E-cigarette use varied among subgroups of PWH. Specifically, current and ever usage was higher among PWH who self-identified as bisexual, homosexual, or gay; males; non-Hispanic white people or others; those aged 25−34 years; those who had more than a high-school diploma; those who used any alcohol or drugs in the past 12 months; and those who have not sustained viral suppression.

Even though E-cigarettes were originally marketed as effective cessation aids to persons who smoke conventional cigarettes, they contain nicotine, the main ingredient, and other toxic ingredients also found in conventional cigarettes.[1] While the emissions from E-cigarettes generally contain lower levels of harmful ingredients than the smoke from regular cigarettes, they are not necessarily safer.[21] Research shows that dual use of E-cigarettes and conventional cigarettes increases nicotine exposure and intake, which may prolong tobacco substance use disorder and negate cessation efforts.[6,14] The finding that approximately 11% of PWH who currently smoke conventional cigarettes had also tried E-

Table 2. Sociodemographic and HIV Clinical Characteristics Among E-cigarette Adult Users With Diagnosed HIV, MMP 2018–2019

Demographics	Current E-cigarette use[a]			Ever E-cigarette use[a]			Never E-cigarette use[a]		
	n[b]	%[c] (95% CI[d])	*p*-Value[e]	*n*[b]	%[c] (95% CI[d])	*p*-Value[e]	*n*[b]	%[c] (95% CI[d])	*p*-Value[e]
Sex			**<0.0001**			**<0.0001**			**<0.0001**
Male	367	6.7 (5.9, 7.5)		1,639	29.1 (26.7, 31.5)		4,201	70.9 (68.5, 73.3)	
Female	69	3.3 (2.3, 4.2)		411	20.5 (16.8, 24.1)		1,666	79.5 (75.9, 83.2)	
Transgender[f]	12	NA		52	31.0 (22.1, 39.9)		111	69.0 (60.1, 77.9)	
Sexual orientation			**0.001**			**<0.0001**			**<0.0001**
Heterosexual or straight	138	3.7 (2.9, 4.5)		738	19.9 (16.8, 23.0)		3,110	80.1 (77.0, 83.2)	
Homosexual or gay	246	8.0 (6.8, 9.1)		1,049	33.1 (30.8, 35.4)		2,205	66.9 (64.6, 69.2)	
Bisexual	42	6.4 (4.4, 8.4)		222	32.6 (27.1, 38.0)		485	67.4 (62.0, 72.9)	
Other	20	9.2 (4.2, 14.2)		89	41.0 (31.6, 50.5)		147	59.0 (49.5, 68.4)	
Race/ethnicity[g]			**<0.0001**			**<0.0001**			**<0.0001**
White, non-Hispanic	193	8.4 (7.3, 9.6)		829	37.4 (34.3, 40.4)		1,477	62.6 (59.6, 65.7)	
Black, non-Hispanic	117	3.9 (3.0, 4.7)		698	21.7 (19.3, 24.0)		2,732	78.3 (76.0, 80.7)	
Hispanic/Latino	96	5.8 (4.3, 7.2)		384	21.4 (17.8, 25.0)		1,416	78.6 (75.0, 82.2)	
Other	42	7.3 (5.0, 9.6)		194	34.7 (29.3, 40.1)		357	65.3 (59.9, 70.7)	
Age at the time of interview (years)			**<0.0001**			**<0.0001**			**<0.0001**
18–24	16	NA		56	34.2 (25.9, 42.6)		116	65.8 (57.4, 74.1)	
25–34	109	10.5 (8.5, 12.5)		467	44.7 (40.0, 49.4)		632	55.3 (50.6, 60.0)	
35–44	104	8.0 (6.3, 9.7)		430	32.2 (29.0, 35.5)		921	67.8 (64.5, 71.0)	
45–54	120	5.1 (4.0, 6.2)		592	26.9 (23.6, 30.2)		1,658	73.1 (69.8, 76.4)	
≥55	99	3.3 (2.5, 4.1)		560	17.6 (15.0, 20.2)		2,655	82.4 (79.8, 85.0)	
Education			**0.006**			**<0.001**			**<0.001**
Less than HS, no diploma	50	3.7 (2.5, 4.8)		293	21.2 (17.8, 24.6)		1,102	78.8 (75.4, 82.2)	
HS diploma or GED	126	5.8 (4.5, 7.1)		564	27.0 (22.4, 31.5)		1,612	73.0 (68.5, 77.6)	
More than HS	272	6.5 (5.7, 7.4)		1,248	29.0 (26.8, 31.1)		3,264	71.0 (68.9, 73.2)	
Combined yearly household income ($)[f]			**0.045**			0.728			0.728
0–19,999	204	5.3 (4.3, 6.2)		1,046	27.7 (24.1, 31.4)		2,905	72.3 (68.6, 75.9)	
20,000–39,999	95	6.8 (5.4, 8.2)		436	28.2 (25.0, 31.5)		1,177	71.8 (68.5, 75.0)	
40,000–74,999	74	7.9 (6.0, 9.9)		275	27.4 (23.4, 31.3)		758	72.6 (68.7, 76.6)	
≥75,000	52	6.3 (4.3, 8.3)		198	25.3 (21.4, 29.2)		622	74.7 (70.8, 78.6)	
Poverty guidelines[f]			**0.023**			0.629			0.629
Above poverty level	258	6.8 (5.9, 7.7)		1,114	27.8 (25.2, 30.5)		3,064	72.2 (69.5, 74.8)	
At or below poverty level	167	5.2 (4.3, 6.2)		840	27.1 (23.4, 30.7)		2,396	72.9 (69.3, 76.6)	

(*continued on next page*)

Table 2. Sociodemographic and HIV Clinical Characteristics Among E-cigarette Adult Users With Diagnosed HIV, MMP 2018–2019 (*continued*)

Demographics	Current E-cigarette use[a]			Ever E-cigarette use[a]			Never E-cigarette use[a]		
	n[b]	%[c] (95% CI[d])	*p*-Value[e]	*n*[b]	%[c] (95% CI[d])	*p*-Value[e]	*n*[b]	%[c] (95% CI[d])	*p*-Value[e]
Time since HIV diagnosis (year)			**<0.0001**			**<0.0001**			**<0.0001**
<5	97	9.5 (7.6, 11.4)		375	35.4 (31.6, 39.2)		743	64.6 (60.8, 68.4)	
5–9	95	7.3 (5.9, 8.8)		430	31.2 (27.7, 34.8)		974	68.8 (65.2, 72.3)	
≥10	256	4.7 (4.0, 5.4)		1,298	24.3 (21.7, 26.8)		4,259	75.7 (73.2, 78.3)	
Health insurance or coverage[f]			0.050			0.421			0.421
Private insurance	172	6.9 (5.7, 8.0)		681	25.9 (23.4, 28.4)		2,076	74.1 (71.6, 76.6)	
Public insurance (excluding RW/ADAP only)	219	5.2 (4.3, 6.0)		1,195	27.7 (24.3, 31.0)		3,294	72.3 (69.0, 75.7)	
RW/ADAP Only or No insurance coverage	55	6.5 (4.6, 8.4)		212	28.5 (25.0, 32.0)		553	71.5 (68.0, 75.0)	
Unspecified insurance	2	NA		12	24.1 (12.3, 35.9)		34	75.9 (64.1, 87.7)	
HIV clinical characteristics[f]									
HIV disease Stage 3 (AIDS)			**<0.001**			**<0.0001**			**<0.0001**
No	226	7.1 (6.1, 8.0)		1,041	31.8 (28.8, 34.7)		2,354	68.2 (65.3, 71.2)	
Yes	222	4.9 (4.1, 5.7)		1,063	23.4 (20.8, 26.0)		3,628	76.6 (74.0, 79.2)	
Prescribed ART			0.900			**0.009**			**0.009**
No	59	6.0 (4.3, 7.7)		309	30.7 (27.0, 34.4)		789	69.3 (65.6, 73.0)	
Yes	389	5.8 (5.1, 6.6)		1,796	26.3 (23.7, 28.9)		5,193	73.7 (71.1, 76.3)	
Currently taking ART			0.882			**0.001**			**0.001**
No	19	5.7 (2.7, 8.6)		105	34.3 (28.8, 39.8)		221	65.7 (60.2, 71.2)	
Yes	429	5.9 (5.2, 6.6)		1,996	26.6 (24.1, 29.2)		5,741	73.4 (70.8, 75.9)	
Viral suppression									
Sustained viral suppression			**0.044**			**<0.0001**			**<0.0001**
No	175	6.7 (5.6, 7.8)		810	31.4 (27.8, 35.0)		1,895	68.6 (65.0, 72.2)	
Yes	273	5.4 (4.6, 6.1)		1,295	24.5 (22.2, 26.7)		4,087	75.5 (73.3, 77.8)	
Most recent viral suppression			0.607			**<0.0001**			**<0.0001**
No	126	6.1 (4.9, 7.3)		636	31.0 (27.2, 34.9)		1,509	69.0 (65.1, 72.8)	
Yes	322	5.7 (5.0, 6.5)		1,469	25.3 (23.1, 27.5)		4,473	74.7 (72.5, 76.9)	
Had at least 1 VL (past 12 months)			0.850			**0.013**			**0.013**
No	83	6.0 (4.6, 7.3)		437	30.4 (25.8, 35.1)		1,080	69.6 (64.9, 74.2)	
Yes	365	5.8 (5.1, 6.6)		1,664	25.9 (23.7, 28.2)		4,899	74.1 (71.8, 76.3)	
Geometric mean CD4 count ≥200			0.064			0.820			0.820
No	20	4.0 (2.4, 5.6)		125	25.9 (21.0, 30.8)		384	74.1 (69.2, 79.0)	
Yes	336	5.9 (5.0, 6.7)		1,548	26.3 (23.8, 28.8)		4,452	73.7 (71.2, 76.2)	
Behavioral characteristics									

(*continued on next page*)

Table 2. Sociodemographic and HIV Clinical Characteristics Among E-cigarette Adult Users With Diagnosed HIV, MMP 2018–2019 (*continued*)

Demographics	Current E-cigarette use[a]			Ever E-cigarette use[a]			Never E-cigarette use[a]		
	n[b]	%[c] (95% CI[d])	*p*-Value[e]	*n*[b]	%[c] (95% CI[d])	*p*-Value[e]	*n*[b]	%[c] (95% CI[d])	*p*-Value[e]
Cigarette use[h]			**<0.0001**			**<0.0001**			**<0.0001**
Never	72	2.0 (1.4, 2.7)		347	9.5 (8.1, 11.0)		3,403	90.5 (89.0, 91.9)	
Former	104	6.5 (5.1, 7.9)		503	30.2 (27.4, 32.9)		1,253	69.8 (67.1, 72.6)	
Current	271	11.1 (9.7, 12.4)		1,251	51.0 (47.2, 54.8)		1,312	49.0 (45.2, 52.8)	
Any alcohol use (past 12 months)[f]			**<0.0001**			**<0.0001**			**<0.0001**
No alcohol use	115	3.8 (2.8, 4.7)		591	19.8 (16.7, 22.8)		2,498	80.2 (77.2, 83.3)	
Alcohol use	333	7.2 (6.3, 8.0)		1,514	31.7 (29.2, 34.1)		3,476	68.3 (65.9, 70.8)	
Any drug use (past 12 months)[i]			**<0.0001**			**<0.0001**			**<0.0001**
No injection or noninjection drug use	199	4.0 (3.3, 4.7)		946	18.4 (16.0, 20.8)		4,448	81.6 (79.2, 84.0)	
Injection or noninjection drug use	248	9.7 (8.5, 11.0)		1,148	44.8 (42.0, 47.6)		1,511	55.2 (52.4, 58.0)	
Depression[f]			**0.002**			**<0.0001**			**<0.0001**
No depression	335	5.3 (4.6, 6.0)		1,621	25.0 (22.4, 27.6)		5,041	75.0 (72.4, 77.6)	
Other depression	38	6.1 (3.7, 8.6)		183	31.7 (27.4, 36.0)		421	68.3 (64.0, 72.6)	
Major depression	71	10.8 (8.1, 13.6)		279	41.9 (37.5, 46.4)		463	58.1 (53.6, 62.5)	
Total	448	5.9 (5.2, 6.5)		2,105	27.1 (24.6, 29.7)		5,982	72.9 (70.3, 75.4)	

Note: Boldface indicates statistical significance ($p<0.05$).

[a]*E-cigarette ever use* was defined as respondents who said that they have used an E-cigarette even just 1 time in their entire life. *Current E-cigarette use* was defined as respondents who said that they have used an E-cigarette even just 1 time in their entire life and have used E-cigarettes during the past 30 days.

[b]Numbers are unweighted.

[c]Percentages are weighted row percentages.

[d]CIs incorporate weighted percentages.

[e]Statistical significance within demographic, HIV clinical, and behavior characteristics using chi-square tests.

[f]Variable definition has been described in detail in the study Centers for Disease Control and Prevention. Behavioral and Clinical Characteristics of Persons with Diagnosed HIV Infection: Medical Monitoring Project, United States 2016 Cycle (June 2016 — May 2017). In: HIV Surveillance Special Report 21; Revised edition. https://www.cdc.gov/hiv/library/reports/hiv-surveillance.html. Published June 2019.

[g]Non-Hispanic White: participants who self-identify as non-Hispanic and White only. Non-Hispanic Black: participants who self-identify as non-Hispanic and Black/African American only; Hispanic participants who self-identify as Hispanic, even if other race/ethnicity categories were selected. Other participants include those who selected Asian, Native Hawaiian/other Pacific Islander, American Indian/Alaska Native, or multiple race/ethnicity categories.

[h]Never smoker: respondents who said that they have not smoked at least 100 cigarettes in their entire life. Current smokers: *respondents* were defined as those who said that they have smoked at least 100 cigarettes in their entire life and who now smoke daily, weekly, monthly, and less than monthly. Former smoker: respondents who said that they have smoked at least 100 cigarettes in their entire life and who now never smoke.

[i]Includes all drugs that were injected and not injected (i.e., administered by any route other than injection), including legal drugs that were not used for medical purposes.

NA estimates are not presented because the coefficient of variance ≥30%.

ART, antiretroviral therapy; HS, high school; MMP, Medical Monitoring Project; NA, not applicable; RW/ADAP, Ryan White HIV/AIDS or AIDS Drug Assistance Coverage; VL, viral load.

cigarettes is consistent with general population studies regarding the dual use of E-cigarettes and conventional cigarettes.[12,13] It is noteworthy that persons with HIV who smoke make fewer quit attempts and have lower rates of smoking cessation success than the general population.[15] Similar to that of the general population, several behavioral risk factors such as alcohol, substance use, and mental health issues have been identified as barriers to successful smoking cessation among PWH.[22] These barriers combined with perceptions that E-cigarettes are effective cessation aids may partially explain the higher prevalence of E-cigarette use among persons with HIV who currently smoke than among the general population. Despite the fact that E-cigarettes are not Food and Drug Administration approved for smoking cessation coupled with the uncertainty of long-term health impacts, PWH are interested in their use.[23] E-cigarettes may have the potential to benefit non-pregnant adults who smoke conventional cigarettes if used as a complete substitute for regular cigarettes and other smoked tobacco products.[21] In order for adults who smoke conventional cigarettes to achieve any meaningful health benefits from e-cigarettes, they must fully switch to E-cigarettes and completely stop smoking conventional cigarettes and other tobacco products.[21] Even though less harmful cessation aids exist (e.g., nicotine replacement, pharmaceutical treatment, and cessation counseling),[24] there is literature to suggest that PWH may use them as a bridge to tobacco cessation or a safer substitute for combustible tobacco products.[23]

Over the past 30 years, achievements in the HIV epidemic resulting in PWH living longer and healthier lives have occurred.[25] Considering amplified health effects caused by the use of conventional cigarettes for PWH compared with that for persons in the general population,[16,24] E-cigarette use among PWH merits close attention. To avoid a rapid increase in E-cigarette use among PWH and to sustain PWH living longer and healthier lives, monitoring efforts for E-cigarette use among PWH and interventions to deter tobacco use for PWH should continue.

Limitations

This study has limitations. First, the analysis is limited to persons diagnosed with HIV in the U.S.; the results do not provide E-cigarette estimates among persons with undiagnosed HIV in the U.S. Second, our estimates of E-cigarette and conventional cigarette use were based on self-report and were not biochemically validated; however, studies have shown good correlation between self-reported tobacco use behaviors and biochemical measures such as cotinine.[26] Third, although MMP used data-weighting methods to mitigate nonresponse bias, nonresponse bias is still possible. In addition, there are differences between MMP and general population surveys (e.g., National Health Interview Survey) in the definition of current E-cigarette use. Fourth, owing to population sample size and unstable estimates, we were unable to perform a multivariable regression.[27] For example, for current E-cigarette use by age, the estimate of the proportion of current E-cigarette use in the age group 18−24 years had a coefficient variation >0.30, so it is suppressed for reporting and cannot be modeled.[27]

CONCLUSIONS

These findings suggest that current and ever use of E-cigarettes among PWH was at a greater proportion than among the general U.S. population,[12] suggesting that E-cigarette use may be a potential issue for PWH if they are being used with other tobacco products and not solely used as a substitute for conventional cigarettes and other smoked tobacco products. It is unclear at this time whether health effects related to E-cigarettes are amplified in the presence of HIV infection as it is for cigarette smoking.[16] E-cigarette use may be a preventable health threat; therefore, usage should be discouraged among adults who do not smoke conventional cigarettes. Persons interested in quitting smoking should be encouraged to first try Food and Drug Administration–approved smoking cessation aids, especially among PWH.

DECLARATIONS OF INTEREST

None.

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Harm Reduction Journal

BRIEF REPORT

Open Access

Improving access to HIV care among people who inject drugs through tele-harm reduction: a qualitative analysis of perceived discrimination and stigma

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Abstract

Background Tele-harm reduction (THR) is a telehealth-enhanced, peer-led, harm reduction intervention delivered within a trusted syringe services program (SSP) venue. The primary goal of THR is to facilitate linkage to care and rapid, enduring virologic suppression among people who inject drugs (PWID) with HIV. An SSP in Miami, Florida, developed THR to circumvent pervasive stigma within the traditional healthcare system.

Methods During intervention development, we conducted in-depth interviews with PWID with HIV ($n=25$) to identify barriers and facilitators to care via THR. We employed a general inductive approach to transcripts guided by iterative readings of the raw data to derive the concepts, themes, and interpretations of the THR intervention.

Results Of the 25 PWID interviewed, 15 were in HIV care and adherent to medication; 4 were in HIV care but non-adherent; and 6 were not in care. Themes that emerged from the qualitative analysis included the trust and confidence PWID have with SSP clinicians as opposed to professionals within the traditional healthcare system. Several barriers to treatment were reported among PWID, including perceived and actual discrimination by friends and family, negative internalized behaviors, denial of HIV status, and fear of engaging in care. Facilitators to HIV care included empathy and respect by SSP staff, flexibility of telehealth location, and an overall destigmatizing approach.

Conclusion PWID identified barriers and facilitators to receipt of HIV care through the THR intervention. Interviews helped inform THR intervention development, centered on PWID in the destigmatizing environment of an SSP.

Keywords PWID, HIV, Stigma, Syringe services program, Tele-harm reduction, Harm reduction

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Background

People who inject drugs (PWID) are at an increased risk for HIV infection due to both syringe sharing and sexual risk behaviors [1] compounded by competing priorities related to unstable housing and sex work [2–5]. Unfortunately, PWID face substantial barriers to HIV diagnosis, linkage to care, retention in care, and viral suppression [6–8]. Individuals retained in HIV care have a higher likelihood of viral suppression and lower mortality [9]. Stigma is a key barrier to HIV care among PWID [10]. Perceived and experienced discrimination from family and community members can discourage PWID with HIV from seeking medical care [11]. Additionally, internalized stigma can prevent PWID with HIV from accessing services [12]. Both internal and external stigma and experiences with rejection can create fear of disclosing HIV status, further impacting retention in care [5–10, 13, 14].

In cases where PWID have access to antiretroviral therapy (ART), poverty, substance use disorders, mental health disorders, social stigma, and medication side effects can limit adherence. Most patients with HIV report more than one barrier to ART adherence [15]. The HIV care continuum among PWID is disproportionally impacted by social determinants of health, including homelessness, discrimination, and medical distrust [16, 17] with only one in two PWID with HIV virally suppressed in the USA [18, 19].

Effective interventions for reducing HIV transmission among PWID include the provision of drug injection equipment through syringe services programs (SSPs) [20, 21]. SSPs can mediate access to health care services; but, in some cases, implementation has been constrained by law enforcement activities [22]. The evidence is clear: when SSPs were used in combination with other prevention interventions following injection drug-associated HIV outbreaks, there are significant declines in incident HIV infections [23, 24]. However, few studies [25, 26] focus on the relationships between PWID and community members in recovery from addiction, specifically peer workers with lived experience of substance use working at SSPs.

Telehealth has been used to increase access to HIV care for patients who experience challenges along the HIV care continuum, improving their adherence and retention [27]. Residing in the U.S. city with the highest rate of new HIV infections, the IDEA SSP in Miami, Florida, has previously shown how services can be leveraged for linkage to HIV care and substance use treatment [28, 29]. Partnership with the Florida Department of Health has facilitated HIV testing and rapid access to ART [26, 30, 31]. To build on this foundation, we developed Tele-Harm Reduction (THR) to facilitate access to HIV care within the non-stigmatizing environment of a harm reduction setting [32]. The purpose of this qualitative analysis was to identify experiences, perceptions, barriers, and facilitators for engagement of PWID with HIV in care via a THR model. Participants that were interviewed were actively participating in the THR model or had knowledge of the THR pilot intervention and were using SSP services at the time.

Materials and methods

Ethics

This study was approved by the Institutional Review Board of University of Miami (IRB# 20190893). All data were de-identified and anonymous.

Tele-harm reduction intervention

THR has been described in greater detail elsewhere [22]. In brief, tele-harm reduction has two components, meeting PWID where they are physically and emotionally. In component 1, PWID are connected to a physician to initiate ART via telehealth wherever they are (e.g. SSP, mobile unit, encampment). In component 2, a peer with lived experience facilitates ongoing telehealth visits with the physicians and psychologist. Peers may also support adherence by delivering medications stored at the SSP and providing ongoing motivational interviewing.

Recruitment and participants

Participants were recruited using convenience sampling methods. Inclusion criteria included: (1)18 years of age or older, (2) enrollment at the IDEA Miami SSP, (3) testing reactive via HIV rapid test, (4) reported history of injection drug use, and (5) English- or Spanish-speaking. Pregnant participants were excluded because they may have a unique and non-generalizable experience accessing HIV care. Some interviewees ($n=17$) were already participating in the THR pilot intervention.

Semi-structured interviews

After anonymous verbal consent, semi-structured interviews were conducted by a research assistant with previous training in qualitative interviewing and experience working with PWID. Interviews were completed both at the IDEA Miami SSP fixed site and mobile unit in a private setting. Interviews ranged between 15 to 30 min and were audio recorded. Questions were designed to be open-ended, and the interview guide focused on barriers to engagement in HIV care and recommendations for the telehealth intervention, including facilitator characteristics and training. We ascertained knowledge and attitudes regarding HIV treatment for PWID, barriers and facilitators to medication adherence, and long-term retention in HIV care. Table 1 shows the domain and

Table 1 Semi-structured interview guide

Domain	
Barriers to engagement in HIV care	What are some of the barriers that [PWID with HIV] have when they want to get into HIV care? What are some of the ways that [PWID with HIV] are treated by others when they want to get into HIV care? What suggestions do you have for making this better?
Perceived benefit of SSP-based care and telehealth	Would [PWID with HIV] feel comfortable coming to a syringe service program like this one to get into HIV care? What are some of the barriers that [PWID with HIV] would have when they want to get into HIV care at a syringe service program? [Telehealth] allows a health care provider to care for a patient when the provider and patient are not physically present with each other by using a computer with a camera and sound so they can see and talk to each other. Would [PWID with HIV] feel comfortable coming to a syringe service program like this one to meet with a case manager or provider using telemedicine?
Recommendations for telehealth test-and-treat	What would be the best location for a syringe services program if it wanted to make it easy for [PWID with HIV] to get into HIV care? What days of the week and times of the day would be best for [PWID with HIV] to get into HIV care at a syringe services program like this one?
Recommendations for facilitator characteristics and training	What should we consider when choosing a staff member at a syringe services program to help [PWID with HIV] to use [telehealth] and to get into HIV care? What are the characteristics of the ideal staff member for this? Would this be different for different types of participants? What types of training or experience should this staff member have?
Knowledge, attitudes, and awareness regarding HIV and treatment for PWID	What are the perceptions/stigma that [PWID with HIV] face? Is there fear that other people will find out about a person's HIV-positive status if they get into HIV care? What suggestions do you have for overcoming these fears of getting into HIV care for people who inject drugs? What do people who inject drugs think about HIV care and HIV treatment medications?
**For participants with HIV currently in care only*- medication adherence, barriers, and facilitators of long-term adherence and successful strategies used	What are some of the *things that make it easier* for you to take your HIV medications as you should? What are some of the *things that make it harder* for you to take your HIV medications as you should? What things have you done/changes have you made to help you take your HIV medications as you should? What would you need to help make this better?

corresponding sample interview questions. All the interviews were transcribed verbatim by an external transcription company.

Procedure and data analysis

We employed a general inductive approach to understand the barriers and facilitators to care for PWID with HIV at an SSP as presented in the transcribed interviews. A general inductive approach is commonly used in the health and social sciences and allows findings to emerge from the most frequent and dominant codes and themes encountered throughout the analysis [33]. Authors were guided by the interview transcripts to derive the concepts, themes, and interpretations on the objectives.

Following a general inductive approach, CS read all the transcripts while BH, YR, and HA each read two different transcripts. A codebook was created that included code names, definitions, sample quotes, and coding decision rules. The approach entailed data exploration, inductive coding, and thematic analysis. Transcripts were read, re-read, and coded in an iterative fashion. An initial list of themes and subthemes were created. Data saturation was met after the 10th transcript when no new themes or subthemes emerged. Coders then coded one transcript together, discussing coding discrepancies, and adjusting coding decision rules and definitions accordingly. The coding pairs coded transcripts and calculated percent agreement based on consistency of ratings against the lead author (CS). The percentage agreement was calculated to ensure interrater reliability of the codebook. Initial rating of agreement between coding pairs ranged between 90 to 97% on independently coded transcripts, with coding pairs reaching 100% on all final codes.

All final codes were analyzed in Dedoose (Version 8.2.14, Sociocultural Research Consultants, Los Angeles, CA). Specifically, code frequencies were extracted, which allowed for identification of the most highly endorsed codes in the data. Then, the information was extracted on code-cooccurrence to understand the number of times two or more codes appeared together in the same excerpt. Lastly, excerpts from each code were discussed to validate the data and codes and gather sample quotations for our themes and subthemes. To improve the quality of the research and ensure explicit and comprehensive reporting of findings, the consolidated criteria for reporting qualitative research (COREQ) checklist guided the reporting of study methods and results [34].

Results

There was a total of 25 participants recruited that included 15 participants in HIV care and adherent to medication, 4 in HIV care but non-adherent, and 6 not in care. Age ranged from 23 to 67 years of age (with a mean age of 31 years old); 12 were males, 11 were females. Two participants had missing demographic data (Table 2). Of the 25 participants, 17 (68%) were patients who had received the *THR* pilot intervention and the remaining 8 participants were using SSP services and had knowledge of the THR pilot intervention.

A total of 34 themes were applied 770 times in the 25 transcripts. Themes that appeared most frequently included HIV care, accessing care, confidence in medical doctors, discrimination, medication adherence, negative acceptance by peers, and syringe exchange. Codes that co-occurred the most were: medication adherence and HIV care; syringe exchange and HIV care; negative acceptance by peers and discrimination; syringe exchange and accessible physical location of medical office. Overall, we lumped codes into two themes: barriers to HIV care for PWID and facilitators to engagement, and their corresponding sub-themes (see Fig. 1). Representative quotations from 22 excerpts are provided to ensure substantial evidence of the thematic findings.

Table 2 Participant demographic profile

Characteristic	*N*
Gender	
Male	12
Female	11
Age (years)	
20–30	7
31–40	7
41–50	5
51–60	1
61–70	3
Race/ethnicity	
White (non-Hispanic)	10
White (Hispanic)	9
Black (non-Hispanic)	3
Native American	1

Missing demographic information from 2 participants are not displayed in the profile

Negative experiences outside syringe exchanges with HIV services

Personal attitudes and beliefs: denial of HIV status and internalized stigma

The most common response when asked about barriers to receiving HIV care pertained to participants' denial or avoidance of their HIV status upon initial diagnosis. Participants frequently reported the fear of being judged due to their HIV status and avoiding certain behaviors or stereotypical locations that would label them as someone who has HIV, such as attending an HIV clinic. Many described waiting until they really had to seek medical treatment to start their care:

> *"My fear was really bad. I hardly felt comfortably and hardly talked to anyone at all until I ended up having something happen to me that was pretty life threatening or whatever, I was just like, well I gotta start talking. I gotta start doin' something. I was just so afraid when I found out that I was positive."*
> *"I didn't do anything about my HIV until I had to."*
> *"I didn't want other people to know. I knew that other people who were using drugs would spread the word that they saw me there and obviously I must have it. That was my biggest fear."*

Adherence to medication and doctor's order: avoidance of medical care in a regular clinical setting

Participants reported difficulty adhering to medication and appointments prior to using the mobile THR pilot due to medical mistrust and mistreatment by professionals. Participants reported mistreatment or humiliation that they encountered at prior medical visits and its effect on their self-esteem and desire for ongoing treatment:

> *"Everywhere else I've gone, even where I'm staying right now, I was even in a treatment facility, treated me like crap. They don't help. Even if they have information, they won't help. I've been asking this lady, I signed up for a program and she wants nothing to do with me. It's a long story, but it had to do with my HIV."*
> *"The lady that was getting ready to do my blood, she said it out real loud to her coworker, and everybody,*

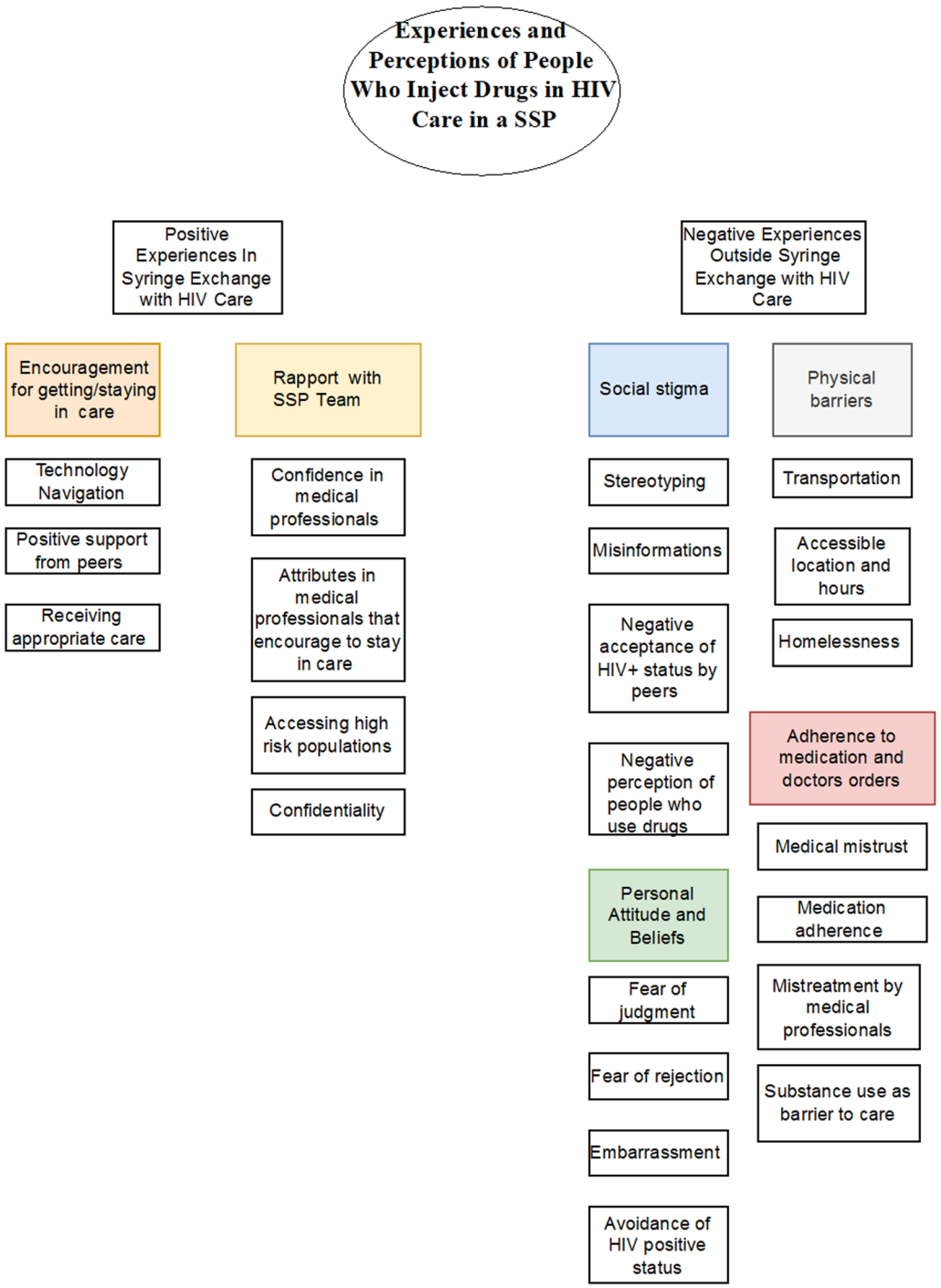

Fig. 1 Experiences and perceptions of PWID in HIV care in an SSP

even the patient sitting in chairs, make sure you get something, this guy has HIV."

Social stigma

The most in-depth parts of conversation within the semi-structured interviews entailed beliefs regarding HIV and HIV care by SSP participants. Specifically, they described fears of being judged and rejected by the societal community, embarrassment, and feeling alone in their journey with HIV. The fear of judgment was also described as being a hindrance to their retention in HIV care. Participants reported feeling lonely in their care continuum

and withdrawn from those who did not know their status. They also reported being fearful that medical professionals would treat them differently because of their HIV status. Below are sample quotations:

"I was worried about people judging me, people knowin' my business, my personal business getting out, my personal health information getting out on the streets, you know?"
"Well, I have HIV. It's like you risk outing yourself and putting yourself out there for people to reject you."
"There's a fear that everyone will find out about my HIV status and leave."

Along with personal feelings of judgment and rejection, participants reported that their encounters with those around them were not always positive and cemented their fears of asking for help or strategy of avoiding others. Many participants reported negative encounters with other people, including medical professionals, friends, and family. These encounters took form as stereotyping, incorrect information regarding HIV, negative feelings, and perceptions of persons with HIV and/or associations with drug use. Most commonly, participants reported an over-generalized belief by those they encountered, specifically being labeled as homosexual or a person who uses drugs:

"People look at you—either you're a homosexual or you're an IV user—my brother was not. He just slept with the wrong person."
"The stigma and the way everybody treated my brother before he died. I haven't told a soul except my doctors because of that."
"Some people I deal with, even my family, for instance. They were rude to me as far as calling me nasty or sick sometimes. Yeah, people are super cruel. It's that they're not educated about it. They're just stupid, and they say harsh things."

Physical barriers to care

Participants reported external barriers that prevented access to HIV care. Examples included lack of transportation, inaccessible location, and inflexible hours outside of working hours in a traditional clinic. Participants experiencing homelessness had many more difficulties initiating linkage to and maintaining care than those who were stably housed.

"Transportation makes it hard for me to get over and get my meds."
"I was just gonna say that my only barrier when I'm not regularly on my medication and because I have a dope habit, is that a lot of time this is too far and it's too hot for me to walk all the way over here. I still don't have the energy to do it."
"When I hadn't got a phone, I couldn't stay on top of it or contact people to get back into care. Then if you're on the streets, and just really don't think of it."

Positive experiences in the Syringe Exchange and Facilitators to HIV Care.

SSP as a protective factor staying in care

Participants reported several positive experiences within the SSP-based THR intervention that could facilitate retention in HIV care. All participants had positive remarks regarding the use of THR for HIV care. All participants were accepting of the use of THR for HIV care and utilizing a tele-health modality for services. All participants agreed it would be beneficial for the community to continue to offer this service. SSP participants reported their confidence in HIV screening and counseling services and felt inclined to share this resource with others.

"And probably one of the best resources or means of getting HIV care."
"I think that it's basic—you come here to get syringes because you need to use. Then, of course, they help with HIV. Because you use syringes, you—there's a possible risk that you can get it, or- and it's all one place, one-stop shop."

Staying in care: encouragement from peers and clinicians at the SSP

Participants were asked if the SSP-based THR intervention was a desired venue for HIV care. All participants reported positive comments regarding their experience with the SSP. Many also cited positive attributes of the personalities of staff that should be emulated among traditional health care provider staff. Although many reported general mistrust with medical professionals, participants considered SSP clinicians trustworthy. Participants described the positivity and welcomeness they felt when visiting the physician at the SSP. Participants reported the unique attributes of staff needed to work with people with HIV and/or PWID. Participants appreciated that the SSP is in an area home to a community placed at high risk, such as PWID and those experiencing homelessness. Participants endorsed the necessity of the SSP and its services for HIV care. Lastly, confidentiality was noted throughout the participant transcripts as being very important when working with patients with HIV:

"The people that are here are very familiar and supportive of people with HIV and other diseases like

hepatitis, and things like that. They don't treat us differently."
"As far as care, the people here—the caseworkers and everyone—they're very supportive about it and they try their best to do the most they can to get it to me over and over and over again."
"Just to let someone know that, if you're open and honest with me, I'm not going to judge you. I'm still going to give you the best care, something like that to help the person understand that they're not asking you these questions to judge you or shut you out. They're just trying to help you the best way they can."
"I think the best thing is to have someone who does a lot more listening than talking, someone that doesn't appear to be nosy or prying. Because just like in life in general I feel confidentiality is important."

Discussion

In this study, we explored the perspectives of PWID with HIV regarding a novel intervention of telehealth-enhanced HIV care delivered through an SSP leveraging the expertise of peer harm reduction counselors (*Tele-Harm Reduction*). Consistent with previous studies, many of these participants reported stigma and discrimination in traditional healthcare settings as the main reasons they discontinued their HIV care or did not seek HIV care. Notable strengths of the *THR* model that facilitated HIV linkage and retention included: (1) nonjudgmental staff, including those with lived experience, who collaborated closely with participants for their HIV and addiction care, and (2) wraparound services in conjunction with telehealth visits that supported comprehensive care at one venue.

Telehealth has been proven to be feasible, cost-effective, and sustainable in SSP settings [35]. Telehealth also reduced the amount of time between an individual's interest in treatment and getting into treatment and speaking to a provider. This shortening of time provides improved rates in substance use treatment, engagement, and retention [35, 36]. SSPs are often one of the few health-related resources with which PWID regularly engage and therefore fill a unique role in promoting health in a welcoming and non-stigmatizing way [37]. Existing literature reveals that social stigma strongly influences PWID's healthcare system engagement [38]. Telehealth has been used for direct patient consultation for HIV care, with marginalized populations such as people with HIV in the prison system, and in remote geographical locations [39–41]. The research on the effectiveness of SSPs in reducing injection risk behaviors and HIV transmission dates to 1989 [42]. SSPs that have trust building communication with PWID can reduce and maintain low levels of HIV transmission [43] and further, it has been found that peers reach more diverse networks of PWID [42].

This qualitative assessment of facilitators and barriers to HIV care among PWID frequenting services at an SSP reveal that low-barrier access to compassionate medical care through telehealth could facilitate access to care for a traditionally overlooked cohort. Tookes et al. 2021 [22] reported out of the 35 PWID living with HIV enrolled in the Tele-Harm Reduction intervention, 25 (78%) were virally suppressed at 6 months. A harm reduction framework was employed afterwards to provide on demand access to HIV care among the PWID via remote technology. This telehealth model was integrated to the fixed and mobile site or the location of the patient's choosing [22]. Centering on PWID, the engagement of peers and linkage to care coordinators in this intervention was of utmost importance. Our study shows that respondent PWID reported their engagement in treatment was influenced by the warm demeanor and non-judgmental ways of staff workers at the IDEA exchange. The majority of those interviewed reported on the stigmatization that they endured in the traditional healthcare setting which ultimately affected their care and treatment, a barrier that could be overcome by the Tele-Harm Reduction intervention.

Limitations

This study has several limitations. Results may not be generalizable since it was conducted at a single SSP in a single city. Additionally, this secondary analysis of transcripts is limited in scope since the qualitative interviews were done during the implementation of THR and the interview guide was not refined in pursuit of the goals of this analysis in identification of barriers and facilitators. Finally, only one interviewer conducted the interviews, which can introduce interview bias, where the interviewer may subconsciously influence the response of the interviewee. Nonetheless, interviews were conducted within the trusted SSP setting and likely had limited social desirability bias in this context.

Next steps

This qualitative study elucidated the experience of PWID and their perspective on the importance of destigmatizing provision of HIV care. Due to the promise of the THR intervention, it is currently being tested in a multisite efficacy trial [44] aiming to transform the way PWID access comprehensive HIV care.

Author contributions

C.S., B.H., Y.R., and T.C. wrote the main manuscript and prepared figures. All authors reviewed and contributed to the editing of the manuscript. H.T. oversaw all steps of the manuscript as PI and mentor.

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Data availability
The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declarations

Competing interests
The authors declare no competing interests.

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