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Stigma, privacy concerns, sexual behaviors, and testing history shape willingness to use HIV self-testing among African refugee men engaged in sex work in Italy – a mixed method study—BGSN-023

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Abstract

Background African refugee men engaged in sex work in Italy experience multiple barriers to facility-based HIV testing, including stigma, privacy concerns, and structural constraints within healthcare systems. HIV self-testing (HIVST), particularly oral fluid-based HIVST, may help address these barriers, yet evidence on willingness to use HIVST in this population remains limited.

Methods We employed a mixed-methods sequential exploratory design in partnership with a community-based organization. Quantitative survey data were collected from 150 African refugee men engaged in sex work, alongside qualitative data from 20 in-depth interviews and two focus group discussions. Descriptive analyses summarized willingness, perceived facilitators, and barriers. Multivariable logistic regression was used to identify factors independently associated with willingness to use HIVST, reporting adjusted odds ratios (aORs) and 95% confidence intervals (CIs). Qualitative data were analyzed using summative content analysis to contextualize quantitative findings.

Results Among participants eligible for HIVST analysis ($n = 115$), 44.4% reported willingness to use HIVST. Commonly reported facilitators included convenience and privacy (47.1%), avoidance of stigma in healthcare settings (23.5%), and ease of use, while key barriers included concerns about test accuracy (27.0%), fear of receiving a positive result without support (20.9%), and limited access to HIVST kits (32.2%). In adjusted analyses, willingness to use HIVST was independently associated with belonging to a religion (aOR = 5.27, 95% CI: 3.77–15.83), having health insurance (aOR = 4.56, 95% CI: 2.78–9.92), experiencing immigration-related challenges in healthcare access (aOR = 1.93, 95% CI: 1.22–4.25), more frequent HIV testing (> once per year; aOR = 2.27, 95% CI: 1.98–5.21), awareness of HIVST (aOR = 3.24, 95% CI: 1.36–6.29), and prior HIVST use (aOR = 2.12, 95% CI: 1.80–8.21). Qualitative findings highlighted occupational relevance, autonomy in health decision-making, and persistent fears of stigma if seen with HIVST kits.

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Conclusions Willingness to use HIVST among African refugee men engaged in sex work in Italy was moderate and shaped by prior testing engagement, healthcare access, and structural vulnerabilities. Expanding HIVST education, reducing cost barriers, and integrating peer-led, stigma-sensitive support mechanisms may improve HIV testing uptake and strengthen HIV prevention efforts in this population.

Keywords HIV self-testing, Health belief model, Mixed-methods research, Migrants and refugees, Men engaged in sex work, Stigma, Healthcare access, Italy

Introduction

Despite global advances in HIV prevention and care, HIV testing uptake remains suboptimal among marginalized populations, including migrants and refugees, gay men and other men who have sex with men, people engaged in sex work, and racial and ethnic minorities [1]. These groups face intersecting legal, economic, and social barriers that limit access to HIV testing and care. Migrants and refugees often encounter restrictive healthcare policies and economic precarity [2, 3], while gay men and other men who have sex with men and people engaged in sex work experience stigma and discrimination that deter engagement with HIV services [4, 5]. Racial and ethnic minorities further face structural inequities, including systemic racism within healthcare systems [6]. Understanding how multiple barriers related to migration status, sexual identity, occupation, and structural exclusion influence HIV testing decisions is essential for designing targeted HIV testing interventions.

Immigrants and refugees from sub-Saharan Africa living in Europe, particularly those who are men who have sex with men, experience elevated vulnerability to HIV that mirrors patterns observed in sub-Saharan Africa [7, 8]. This vulnerability is shaped by overlapping structural, social, and economic marginalization, including stigma, discrimination, precarious legal status, and limited access to culturally competent healthcare services [9, 10]. Fear of immigration enforcement further discourages healthcare engagement among migrants and refugees [11, 12], while language barriers, financial hardship, and unfamiliarity with healthcare systems compound these challenges [13]. Among people engaged in sex work, societal and internalized stigma further suppress routine engagement with HIV services, increasing the likelihood of delayed diagnosis and onward transmission [14, 15].

Although men have engaged in sex work across historical and cultural contexts [16], male engagement in sex work remains underexamined in HIV research and programming in Europe, where interventions have historically focused on women engaged in sex work. This focus reflects gendered policy approaches to sex work and the greater visibility of female sex worker networks, which have contributed to more robust epidemiological and programmatic evidence for women than for men [17–19]. As a result, men engaged in sex work, particularly those from immigrant and refugee backgrounds,

have been largely overlooked despite evidence of heightened vulnerability to HIV and other sexually transmitted infections [2, 20]. This gap limits the development of tailored policies and interventions that address the distinct challenges faced by African refugee men engaged in sex work, including legal precarity, stigma, and exclusion from targeted healthcare services.

HIV testing services are central to Italy's HIV response [21]. Testing is delivered primarily through client-initiated approaches in healthcare facilities, community settings, and outreach programs, as well as provider-initiated testing in clinical contexts where HIV vulnerability is identified [22–24]. Despite these pathways, barriers persist, including stigma, fear of discrimination, confidentiality concerns, limited awareness of testing options, apprehension about receiving a positive result, and restricted access among undocumented migrants and other marginalized groups [25–30]. Broader scholarship on men engaged in sex work highlights that transactional sex is frequently shaped by economic vulnerability and power imbalances between sex workers and clients, conditions that may also apply to migrant men engaged in sex work in Italy [16, 31]. Criminalization and policing practices can further exacerbate these vulnerabilities by pushing sex work into hidden contexts, restricting access to HIV prevention and treatment services [32]. As a result, low awareness and limited willingness to undergo routine HIV testing remain significant challenges for this population [33–37].

Given these persistent barriers, alternative testing strategies such as HIV self-testing (HIVST) remain important for expanding access to HIV diagnosis among populations facing entrenched healthcare exclusion. HIV self-testing in this study referred to oral-fluid HIV self-testing. HIVST allows individuals to test privately, potentially addressing concerns related to stigma, discrimination, and confidentiality breaches [38]. Evidence from multiple settings suggests that HIV self-testing can increase testing uptake among marginalized populations, including migrants and people engaged in sex work [39–42]. Recognizing its potential, the World Health Organization recommends HIVST as a complementary testing strategy [38], and Italy approved its use in 2016 [43].

Despite the growing recognition of HIV self-testing's potential, little is known about willingness to use HIVST among African refugee men engaged in sex work in

Italy. In this study, we use the term African refugee men engaged in sex work to refer to cisgender men from sub-Saharan Africa with refugee backgrounds who reported engagement in sex work. Research among other key populations, including gay men and other men who have sex with men and women engaged in sex work, indicates that willingness to use HIVST is influenced by stigma, privacy concerns, prior healthcare experiences, and exposure to discrimination [44–46]. While transgender sex workers experience a disproportionately high burden of HIV globally [47], the present study focuses primarily on cisgender men engaged in sex work, as only one transgender participant remained in the analytic sample after excluding participants living with HIV. Studying this population in Italy is particularly relevant given the country's role as a major entry point for migrants and refugees from sub-Saharan Africa into Europe [48], as well as the structural barriers they face in accessing healthcare services, including administrative obstacles to insurance coverage, fear of immigration enforcement, and experiences of institutional stigma within healthcare settings [10–13]. The intersection of migration policies, legal precarity, and social exclusion uniquely shapes the healthcare experiences of African refugee men engaged in sex work, underscoring the need for targeted research to inform effective HIV testing interventions.

To address these gaps, we employed a mixed-methods approach to examine both quantitative associations and qualitative experiences shaping willingness to use HIVST. This design enabled an empirical exploration of how individual perceptions interact with structural and social constraints to influence HIV testing decisions. The study was guided by the Health Belief Model (HBM), which provides a pragmatic framework for examining how perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy shape health-related behaviors [49, 50]. The HBM has been applied to understand HIVST behaviors across diverse populations and settings, including gay men and other men who have sex with men, adolescents, migrants, and other key populations [51–55]. Although the HBM focuses primarily on individual perceptions, it was applied in this study to understand how structural conditions, such as stigma, legal precarity, and healthcare exclusion, are internalized and experienced as barriers or motivators influencing willingness to engage in HIVST. The specific research questions guiding this study were: (1) whether African refugee cisgender men engaged in sex work in Italy are willing to use HIVST, and (2) what factors are associated with willingness to use HIVST in this population. Findings from this study aim to inform context-sensitive HIV testing strategies, interventions, and policy responses that address stigma and structural

barriers while improving access to timely HIV services among marginalized populations.

Methodology

Research design

We employed a mixed-methods sequential exploratory design, in which qualitative data collection and analysis preceded the quantitative phase, to comprehensively examine willingness to use HIVST among African refugee men engaged in sex work in Italy between September to December 2023. This approach is particularly appropriate when exploring under-researched populations and when qualitative findings are needed to inform quantitative measurement and interpretation [56, 57]. The qualitative strand was given initial priority and was used to generate in-depth insights into participants' perceptions, experiences, and decision-making processes related to HIVST. Findings from this phase informed the development and refinement of the quantitative survey instrument. The subsequent quantitative strand was used to describe patterns of willingness to use HIVST and to identify factors associated with willingness at the population level. This approach allowed us to contextualize quantitative findings within participants' lived experiences and to provide a more comprehensive understanding of barriers and facilitators influencing HIVST uptake.

Participants and setting

This study involved African refugee men engaged in sex work in Italy. A total of 150 participants completed the quantitative survey, and 35 participants took part in the qualitative component of the study. Eligibility criteria included: (1) being from sub-Saharan Africa; (2) currently residing in Italy; (3) being at least 18 years old; (4) speaking and understanding English or Italian fluently; (5) having been assigned male sex at birth (including cisgender men and transgender women); and (6) having engaged in sex work within the past six months.

The quantitative sample size was not determined through a formal power calculation, as the study was designed as formative mixed-methods research aimed at exploring willingness to use HIVST and identifying context-specific facilitators and barriers. Instead, the sample size was pragmatically determined based on the reach of the community partner, feasibility considerations, and the study team's assessment of adequacy for generating stable descriptive estimates and multivariable associations. Similar community-based studies among hidden or hard-to-reach key populations have used comparable sample sizes [53].

The study was conducted in collaboration with Circolo Pink (Pink Refugees), a community-based human services organization with established access to African refugee and migrant sexual minority communities. Data

collection took place in safe and accessible community spaces within Circolo Pink's offices in Verona and at a sister organization in Turin, Northern Italy.

Researcher positionality and reflexivity

This study was conducted by a multidisciplinary research team with expertise in HIV prevention, migration health, and community-engaged research with sexual and gender minority populations. Prior to data collection, the Principal Investigator (PI) and first author, conducted formative work with Pink Refugees, including in-person engagement in Italy, collaborative study planning, and training of peer researchers and research staff involved in qualitative and quantitative data collection. Through this process, the PI established working relationships with Circolo Pink staff and gained familiarity with the local context and community dynamics. The PI was present during focus group discussions in a supportive and observational role, providing methodological support to trained facilitators while not leading discussions or directing participant responses.

The research team remained attentive to how existing relationships, community trust, and researchers' professional commitments to HIV prevention could shape data generation and interpretation. To address reflexivity, interviewers followed a semi-structured guide, emphasized voluntary participation, and actively encouraged participants to express diverse perspectives, including critical or negative views of HIVST. During analysis, reflexivity was incorporated through team-based discussions in which analysts critically examined assumptions and interpretations. Discrepancies were resolved through consensus, and preliminary themes were reviewed with Circolo Pink staff to ensure cultural and contextual resonance.

Data collection procedures

Process

Data were collected by a field team comprising two trained bilingual peer researchers (African refugee men engaged in sex work) and one anthropologist affiliated with Circolo Pink. Prior to data collection, the Principal Investigator conducted a week-long intensive training at Circolo Pink's Verona office covering research ethics, confidentiality, trauma-informed interviewing, management of sensitive disclosures, and referral procedures.

In the qualitative phase, we conducted 20 semi-structured in-depth interviews (10 in Verona and 10 in Turin) and two focus group discussions (one per site, 7–8 participants per group (total $n=15$) between September and October 2023 with African refugee men engaged in sex work. The two qualitative methods served complementary but distinct purposes. The in-depth interviews were used to explore individual experiences, perceptions,

and decision-making processes related to HIV testing and HIVST, including sensitive topics such as stigma, healthcare encounters, migration-related stressors, and emotional responses to testing. Interviews lasted approximately 45–60 min, allowing participants to discuss personal experiences in a private setting. Thematic saturation was reached by the seventh and eighth interviews; additional interviews were conducted to confirm the stability of emerging patterns.

The focus group discussions were conducted to examine shared norms, collective understandings, and group-level dynamics surrounding HIV testing and HIVST within peer networks. FGDs enabled participants to reflect on common challenges, community narratives, and areas of agreement or divergence in attitudes toward HIV testing, which may not emerge in individual interviews alone. Each FGD lasted approximately 90–120 min and was facilitated by two trained peer researchers using a semi-structured guide aligned with the interview topics. All interviews and focus groups were conducted face-to-face in private community spaces at Circolo Pink and its affiliated locations, audio-recorded with participant consent, and supplemented by detailed field notes. Interviews and FGDs were conducted in English or Italian based on participant preference, with the bilingual peer researchers assisting with interpretation when needed. Participants received a modest token of appreciation (€30) for their participation in the qualitative phase.

The quantitative phase extended the qualitative findings by translating key themes, housing and food insecurity, stigma, substance use, healthcare access, HIV testing experiences, and migration-related stress, into measurable variables. The survey was programmed in REDCap and pre-tested with Circolo Pink staff. Data collection occurred between November and December 2023 and used a mixed-mode approach. Participants who were able to attend in person completed the survey with trained peer researchers using mobile devices at Circolo Pink sites. For participants who could not attend in person, peer researchers explained the study by phone, answered questions, and, upon verbal agreement, sent a secure REDCap survey link via WhatsApp for self-completion. In all cases, informed consent was obtained prior to survey initiation. A total of 150 African refugee men engaged in sex work completed the survey. Participants received a modest token of appreciation (€20) upon survey completion. Survey data were collected anonymously and stored on secure Behavioral Sexual and Global Health (BSGH) Lab servers.

Interview guide and questionnaire development

The semi-structured qualitative guides were developed specifically for this study by the BSGH Lab in collaboration with Circolo Pink to ensure contextual relevance for

African refugee men engaged in sex work in Italy. The Guides explored economic and social drivers of sex work, migration and resettlement experiences, interpersonal and institutional stigma, and access to HIV testing, care, and other sexual health services. Draft guides were pilot-tested with two participants, reviewed for cultural sensitivity, and revised collaboratively. *An English-language version of the interview and focus group guides is provided as Supplementary File 1 and 2.*

The quantitative questionnaire mirrored these domains and included items drawn from validated scales where available, supplemented with locally developed measures. Depressive symptoms were assessed using the Patient Health Questionnaire-9 (PHQ-9), a widely validated screening tool (items Q096–Q104) [59]. All other questionnaire items, including sociodemographic characteristics, healthcare access and utilization, immigration-related barriers, HIV and STI testing history, HIVST awareness and use, PrEP awareness and uptake, substance use, sex work characteristics, and intersectional stigma experiences, were developed ad hoc or adapted from prior HIV and key population research to reflect the lived experiences of African refugee men engaged in sex work in the Italian context. All variables presented in Table 1 were derived directly from corresponding questionnaire items, with multi-response items collapsed into categorical variables as specified in the table. The questionnaire was administered in English only using REDCap, a secure mobile data-collection platform. An English-language version of the quantitative questionnaire is provided as Supplementary File 3.

Sampling

Given the hidden and hard-to-reach nature of African refugee men engaged in sex work, participants for both the qualitative and quantitative components were recruited using peer-led snowball sampling, complemented by venue-based recruitment at community drop-ins and meetings hosted by Circolo Pink in Verona and its sister venue in Turin. Two trained peer researchers, who were themselves African refugee men engaged in sex work and long-standing members of Circolo Pink, initiated recruitment as “seeds” by activating trusted social and sexual networks through WhatsApp, phone calls, and in-person outreach during community sessions. Sampling for the qualitative and quantitative components was partially overlapping but not identical. Participants recruited for in-depth interviews and focus group discussions were invited, but not required, to participate in the subsequent survey. To reduce participant burden and avoid coercion, survey participation was voluntary and independent of qualitative participation. As a result, some individuals contributed data to both components, while others participated in only one phase of the study.

For the quantitative component, the survey was administered in person using mobile devices by trained peer researchers, rather than being distributed as an open online survey. Peer researchers provided brief explanations of the study purpose and assisted participants as needed to ensure comprehension. This approach was used to maximize participation among individuals with limited digital access or literacy, while maintaining anonymity. Peer researchers received a modest stipend for their recruitment and data-collection efforts.

Nature of questions

The primary outcome of this study was willingness to use HIVST. During the qualitative phase, we explored participants' HIV testing behaviors, prior testing experiences, and willingness to use HIVST. After participants viewed a short demonstration video of the OraQuick oral HIV self-test, they were asked: “*Would you be willing to use an HIV self-testing kit in the future?*” Follow-up open-ended questions probed why participants would or would not be willing to use HIVST, allowing them to describe their reasoning in their own words. These discussions elicited narratives related to privacy, convenience, stigma experiences, emotional preparedness, perceptions of test accuracy, access to testing services, and occupational considerations related to sex work. Findings from this qualitative phase were used to inform the content, wording, and structure of the quantitative survey. Specifically, recurrent themes identified in the interviews and focus group discussions, such as convenience and privacy, stigma in healthcare settings, emotional concerns about receiving results alone, skepticism toward oral testing, access to testing services, and healthcare navigation challenges were translated into measurable survey items. This process ensured that the quantitative instrument reflected participants' lived experiences and locally salient determinants of HIVST willingness rather than relying solely on externally derived measures.

In the quantitative phase, participants were first provided with a standardized description of HIVST to ensure a shared understanding of the technology: “*The oral HIV self-test is a convenient method that allows individuals to perform the test themselves using oral saliva. It eliminates the need for laboratory equipment and can be conducted at home or any preferred location. However, if the test result is positive, confirmation through additional testing at a healthcare facility is necessary for appropriate guidance and further steps.*” Willingness to use HIVST was then assessed using the question: “*Would you be willing to use an HIV self-testing kit in the future?*” (Yes/No), which was coded as a binary outcome (1 = Yes, 0 = No).

Independent variables included sociodemographic characteristics, healthcare access and testing behaviors, stigma experiences, and sex work-related factors. These

Table 1 Descriptions of measurements

Variable	Description	Coding
Primary outcomes		
WTU HIVST	Willing to use HIVST in the future	1 = Yes, 0 = No
Socio-demographic & structural factors		
Age	Participant's age	0 = 18–24, 1 = 25 +
Gender Identity	Self-identified gender	1 = Cisgender Man 2 = Transgender woman 3 = non-binary 4 = Other (specify)
Education	Highest level of education completed	1 = Primary or less 2 = Secondary or more
Marital Status	Current marital status	0 = Unmarried 1 = Married
Number of Children	Number of children	0 = No children 1 = One or more children
Religious Affiliation	Whether participant belongs to any religion	0 = No religion 1 = Belong to a religion
Rank of Religiosity	How religious the participant is	0 = Not religious 1 = Religious
Length of Stay in Italy	How long participant has been in Italy	0 = A year or less 1 = More than a year
Sexual Orientation	Participant's sexual orientation	0 = Gay 1 = Bisexual 2 = Heterosexual 3 = Other (specify)
Sex role	Sexual role preference	0 = Top 1 = Bottom 2 = Versatile (Verse)
Employment Beyond Sex Work	Any other job apart from sex work	0 = No 1 = Yes
Healthcare access & testing behavior		
Distance to Healthcare Facility (Km)	Distance in kilometers	0 = 1–5 km 1 = 6 km or more
Healthcare frequency	Frequency of accessing healthcare	0 = Never 1 = Have ever
Health Insurance status	Covered by health insurance	0 = No 1 = Yes
Immigration challenge in healthcare access	Encountered difficulties in access healthcare due to immigration status	0 = No 1 = Yes
Experienced stigma or discrimination at the hospital	Experienced stigma or discrimination at the hospital	0 = No 1 = Yes
Awareness of testing facilities	Do you know where to go for STI/HIV testing and care?	0 = No 1 = Yes
Tested for STI	Ever tested for any STI	0 = Never tested 1 = Ever tested
Tested for HIV	Ever tested for HIV	0 = Never tested 1 = Ever tested
HIV test frequency	Frequency of HIV testing	0 = Once a year or less 1 = More than once a year
HIV test result	Self-reported last HIV test result	0 = Negative 1 = Positive
Awareness of HIVST	Ever heard of HIV self-testing	0 = No 1 = Yes
Ever used HIVST	Used an HIV self-test before	0 = No 1 = Yes
Sex work-related factors		
Venue for meeting client	Where participants find clients	0 = Offline 1 = Online

Table 1 (continued)

Variable	Description	Coding
No. of client in past 2 month (Men)	Number of male clients in the past 2 months	0 = Less than 20 1 = 20 or more
No. of client in past 2 month (Women)	Number of female clients in the past 2 months	0 = Less than 10 1 = 10 or more
Vaginal sex	Engaged in vaginal sex	0 = No 1 = Yes
Condom use for vaginal sex	Consistency of condom use for vaginal sex	0 = Sometimes/Never 1 = Always
Anal sex	Engaged in anal sex	0 = No 1 = Yes
Condom use for anal sex	Consistency of condom use for anal sex	0 = Sometimes/Never 1 = Always
Lubricant use for anal sex	Consistency of lubricant use for anal sex	0 = Sometimes/Never 1 = Always
Transactional condomless sex	Engaged in unprotected transactional sex	0 = No 1 = Yes

domains were selected based on their prominence in the qualitative findings and prior empirical literature on HIV testing and HIVST among migrants, people engaged in sex work, and gay men and other men who have sex with men [45, 46, 53, 60]. Variables were operationalized using categorical or binary indicators, as detailed in Table 1. While not all qualitative nuances could be fully captured in closed-ended survey items, this approach allowed for systematic examination of key themes identified qualitatively while preserving contextual depth through integrated interpretation of both data strands.

To balance analytic feasibility with interpretability given the modest sample size, several continuous or multi-category variables were operationalized using theoretically informed categorical groupings. Age was categorized as 18–24 and ≥ 25 years to distinguish younger participants at earlier stages of sex work and migration trajectories from older participants with potentially greater cumulative exposure to healthcare systems and HIV prevention messaging. Length of stay in Italy was categorized as ≤ 1 year versus > 1 year to reflect early versus more established phases of settlement, a distinction commonly used in migrant health research. Although sensitivity analyses using continuous specifications yielded comparable results, residual loss of information due to categorization cannot be fully excluded. For venue of client solicitation, participants were asked to report their primary venue for meeting clients, which was subsequently categorized as online or offline.

Data analysis

Qualitative data were analyzed prior to quantitative analysis, consistent with the sequential exploratory mixed-methods design. All audio-recorded IDIs and FGDs, were transcribed verbatim, de-identified, and analyzed in English. Interviews conducted in Italian were translated into

English by the bilingual research assistants affiliated with Circolo Pink, with spot-checks conducted by the anthropologist to ensure accuracy. We employed an interpretive summative content analysis approach, which emphasized the identification and synthesis of salient issues and recurring ideas across participant narratives, while preserving contextual meaning rather than relying on word frequency counts [61].

Analysis proceeded through a multi-step, team-based process. First, each transcript was independently reviewed by at least two analysts, who identified key ideas, salient factors, and recurring patterns related to HIV testing experiences and willingness to use HIVST. Second, analysts compared their summaries during consensus meetings, where discrepancies were discussed and resolved through deliberation. Third, the Principal Investigator and first author reviewed all reconciled summaries and conducted a cross-synthesis, identifying higher-order themes that consistently emerged across analysts and organizing them into a structured analytic matrix. To ensure interpretive accuracy, the lead analyst revisited transcripts to extract illustrative quotations and verify that themes were grounded in participants' narratives. As an additional validation step, emergent themes were reviewed with Circolo Pink staff to confirm cultural and contextual resonance. This multi-step process emphasized triangulation, team-based validation, and transparency, thereby enhancing analytic rigor without reducing qualitative data to purely quantitative counts. The Health Belief Model was used as an interpretive framework during the later stages of analysis, mapping inductively identified themes onto relevant constructs such as perceived benefits, perceived barriers, cues to action, and self-efficacy. Qualitative findings are presented thematically in the Results section, with themes organized according to their relative salience across

interviews and focus group discussions while preserving contextual interpretation. The reporting of qualitative findings followed the Consolidated Criteria for Reporting Qualitative Research (COREQ). As indicated earlier, participation in the qualitative and quantitative components was not mutually exclusive; however, data from each component were analyzed independently.

Quantitative analyses were restricted to participants who self-reported not living with HIV or who were unaware of their HIV status ($n=115$). There were no missing data for the primary outcome, as key survey items were programmed as mandatory in REDCap. Participants who self-reported living with HIV ($n=35$) were excluded, as HIV self-testing is intended for individuals who do not already know their HIV status. Descriptive statistics were used to summarize participant characteristics, with categorical variables reported as frequencies and percentages and continuous variables summarized using means and standard deviations or medians and interquartile ranges, as appropriate. Willingness to use HIVST was dichotomized as willing versus not willing. Bivariate associations between willingness and independent variables were assessed using chi-square tests. Variables associated with willingness at $p < 0.05$ were included in multivariable logistic regression models to identify factors independently associated with willingness to use HIVST. Multicollinearity among independent variables was assessed using variance inflation factors (VIFs). All VIF values were below commonly accepted thresholds ($VIF < 5$), indicating no evidence of problematic multicollinearity. Model fit was further evaluated using the Hosmer–Lemeshow goodness-of-fit test ($\chi^2(8)=7.21$, $p=0.231$). Given adequate model fit and absence of separation, standard logistic regression was retained. Quantitative analyses were conducted using Stata version 18, and qualitative data management and analysis were supported using Dedoose version 10.

Ethical approval

Ethical approval for this study was granted by the National Ethics Committee for Clinical Trials under the Italian Ministry of Health (AOO-ISS—04/07/2023—0031228). As part of the approval process, the Principal Investigator presented the study during a dedicated session with the ethics committee and received guidance on participant protection, including procedures for obtaining informed consent and ensuring anonymity when working with vulnerable populations.

Written informed consent was obtained from all participants prior to in-depth interviews and focus group discussions. For the quantitative survey, informed consent was obtained electronically. All participants, whether completing the survey in person or remotely, reviewed an electronic information sheet embedded at the start of

the REDCap survey describing the study purpose, procedures, risks, benefits, confidentiality protections, and voluntary nature of participation. Consent was indicated by proceeding to complete the survey.

No personal identifiers were collected, and survey responses were stored anonymously. Participants were informed that they could decline or withdraw at any time without consequences and that non-participation would not affect access to services provided by the partner organization.

Results

Sociodemographic characteristics of respondents

Between September and October 2023, 35 African refugee men engaged in sex work participated in the qualitative phase of the study, comprising 20 in-depth interviews and two focus group discussions ($n=15$). Participants in the IDIs had an average age of 28 years, while those in the FGDs had an average age of 32 years. Qualitative participants were primarily from Nigeria (48.6%; $n=17$), followed by Cameroon (22.9%; $n=8$) and Côte d'Ivoire (17.1%; $n=6$). Smaller proportions were from Ghana, Benin, Kenya, and The Gambia (each 2.9%; $n=1$).

Subsequently, 150 African refugee men engaged in sex work completed the quantitative survey between November and December 2023. Some participants who took part in the qualitative phase also completed the survey, although participation in the two components was not universal. Quantitative analyses were restricted to participants who self-reported being HIV-negative or of unknown HIV status (analytic sample: $n=115$). Among this analytic sample, the mean age was 33 years ($SD=3.9$), and the mean age at which participants commenced sex work was 21 years ($SD=4.2$). The majority identified as cisgender men (96.7%), while 3.3% identified as transgender women or non-binary. More than half were single (57.3%), while 35.3% reported being married to women. Educational attainment varied, with 60.0% having completed senior high school or vocational training, 36.0% having tertiary education, and 4.0% reporting no formal education. Most participants held refugee status (92.3%), and 57.3% originated from Nigeria.

Willingness to use HIVST among African refugee men engaged in sex work

Qualitative findings on willingness to use HIVST

Across the qualitative sample, willingness to use HIVST was common. Thirteen of the 20 participants interviewed in IDIs explicitly stated that they would be willing to use HIVST in the future, and participants in both FGDs expressed broad support for HIVST, often framing it as a desirable and practical testing option. Participants highlighted several factors shaping willingness, including convenience, privacy, occupational safety, perceived

effectiveness, and a sense of empowerment over their health.

Convenience and accessibility

One of the most frequently cited reasons for willingness to use HIVST was its convenience, as it would allow participants to test at any time and in any location of their choice. Many participants emphasized that the ability to conduct an HIV test independently, without visiting a hospital or clinic, made HIVST particularly appealing. Participants in FGDs frequently highlighted the time-saving nature of HIVST and how it fit into their daily routines: *"It's fast, and you can do it anytime."* (FGD1-P04). Others contrasted this convenience with facility-based testing, noting cost trade-offs: *"It saves transportation costs, but hospital tests are free."* (FGD2-P03). Some participants also framed convenience in relation to sex work, describing HIVST as a tool that could be used immediately before sexual encounters: *"For some situations, like if you're a sex worker and a client asks for unprotected sex, you can use the test to check. It's good for business and provides privacy."* (FGD1-P03).

Many participants in IDIs echoed similar sentiments, particularly regarding the speed and simplicity of the test: *"Hmm, I think that is a good development for people who don't have time to go to the hospital, and it can be done at any time. And also, you can do it even before sex with anyone."* (IDI-P04). Others emphasized how quickly results could be obtained: *"It's very simple and it's done within less than 30 min, so the urge can wait for 30 min and you run this test and you confirm what you have to do."* (IDI-P09). For some, this immediacy generated enthusiasm and anticipation: *"I wish I could have one right now to test myself and see my results."* (IDI-P12).

Privacy and confidentiality

The ability to test privately emerged as a key facilitator of willingness for many participants. Several participants described hospital-based testing as stressful due to fear of being seen, judged, or exposed, which discouraged routine testing. HIVST, by contrast, was viewed as a discreet and stigma-free alternative. They described how testing at home increased confidence and comfort: *"I think it's easy to use and gives you confidence to run the test at home."* (FGD2-P01). Others emphasized the value of seeing results alone: *"Yes, because I will test myself and see my result again alone myself without meeting strange faces every day."* (IDI-P07). Some participants linked private testing to broader prevention benefits: *"And in our home so we can have this, and this will help to reduce the rate of HIV."* (IDI-P11).

Participants in FGDs also reflected on negative experiences with hospital visits, reinforcing the appeal of privacy: *"I like that it can be done in private; sometimes*

going to the hospital is stressful, and people might see you there." (FGD2-P02).

Occupational relevance and safety

Participants in both IDIs and FGDs recognized HIVST as a valuable tool for managing their health and ensuring safety within the context of sex work. Several emphasized the importance of frequent testing due to mobility, multiple clients, and occupational exposure. One participant described HIVST as essential for routine self-care: *"As a sex worker who travels a lot, I need the kit to be safe for myself and my clients. Every three months, I check myself to know whether to continue or take care of myself."* (FGD2-P07). Others highlighted its potential use during client interactions: *"And we can even use it to test on our clients."* (IDI-P03).

Some participants framed HIVST as a necessary tool for anyone engaged in sex work. One IDI participant stated: *"This can be owned by every sex worker that is going around... every sex worker that really wants to do sex working and is interested in a life like this traffic client, should have this sex working kit."* (IDI-P15). Similarly, an FGD participant emphasized unpredictability in client encounters: *"It's useful for those of us who meet different clients. You don't know who has what."* (FGD1-P06).

Perceived effectiveness and ease of use

After viewing the HIVST demonstration video, participants across both FGDs and IDIs expressed confidence in the test's usability. Many noted that the procedure appeared simple and manageable. Participants in FGDs commented on the straightforward nature of the test: *"From what you are saying now, it doesn't take much time and isn't complicated."* (FGD2-P01). Others appreciated the autonomy it offered: *"I like that you don't need to go to the hospital to do it. You can just do it and know your status."* (FGD1-P05).

Many IDI participants echoed this enthusiasm, describing HIVST as modern and user-friendly: *"It's very modernized... And in our home so we can have this, and this will help to reduce the rate of HIV."* (IDI-P06). Another participant expressed strong approval of the testing experience itself: *"I'm so happy about the team, the communication, the project, and the HIV test itself. It's so easy to use, and I love that."* (IDI-P18).

Empowerment and control over health

A sense of personal responsibility and empowerment was also central to willingness to use HIVST. Many participants described HIVST as a way to take control of their health and make informed decisions. Several participants framed testing as an essential act of self-care: *"It's important to know your status so you can take action."* (FGD1-P08). Others emphasized urgency

and importance: *"I really need it; it's very, very important."* (IDI-P02). Curiosity and openness to innovation also shaped willingness for many: *"I'm willing to try it. I've never seen this type of test before, and I'm curious."* (FGD2-P03). For some, access alone was enough to prompt testing: *"If I have the opportunity to test myself, I will."* (FGD1-P02).

Some Participants with diverse sexual networks underscored frequent testing as a necessity rather than a choice: *"I work with both men and women, so I can't say I don't need it."* (IDI-P10). Others expressed overall satisfaction with the concept of HIVST: *"I'm really happy about it. It's very good, and I love it."* (IDI-P19).

Quantitative findings on willingness to use HIVST

Consistent with these qualitative insights, 44.4% ($n = 51$) of survey respondents reported being willing to use an HIVST kit in the future (Table 2). The most common reasons included convenience and privacy ($n = 24$, 47.1%), avoidance of stigma and discrimination at healthcare facilities ($n = 12$, 23.5%), concern about potential HIV exposure ($n = 6$, 11.8%), and ease of use ($n = 8$, 15.7%).

Qualitative findings on barriers to HIVST

Qualitative data identified multiple and often overlapping barriers to HIVST uptake among African refugee men engaged in sex work. Many participants raised more than one concern, reflecting how emotional, social, and structural factors intersect to shape reluctance toward HIVST. Key barriers included fear of test results, concerns about test accuracy, stigma associated with possession of HIVST kits, cost, and limited knowledge about self-testing.

Fear of the test result and emotional distress

Fear of receiving an HIV-positive result emerged as one of the most frequently discussed barriers, particularly concerns about testing alone without immediate emotional or professional support. Several participants described anxiety about how they might cope with a positive result outside

a healthcare setting, often contrasting home testing with hospital-based care. Participants in FGDs emphasized the emotional support available in clinical settings and the perceived risks of testing alone: *"My concern is that in the hospital, if you test positive, they support you. At home, you might harm yourself if you're alone."* (FGD1-P07). Others expressed fear in more direct terms: *"I'm scared of the result."* (FGD2-P04). Some participants also raised concerns about extreme emotional reactions among peers: *"Some people are afraid of doing the test because if they find out they are positive, they might commit suicide."* (FGD1-P01).

Similar fears were echoed in IDIs, where participants reflected on their own emotional vulnerability. One participant explained uncertainty about coping alone: *"If I do this test alone and I see a bad result, I don't know how I will react. I might break down."* (IDI-P08). Another participant described the anxiety associated with waiting for results: *"What will come to your mind while waiting for the result?"* followed by *"I'd have doubts about whether it's positive or negative."* (FGD2-P03). For some participants, avoiding testing altogether was described as a way to avoid emotional distress: *"If I don't check, I won't have to worry about it."* (IDI-P14).

Concerns about accuracy and need for confirmation

Concerns about the reliability of oral HIVST were raised by many participants across both IDIs and FGDs. Some participants frequently compared HIVST to blood-based testing, expressing skepticism about whether oral tests could provide accurate results. A few participants in FGDs questioned the scientific basis of saliva testing: *"I see it as a good innovation, but I'm still not clear. I think I'll do more research on how it functions. We've always known that tests require blood samples, so I'm a bit confused."* (FGD1-P02). Another participant echoed this uncertainty: *"It's strange to get a result from a test with just saliva."* (FGD2-P05). Some participants emphasized uncertainty about next steps following a positive result: *"In the hospital, if you test positive, they will tell you what to do. But if I do this test at home and see a positive result, I might not know what steps to take."* (FGD1-P07).

Table 2 Willingness to Use HIVST among African refugee men engaged in sex work

Variable($n = 115$)	Frequency (n)*	Percentage (%)
Would you be willing to use an HIV self-testing kit in the future?		
Yes	51	44.4
No	64	55.6
What are the reasons you would consider using an HIV self-testing kit in the future?		
It's convenient and private	24	47.1
Worried about potential HIV exposure	6	11.8
I want to avoid stigma and discrimination at hospitals/clinics	12	23.5
It's easy to use	8	15.7
I can't easily go to the hospital	8	15.7

*All frequencies and percentages presented in Tables 2 are based on the quantitative survey sample ($n = 115$)

Several IDI participants expressed fears of false results and their emotional consequences. One participant stated: *"What if the test says I am positive and it's not true? That will destroy me emotionally."* (IDI-P05). Others emphasized the need for confirmation testing: *"I think the person should try the test again. If they still aren't clear, they can go to the hospital to check their viral load."* (FGD2-P02).

Stigma and fear of being seen with an HIVST kit

Despite the private nature of HIVST, some participants expressed concern that merely possessing a self-test kit could expose them to stigma, particularly in shared living environments. Participants described fear of assumptions and gossip if others saw the kit.

Participants in FGDs raised concerns about being questioned by family or peers: *"What if you take the test kit home and your friends or parents see it? What would you say to them?"* (FGD1-P07). Others emphasized anticipated judgment: *"Sincerely, if anyone sees it with me, they might think I have HIV."* (FGD2-P06). Participants also noted the persistence of rumors regardless of explanation: *"People will spread rumors regardless of what you tell them."* (FGD1-P05).

An IDI participant shared a similar concern rooted in community perceptions: *"If someone sees you with a self-test, they assume you must have been exposed to HIV. They won't believe you're just checking."* (IDI-P11). These fears were often linked to prior experiences of stigma and discrimination. One participant recalled family reactions in their country of origin: *"In Africa, if someone tests positive, their family avoids them. They put food at their door instead of handing it to them directly."* (FGD2-P08). Others cited breaches of confidentiality in healthcare settings as reinforcing mistrust: *"Even in hospitals, doctors sometimes shout results in crowded places. It's not professional."* (FGD1-P07).

Cost as a potential barrier

Cost was another commonly discussed barrier, particularly among participants experiencing economic insecurity. While some participants were willing to pay modest amounts, many emphasized that HIVST should be free or heavily subsidized for migrants and refugees.

Participants in FGDs framed HIV testing as a public responsibility: *"The story of HIV is public knowledge. They should make it accessible. In Africa, many people don't want to spend money on health issues."* (FGD1-P04). Others emphasized financial hardship in the Italian context: *"Here in Italy, they should make it affordable for immigrants who might not have jobs."* (FGD2 – P06). Several IDI participants directly compared HIVST costs to free hospital testing: *"It should be free. If I have to pay, I*

might just go to the hospital instead since it's free there." (IDI-P16).

Suggested price points varied among those open to paying. Some participants mentioned specific amounts: *"For me, 10 euros."* (FGD1-P01) and *"Five euros."* (FGD2-P02). Others rejected payment altogether: *"I wouldn't want to pay for it."* (FGD1-P06). One participant questioned the added value of paid HIVST relative to free facility testing: *"Yes, it saves transportation costs, but hospital tests are free. Why should I pay for this?"* (FGD2-P04).

Insufficient knowledge and misinformation

Limited knowledge about HIVST procedures and interpretation of results was also raised as a barrier. Several participants expressed concern that inadequate education could lead to misuse or confusion, particularly following a positive result.

One IDI participant emphasized the need for training: *"I think you have to train people on how to use this test. Not everyone knows what to do if the result is positive."* (IDI-P01). Participants in FGDs also highlighted the lack of outreach and support services in Italy compared to their countries of origin: *"In Africa, I belonged to an association that provided support to people with diseases. They gave out condoms and gels. But here in Italy, I haven't seen such services."* (FGD1-P04).

Some participants described broader mistrust and misinformation surrounding HIV testing. One FGD participant noted: *"Some people don't test because they believe that knowing their status will change their life in a bad way."* (FGD2-P07). An IDI participant highlighted denial and disbelief as barriers: *"There are people who don't believe HIV is real. They say, 'If I can't see it, then I don't have it.'" (IDI-P13).*

Quantitative findings on barriers to HIVST uptake

These qualitative concerns were reflected in the survey findings. The most commonly reported barriers to HIVST included difficulty obtaining self-testing kits (32.2%), concerns about test accuracy (30.0%), fear of receiving a positive result without immediate support (20.9%), and lack of knowledge about HIVST (10.4%) (Table 3). A smaller proportion of respondents (7.0%) reported preferring hospital-based HIV testing. Despite these concerns, 20.0% of participants indicated that nothing would prevent them from using an HIVST kit.

Factors associated with willingness to use HIVST **Bivariate analysis of factors associated with willingness to use HIVST among African refugee men engaged in sex work**

Table 4 presents bivariate associations between sociodemographic characteristics, healthcare access and testing behaviors, sex work-related factors, and willingness

Table 3 Barriers to HIVST uptake

Variable (n = 115)	Frequency (n)*	Percentage (%)
What might stop you from using an HIV self-testing kit?		
Nothing stops me	23	20.0
Worries about how accurate self-testing is	31	30.0
Not easily getting a self-testing kit	37	32.2
Afraid of getting a positive result without support	24	20.9
I don't know enough about self-testing	12	10.4
I Prefer testing at the hospital	8	7.0

*All frequencies and percentages presented in Tables 3 are based on the quantitative survey sample (n = 115)

to use HIVST. Willingness to use HIVST differed significantly by religious affiliation ($\chi^2(1)=8.19$, $p<0.001$). Significant associations were also observed for several healthcare-related factors, including distance to a healthcare facility ($\chi^2(1)=1.99$, $p=0.014$), healthcare utilization ($\chi^2(1)=2.60$, $p=0.018$), health insurance coverage ($\chi^2(1)=2.83$, $p<0.001$), and immigration-related challenges in accessing healthcare ($\chi^2(1)=3.88$, $p=0.049$).

Testing-related factors were significantly associated with willingness to use HIVST, including knowledge of where to access HIV/STI testing services ($\chi^2(1)=3.15$, $p<0.001$), ever testing for STIs ($\chi^2(1)=4.87$, $p<0.001$), HIV testing frequency ($\chi^2(1)=3.87$, $p=0.007$), awareness of HIVST ($\chi^2(1)=2.84$, $p<0.001$), and prior use of HIVST ($\chi^2(1)=3.93$, $p<0.001$).

Among sex work-related characteristics, willingness to use HIVST was significantly associated with the number of male clients in the past two months ($\chi^2(1)=3.67$, $p=0.001$) and engagement in transactional condomless sex ($\chi^2(1)=1.74$, $p=0.016$).

Multivariable logistic regression analysis of factors influencing willingness to use HIVST

Table 5 presents the results of unadjusted and adjusted logistic regression analyses examining factors associated with willingness to use HIV self-testing (HIVST) among African refugee men engaged in sex work in Italy.

In unadjusted analyses, willingness to use HIVST was significantly associated with religious affiliation, health insurance coverage, immigration-related challenges in healthcare access, knowledge of where to access HIV/STI testing services, prior STI testing, more frequent HIV testing, awareness of HIVST, prior use of HIVST, number of male clients in the past two months, and engagement in transactional condomless sex. Greater distance to healthcare facilities (≥ 6 km) was also associated with willingness to use HIVST in unadjusted models.

After adjustment for all variables included in the model, several factors remained independently associated with willingness to use HIVST. Participants who reported belonging to a religion had significantly higher odds of willingness to use HIVST compared with those reporting no religious affiliation (aOR=5.27, 95% CI:

3.77–15.83, $p=0.004$). Having health insurance coverage was also associated with higher odds of willingness (aOR=4.56, 95% CI: 2.78–9.92, $p=0.049$). Participants who experienced immigration-related challenges in accessing healthcare had nearly twice the odds of willingness to use HIVST compared with those who did not report such challenges (aOR=1.93, 95% CI: 1.22–4.25, $p=0.025$).

Testing-related factors remained important predictors in the adjusted model. Participants who reported testing for HIV more than once per year were more likely to express willingness to use HIVST than those who tested once per year or less (aOR=2.27, 95% CI: 1.98–5.21, $p=0.040$). Similarly, participants who were aware of HIVST had higher odds of willingness compared with those who had never heard of HIVST (aOR=3.24, 95% CI: 1.36–6.29, $p=0.030$). Prior use of HIVST was also associated with greater willingness, with users being more likely to report future willingness than non-users (aOR=2.12, 95% CI: 1.80–8.21, $p=0.030$).

Overall, the multivariable analysis shows that African refugee men engaged in sex work who are more connected to HIV testing services, more familiar with HIVST, and more integrated into healthcare systems are more likely to be willing to use HIVST. These findings suggest that willingness is shaped less by individual demographics alone and more by prior testing experience, access to care, and broader social and structural contexts.

Qualitative contextualization of multivariable findings

Qualitative narratives provided contextual insight into several factors that remained independently associated with willingness to use HIVST in the adjusted model. Participants who reported frequent HIV testing commonly described testing as a routine and proactive health practice, framing HIVST as a convenient extension of existing health-seeking behaviors rather than a novel or disruptive intervention. Similarly, prior awareness and experience with HIVST were associated with narratives emphasizing ease of use, confidence, and a sense of autonomy in testing decisions.

Table 4 Chi-square analysis of factors associated with willingness to use HIVST among African refugee men engaged in sex work

Variable	WTU to use HIVST (n = 115)		P-value
	Yes (n= 51, 44.4%)	No(n= 64, 55.6%)	
Age			0.796
Young Adult (18 -24)	8 (57.1)	6 (42.9)	
Adult (25+)	43 (42.6)	58 (57.4)	
Education			0.156
Primary or less	32 (40.0)	48 (60.0)	
Secondary or more	19 (54.3)	16 (45.7)	
Gender Identity			0.370
Cisgender Men	51 (44.7)	63 (55.3)	
Transgender women	0 (0.0)	1 (100.0)	
Marital Status			0.843
Unmarried	32 (45.1)	39 (54.9)	
Married	19 (43.2)	25 (56.8)	
Number of Children			0.251
None	27 (50.0)	27 (50.0)	
≥1 child	24 (39.3)	37 (60.7)	
Religious Affiliation			<0.001*
No religion	1 (5.0)	19 (95.0)	
Belong to a religion	50 (52.6)	45 (47.4)	
Rank of Religiosity			0.205
Not religious	4 (28.6)	10 (71.4)	
Religious	47 (46.5)	54 (53.5)	
Length of Stay in Italy			0.780
≤1 year	18 (46.2)	21 (53.8)	
>1 year	33 (43.4)	43 (56.6)	
Sexual Orientation			0.107
Gay	32 (39.5)	49 (60.5)	
Bisexual	19 (55.9)	15 (44.1)	
What role do you play during sex?			0.107
Top	32 (39.5)	49 (60.5)	
Bottom	19 (55.9)	15 (44.1)	
Any other job apart from sex work			0.650
Yes	13 (48.2)	14 (51.8)	
No	38 (43.2)	50 (56.8)	
Healthcare access & testing behavior factors			
Distance to Healthcare Facility			0.014*
1 – 5km	34 (54.8)	28 (45.1)	
≥6 km	17 (32.1)	36 (67.9)	
Healthcare frequency			0.018*
Never	7 (25.0)	21 (75.0)	
Ever	44 (50.6)	43 (49.4)	
Health Insurance status			<0.001*
Yes	35 (64.8)	19 (35.2)	
No	16 (26.2)	45 (73.8)	
Immigration challenge in healthcare access			0.049*
Yes	26 (55.3)	21 (44.7)	
No	25 (36.8)	43 (63.2)	
Hospital stigma/discrimination			0.05*
Yes	22 (56.4)	17 (43.6)	
No	29 (38.2)	47 (61.8)	
Knows where to test for HIV/STIs			<0.001*
Yes	35 (64.8)	19 (35.2)	
No	16 (26.2)	45 (73.8)	

Table 4 (continued)

Variable	WTU to use HIVST (n =115)		P-value
	Yes (n= 51, 44.4%)	No(n= 64, 55.6%)	
Tested for STIs			<0.001*
Never	8 (18.60)	35 (81.40)	
Ever	43 (59.72)	29 (40.28)	
Tested for HIV			0.201
Never	26 (51.0)	25 (49.0)	
Ever	25 (39.1)	39 (60.9)	
HIV test frequency (n=61)			0.007*
≤Once/year	12 (34.3)	23 (65.7)	
>Once/year	18 (69.2)	8 (30.8)	
Awareness of HIVST			<0.001*
Yes	32 (64.0)	18 (36.0)	
No	19 (29.2)	46 (70.8)	
Ever used HIVST (n=50)			<0.001*
Yes	25(92.6)	2(7.4)	
No	7(30.4)	16(69.6)	
Sex work related factors			
Venue for meeting clients			0.253
Offline	49 (45.8)	58 (54.2)	
Online	2 (25.0)	6 (75.0)	
No. of client in past 2month (Men)			0.001*
< 20	37 (58.7)	26 (41.3)	
20 or more	14 (26.9)	38 (73.1)	
No. of client in past 2month (Women) (n=41)			0.520
Less than 10	20 (52.6)	18 (47.4)	
10 or more	1 (33.3)	2 (66.7)	
Vaginal sex			0.270
Yes	30 (40.5)	44 (59.5)	
No	21 (51.2)	20 (48.8)	
Condom use for vaginal sex (n=74)			0.550
Sometimes/Never	22 (40.7)	32 (59.3)	
Always	10 (50.0)	10 (50.0)	
Anal sex			0.968
Yes	40 (44.4)	50 (55.6)	
No	11 (44.0)	14 (56.0)	
Condom use for anal sex			0.328
Sometimes/Never	26 (40.0)	39 (60.0)	
Always	14 (60.9)	9 (39.1)	
Lubricant use for anal sex			0.136
Yes	33 (42.9)	44 (57.1)	
No	7 (53.8)	6 (46.2)	
Transactional condomless sex			0.016*
No	20 (32.8)	41 (67.2)	
Yes	31 (57.4)	23 (42.6)	

* Statistically significant at the 5% level (p < 0.05)

Participants who reported immigration-related challenges in accessing healthcare frequently articulated preferences for testing approaches that minimized interaction with formal health systems and reduced perceived institutional scrutiny. In these accounts, HIVST was viewed as a means of maintaining privacy and control in contexts where healthcare encounters were perceived

as stressful, exclusionary, or bureaucratically complex. These narratives help explain why individuals facing structural barriers within conventional healthcare settings may find HIVST particularly acceptable.

Although religious affiliation emerged as a significant predictor of willingness to use HIVST in the quantitative analysis, religious beliefs and practices were not

Table 5 Crude and adjusted multivariable logistic regression analysis of factors influencing willingness to use HIVST

WTU HIVST	Unadjusted Model		Adjusted Model	
	cOR (95% CI)	P-value	aOR (95% CI)	P-value
Religious Affiliation				
No religion	Ref	Ref	Ref	Ref
Belong to a religion	7.11 (2.71–11.12)	0.028*	5.27 (3.77–15.83)	0.004*
Distance to Healthcare Facility (Km)				
1–5 km	Ref	Ref		
6 km or more	1.39 (1.11–4.83)	<0.01*	1.21 (0.89–6.30)	0.30
Healthcare frequency				
Never	Ref	Ref	Ref	Ref
Have ever	3.07 (1.18–7.96)	0.02*	1.08 (0.99–3.78)	0.252
Health Insurance status				
No	Ref	Ref	Ref	Ref
Yes	5.18 (2.33–11.51)	<0.01*	4.56 (2.78–9.92)	0.049*
Immigration challenge in healthcare access				
No	Ref	Ref	Ref	Ref
Yes	2.13 (1.00–4.54)	0.05*	1.93 (1.22–4.25)	0.025*
Hospital stigma or discrimination				
No	Ref	Ref	Ref	Ref
Yes	1.68 (0.89–3.20)	0.01*	1.23 (0.92–3.68)	0.08
Knows where to test for HIV/STIs				
No	Ref	Ref	Ref	Ref
Yes	5.37 (2.99–8.17)	<0.01*	4.83 (0.71–32.75)	0.106
Tested for STI				
Never tested	Ref	Ref	Ref	Ref
Ever tested	3.49 (2.53–10.97)	<0.01*	2.02 (0.65–6.36)	0.113
HIV test frequency				
Less than once a year	Ref	Ref	Ref	Ref
More than once a year	4.5 (1.85–7.95)	0.03*	2.27 (1.98–5.21)	0.04*
Awareness of HIVST				
No	Ref	Ref	Ref	Ref
Yes	4.30 (1.95–9.45)	<0.01*	3.24 (1.36–6.29)	0.03*
Ever used HIVST				
No	Ref	Ref	Ref	Ref
Yes	3.71 (2.26–9.13)	<0.01*	2.12 (1.80–8.21)	0.03*
No. of client in past 2 month (Men)				
Less than 20	Ref	Ref	Ref	Ref
20 or more	3.27 (1.24–5.92)	0.027*	1.83 (0.97–4.77)	0.06
Transactional condomless sex				
No	Ref	Ref	Ref	Ref
Yes	2.76 (1.29–5.90)	0.01*	1.44 (0.87–5.77)	0.351

cOR Crude odds ratio, aOR Adjusted odds ratio, 95% CI 95% Confidence interval

* Statistically significant at the 5% level ($p < 0.05$)

systematically explored during qualitative interviews. Nonetheless, some narratives referenced broader themes of personal responsibility, moral accountability, and the importance of knowing one's health status, which may reflect underlying value-based or social frameworks associated with religious affiliation rather than explicit doctrinal influences.

Discussion

To our knowledge, this is the first study to assess willingness to use HIVST among African refugee men engaged in sex work in Italy, a population facing heightened vulnerability to HIV [7, 8]. Using a mixed-methods approach, we identified a complex interaction of individual perceptions, healthcare access constraints, and broader structural conditions shaping attitudes toward HIVST. Guided by the Health Belief Model (HBM), we examined how perceived benefits, barriers, cues to

action, and self-efficacy influenced willingness to self-test [55]. Overall willingness was moderate and with convenience, privacy, and stigma avoidance being the most highlighted reasons for willingness, while concerns about test accuracy, emotional readiness, and access to kits emerged as key barriers. Healthcare access, religious affiliation, prior HIV/STI testing behaviors, and sex work-related characteristics also shaped willingness.

Our study found that 44.4% of participants were willing to use HIV self-testing, indicating a moderate level of acceptance alongside notable hesitation among the majority. This level of willingness is consistent with findings from some prior studies [62], remains lower than estimates reported among key populations in the United States (68%) [63], Thailand (99.3%) [64], Peru (95%) [65], Cambodia (100%) [66], Benin (100%) [67], Nigeria [68], and Botswana [46]. Nevertheless, this finding demonstrates that a substantial proportion of African refugee men engaged in sex work in Italy may be receptive to HIV self-testing as an alternative HIV testing modality. The moderate willingness to HIVST in our study may, in part, be explained by the low levels of awareness and limited education about HIVST among our target population. Previous studies have shown that settings, where educational campaigns have been implemented, show much higher willingness to use HIVST because users are more familiar with its procedures and potential advantages (e.g., confidentiality and convenience) [69].

Constructs of the Health Belief Model such as perceived benefits (e.g., convenience and privacy), perceived barriers (e.g., fear of results, concerns about accuracy, and access constraints), cues to action (e.g., prior HIV/STI testing and awareness of HIVST), and self-efficacy (confidence in testing independently) were consistently reflected in both the quantitative and qualitative findings, while perceived severity and perceived susceptibility were less prominently articulated as explicit motivators for willingness to use HIVST. This supports the relevance of the HBM for understanding proximal decision-making around HIVST willingness.

From the perceived benefits perspective, HIVST was seen as an opportunity to test in a manner that is both discreet and private, thus avoiding the stigma and unwanted scrutiny often associated with conventional, facility-based HIV testing [51, 52, 55]. Our quantitative data indicated that nearly half of those willing to use HIVST cited convenience and privacy as their primary motivation. Perceived susceptibility to HIV infection itself was less frequently articulated as an explicit assessment of biomedical risk, but emerged implicitly through occupational safety considerations related to sex work, including concerns about frequent client turnover and uncertainty around clients' HIV status [51, 52, 55]. In other settings, similar motivations have been reported;

participants often choose self-testing because it allows them to manage their health on their own terms, without the perceived barriers of judgment or exposure at health facilities [42, 46, 70].

In this study, HIV testing behaviors strongly influenced willingness to use HIVST. Participants who had tested for HIV more than once annually were more likely to express willingness to use HIVST, as were those already aware of HIVST or with prior experience using it. These findings reflect the HBM's concept of "cues to action," where previous behaviors and exposure reduce uncertainty and foster positive attitudes toward health innovations [51, 52, 55]. Similar associations have been reported in South-east Asia and sub-Saharan Africa, where HIVST awareness and prior use were among the strongest predictors of future uptake [53, 54, 71]. This suggests that expanding awareness and providing opportunities to try HIVST may increase demand, especially among those with testing experience.

Several perceived barriers significantly discouraged willingness to use HIVST among participants. More than half of respondents expressed unwillingness to self-test, citing concerns related to test accuracy, emotional preparedness for a positive result, and limited access to kits. These findings align with prior studies that identify psychological and logistical barriers as major deterrents to HIVST uptake [60]. Skepticism toward saliva-based tests mirrors findings from other settings where blood-based testing is viewed as more reliable [72, 73]. Fear of emotional distress, particularly the anxiety of dealing with a positive result alone, was another central barrier. This highlights low self-efficacy, a key HBM element, where individuals doubt their capacity to cope with testing outcomes without immediate psychosocial support [51, 52, 55]. Similar concerns have been documented in studies with other key populations, where the absence of pre- and post-test counseling diminished confidence in managing HIV test results [68]. This highlights the importance of integrating HIVST with supportive services, such as hotlines or linkage-to-care platforms.

Structural barriers also played a critical role. Participants who reported immigration-related challenges in accessing healthcare were more likely to express willingness to use HIVST, suggesting that HIVST may be perceived as a practical alternative for individuals who experience exclusion or discomfort within formal health systems. This aligns with literature showing that migrants and key populations who face stigma, discrimination, or fears related to legal status may prefer self-directed testing approaches that reduce institutional interaction [27]. Similarly, participants with health insurance coverage were more likely to express willingness to use HIV self-testing, indicating greater engagement with and confidence in the healthcare system. This pattern is consistent

with studies showing that health insurance coverage is associated with improved health-seeking behaviors, greater trust in health services, and increased uptake of preventive health innovations [74].

Religious affiliation emerged as the strongest predictor of willingness to use HIVST in the adjusted model. This association likely reflects the broader social and psychosocial roles of religion in migrant contexts, where faith-based communities can provide social support, moral framing, and coping resources amid displacement and stigma [75, 76]. While religious environments are not uniformly supportive of sexual minority health, affiliation may enhance self-efficacy and openness to preventive behaviors through mechanisms consistent with the HBM's cues to action and perceived benefits [75, 76]. However, religious beliefs were not systematically explored in qualitative interviews, and this finding should be interpreted cautiously as indicative of broader social context rather than doctrinal endorsement of HIV testing.

Cost also emerged as an important consideration. Although some participants were willing to pay modest amounts for HIVST kits, many emphasized the need for free or heavily subsidized access, particularly given economic vulnerability among migrants and refugees. Similar cost sensitivity has been documented across multiple settings, where willingness to use HIVST declines sharply when users are required to pay [53, 71]. These findings underscore the importance of affordability in HIVST implementation strategies, especially in contexts where free facility-based testing is already available.

Our findings highlight limitations of the HBM in settings characterized by strong structural constraints. While the model effectively captured individual-level perceptions and motivations, immigration status, healthcare exclusion, and stigma exerted influence indirectly by shaping perceived barriers, benefits, and self-efficacy rather than functioning as independent determinants. Moreover, perceived severity and susceptibility were less prominent motivators than pragmatic considerations related to privacy, autonomy, and healthcare access. Together, these findings suggest that the HBM may incompletely account for HIV self-testing decision-making in this context and underscore the value of integrating structural and social perspectives when examining HIV prevention behaviors among marginalized populations.

Perhaps one of the most critical implications of our findings is the persistent gap in HIV testing engagement among African refugee men engaged in sex work, despite moderate willingness to use HIVST. Notably, 44% of participants included in the quantitative analysis reported never having tested for HIV, underscoring the extent to which structural, social, and psychological barriers continue to impede initial engagement with HIV testing

services. This finding highlights the need for education and support structures that address the barriers identified in this study, particularly challenges related to facility-based testing and concerns about testing alone. While participants did not explicitly articulate a preference for community-based delivery models, the barriers reported, such as fear of stigma in formal healthcare settings, limited access to trusted information, and anxiety about coping with test results without support, suggest gaps that could be effectively addressed through community-based education and support services. Evidence from other settings indicates that community-based approaches (CBAs) can provide culturally appropriate education, build trust, and deliver HIV prevention services in ways that resonate with marginalized populations [69, 77–79]. In contexts where migrants and sex workers often experience exclusion from mainstream healthcare, CBAs, particularly those involving peer educators and trusted organizations, may help mitigate identified barriers by supporting first-time testers, offering HIVST education, optional psychosocial support, and facilitated linkage to care [69, 77–79]. As such, strengthening partnerships with migrant-led and community-based organizations represents a key programmatic strategy, informed by the study findings and broader literature, to support effective and equitable HIVST implementation among African refugee men engaged in sex work in Italy.

Limitations

Our study has several limitations that should be considered when interpreting the findings. First, recruitment through *Circolo Pink* and peer-led snowball sampling may have introduced selection bias, as participants connected to community organizations or social networks may differ systematically from more isolated African refugee men engaged in sex work, particularly with respect to healthcare access, HIV knowledge, and testing behaviors. As a result, the findings may overestimate engagement with HIV services relative to those who are less connected to support structures. Second, the quantitative component was based on a relatively small analytic sample ($n = 115$), which limited statistical power and constrained the complexity of multivariable modeling. To reduce model overfitting, several variables were categorized rather than modeled as continuous measures (e.g., age and length of stay in Italy). Although sensitivity analyses treating these variables as continuous yielded substantively similar results, residual loss of information and reduced precision cannot be ruled out. Relatedly, some adjusted estimates were accompanied by wide confidence intervals, reflecting limited sample size and variability within subgroups. Third, all quantitative measures relied on self-reported data, including HIV testing history, HIVST awareness, and willingness to self-test.

These responses may be subject to recall bias or social desirability bias, particularly given the sensitive nature of HIV, sex work, and migration status. While confidentiality was emphasized and data collection occurred in trusted community settings, misclassification remains possible. In addition, willingness to use HIVST reflects stated intention rather than actual uptake and may not translate directly into future behavior.

Fourth, although the mixed-methods sequential exploratory design allowed qualitative findings to inform survey development and interpretation, the qualitative component did not systematically probe all variables that emerged as significant in the multivariable analysis, most notably religious affiliation. As such, qualitative data could contextualize some, but not all, quantitative associations, limiting deeper interpretation of certain predictors. Fifth, participation in the qualitative and quantitative components was not mutually exclusive, but analyses were conducted independently for each component. Due to privacy protections and the absence of identifiable linkage variables, we were unable to examine within-person convergence or divergence across qualitative and quantitative responses, nor could we assess changes over time. The cross-sectional design further limits causal inference and precludes assessment of temporal relationships between healthcare access, prior testing behaviors, and willingness to use HIVST. Finally, the study was conducted in two cities in northern Italy (Verona and Turin), where healthcare infrastructure, community organization presence, and migration dynamics may differ from other regions. Findings may therefore not be fully generalizable to African refugee men engaged in sex work living in southern Italy or in settings with more restrictive healthcare access or weaker community-based support.

Despite these limitations, this study represents one of the first empirical examinations of HIVST willingness among African refugee men engaged in sex work in Italy. By integrating quantitative associations with in-depth qualitative narratives, we provide critical, contextually grounded insights to inform future research, policy, and HIV prevention programming for this underserved population.

Conclusion

This study shows that willingness to use HIVST among African refugee men engaged in sex work in Italy is shaped by a combination of individual perceptions, healthcare access, and structural conditions. Convenience, privacy, and stigma avoidance facilitated interest in HIVST, while concerns about test accuracy, emotional distress when testing alone, limited access to kits, and migration-related barriers constrained willingness. Importantly, a substantial proportion of participants

had never tested for HIV, highlighting persistent gaps in access to existing testing services. Healthcare access, prior HIV testing experiences, religious affiliation, and awareness and prior use of HIVST were independently associated with greater willingness to self-test. Interpreted through the Health Belief Model, these findings suggest that willingness to use HIVST is driven less by perceived biomedical risk and more by practical considerations related to stigma, autonomy, and navigation of healthcare systems. Overall, the findings underscore the need for targeted, community-based HIV testing strategies that address both individual concerns and structural barriers. Peer-led education, psychosocial support for self-testing, and free or subsidized HIVST distribution, particularly through trusted migrant- and sex worker-led organizations, may help increase testing uptake and reduce the proportion of African refugee men engaged in sex work who remain untested in Italy.

Abbreviations

AIDS	Acquired Immunodeficiency Syndrome
HBM	Health Belief Model
HIV	Human Immunodeficiency Virus
HIVST	HIV Self-Testing
IDI	In-Depth Interview
FGD	Focus Group Discussion
PLHIV	People Living with HIV
REDCap	Research Electronic Data Capture
STI	Sexually Transmitted Infection
WHO	World Health Organization

Supplementary Information

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Supplementary Material 1.

Supplementary Material 2.

Supplementary Material 3.

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Disclosures

The authors report no real or perceived vested interests related to this article that could be construed as a conflict of interest.

Authors' contributions

G.R. Abu-Ba'are conceptualized and designed the study and secured funding. E. Gyamerah led data collection and transcription. O.W. Shamrock, H.D. Dakpui, M. Sena, and C. Guure contributed to data analysis. H.D. Dakpui, G.R. Abu-Ba'are, and LaRon Nelson drafted the manuscript. All authors reviewed, revised, and approved the final version of the manuscript.

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Data availability

The datasets generated and/or analyzed during the current study are not publicly available due to confidentiality and privacy considerations related to the sensitive nature of the data and the vulnerability of the study population. De-identified data may be made available from the corresponding author (at henrydelali5@gmail.com) upon reasonable request.

Declarations

Ethics approval and consent to participate

This study received ethical approval from the National Ethics Committee for Clinical Trials under the Italian Ministry of Health (AOO-ISS – 04/07/2023–0031228). The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Written informed consent was obtained from all participants in the in-depth interviews and focus group discussions. For the survey component, informed consent was obtained electronically or orally prior to participation, depending on the mode of survey administration. All participants were informed that participation was voluntary and that they could withdraw at any time without consequence.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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References

- UNAIDS. New HIV infections data among key populations: proportions in 2010 and 2022. Geneva: 2024. Available from: https://www.unaids.org/sites/default/files/media_asset/new-hiv-infections-data-among-key-populations-proportions_en.pdf. Cited 2025 Jun 11.
- Ekerin O, Shomuyiwa DO, Lucero-Prisno DE, Agboola OO, Damilola AS, Onoja SO, et al. Restrictive migration policies and their impact on HIV prevention, care and treatment services. *Health Res Policy Syst*. 2024;22(1):91. <https://doi.org/10.1186/s12961-024-01172-0>.
- Ndumbi P, del Romero J, Pulido F, Velasco Arribas M, Dronda F, Blanco Ramos JR, et al. Barriers to health care services for migrants living with HIV in Spain. *Eur J Public Health*. 2018;28(1):451–7. <https://doi.org/10.1093/eurpub/ckx225>.
- BabelRA, Wang P, Alessi EJ, Raymond HF, Wei C. Stigma, HIV risk, and access to HIV prevention and treatment services among men who have sex with men (MSM) in the United States: a scoping review. *AIDS Behav*. 2021;1–31. <https://doi.org/10.1007/s10461-021-03262-4>.
- Schweitzer AM, Dišković A, Krongauz V, Newman J, Tomažič J, Yancheva N. Addressing HIV stigma in healthcare, community, and legislative settings in Central and Eastern Europe. *AIDS Res Ther*. 2023;20(1):87. <https://doi.org/10.1186/s12981-023-00585-1>.
- Pattillo M, Stieglitz S, Angoumis K, Gottlieb N. Racism against racialized migrants in healthcare in Europe: a scoping review. *Int J Equity Health*. 2023;22(1):201. <https://doi.org/10.1186/s12939-023-02014-1>.
- Hessou PHS, Glele-Ahanhanzo Y, Adekpedjou R, Ahouada C, Johnson RC, Boko M, et al. Comparison of the prevalence rates of HIV infection between men who have sex with men (MSM) and men in the general population in sub-Saharan Africa: a systematic review and meta-analysis. *BMC Public Health*. 2019;19:1–10.
- Lewis NM, Wilson K. HIV risk behaviours among immigrant and ethnic minority gay and bisexual men in North America and Europe: a systematic review. *Soc Sci Med*. 2017;179:115–28. Available from: <https://www.sciencedirect.com/science/article/pii/S0277953617301314>.
- Brandenberger J, Tylleskär T, Sontag K, Peterhans B, Ritz N. A systematic literature review of reported challenges in health care delivery to migrants and refugees in high-income countries-the 3C model. *BMC Public Health*. 2019;19:1–11.
- Nakakawa A, Lizette C. K, Sarah E. S, Simon E, Kalle R, Daniel B, et al. Access to HIV prevention, testing and care among people with a migration background in Euregio Meuse-Rhine: a needs and assets assessment. *AIDS Care*. 2025;37(3):480–503. Available from: <https://doi.org/10.1080/09540121.2024.2446697>.
- GalanisP, Spyros K, Siskou O, Konstantakopoulou O, Angelopoulos G, Kaitelidou D. Healthcare services access, use, and barriers among migrants in Europe: a systematic review. *medRxiv*. 2022;2022. <https://doi.org/10.1101/2022.02.24.22271449>.
- Mona H, Andersson LMC, Hjern A, Ascher H. Barriers to accessing health care among undocumented migrants in Sweden - a principal component analysis. *BMC Health Serv Res*. 2021;21(1):830. <https://doi.org/10.1186/s12913-021-06837-y>.
- Puthooppambal SJ, Phelan M, MacFarlane A. Migrant health and language barriers: uncovering macro level influences on the implementation of trained interpreters in healthcare settings. *Health Policy (New York)*. 2021;125(8):1085–91. Available from: <https://www.sciencedirect.com/science/article/pii/S0168851021001457>.
- Benoit C, Jansson S, Smith M, Flagg J. Prostitution Stigma and Its Effect on the Working Conditions, Personal Lives, and Health of Sex Workers. *J Sex Res*. 2017;17(55):1–15.
- Chanda Michael M, Perez-Brumer Amaya G, Ortblad Katrina F, Mwale Magdalene, Chongo Steven, Kamungoma Nyambe, et al. Barriers and facilitators to HIV testing among Zambian female sex workers in three transit hubs. *AIDS Patient Care STDS*. 2017;31(7):290–6. Available from: <https://journals.sagepub.com/action/showAbstract>.
- KayeK. Male sex work in modern times. *Male Sex Work Soc*. 2014;34–49. <https://doi.org/10.17312/harringtonparkpress/2014.09.msww.002>.
- Giomi B, Silvestri C, Bravi S, Stasi C, Bertini L, Mechi L, et al. Sexual behavior and awareness of sexually transmitted diseases among street-based female sex workers in the florence area. *Central Italy Int J Dermatol Venereol*. 2022;5(04):226–30.
- Platt L, Jolley E, Rhodes T, Hope V, Latypov A, Reynolds L, et al. Factors mediating HIV risk among female sex workers in Europe: a systematic review and ecological analysis. *BMJ Open*. 2013;3(7):e002836.
- Trani F, Altomare C, Nobile CGA, Angelillo IF. Female sex street workers and sexually transmitted infections: Their knowledge and behaviour in Italy. *J Infect*. 2006;52(4):269–75. Available from: <https://www.sciencedirect.com/science/article/pii/S0163445305001751>.
- Segala FV, Novara R, Panico G, Laforgia R, Raho L, Schiavone M, et al. Prevalence of sexually transmitted infections and predictors for loss to follow up among marginalized homeless and migrant communities: a cross-sectional study. *Ann Glob Health*. 2024;90(1):25.
- Galli M, Borderi M, Viale P. HIV policy in Italy and recommendations across the HIV care continuum. *Infez Med*. 2020;28(1):17–28.
- EuropeanCentre for Disease Prevention and Control. HIV testing in Europe and Central Asia. Monitoring implementation of the Dublin Declaration on partnership to fight HIV/AIDS in Europe and Central Asia. Stockholm: 2023. <https://www.ecdc.europa.eu/en/publications-data/hiv-testing-europe-and-central-asia>.
- Scognamiglio P, Chiaradia G, Giovanetti M, Albertini E, Camposeragna A, Fari-nella M, et al. HIV rapid testing in community and outreach sites: results of a nationwide demonstration project in Italy. *BMC Public Health*. 2018;18(1):748. <https://doi.org/10.1186/s12889-018-5680-6>.
- Galli C, Regine V, Caraglia A, Centrone F, Chironna M, Cruschelli G, et al. Outpatient testing for HIV in Italy, 2018–2023—preliminary data. *Microorgan-isms*. 2025;13(3):655.
- Alvarez-del Arco D, Monge S, Caro-Murillo AM, Ramírez-Rubio O, Azcoaga-Lorenzo A, Belza MJ, et al. HIV testing policies for migrants and ethnic minorities in EU/EFTA member states. *Eur J Public Health*. 2014;24(1):139–44.
- Lagi F, Gatteschi C, Tilli M, Zocco N, Avarello A, Bellini S, et al. Facilitators and barriers in HIV testing and continuum of care among migrant transgender

- women who are sex workers residing in Florence, Italy. *Int J Transgender Health*. 2023;25(2):268–82.
27. Fakoya I, Álvarez-del Arco D, Copas AJ, Teixeira B, Block K, Gennotte AF, et al. Factors associated with access to HIV testing and primary care among migrants living in Europe: cross-sectional survey. *JMIR Public Health Surveill*. 2017;3(4):e7741.
28. Mirandola M, Gios L, Joanna Davis R, Furegato M, Breveglieri M, Folch C, et al. Socio-demographic factors predicting HIV test seeking behaviour among MSM in 6 EU cities. *Eur J Public Health*. 2017;27(2):313–8. Available from: <https://doi.org/10.1093/eurpub/ckw144>.
29. Deblonde J, De Koker P, Hamers FF, Fontaine J, Luchters S, Temmerman M. Barriers to HIV testing in Europe: a systematic review. *Eur J Public Health*. 2010;20(4):422–32.
30. den Daas C, Doppen M, Schmidt AJ, Op de Coul E. Determinants of never having tested for HIV among MSM in the Netherlands. *BMJ Open*. 2016;6(1):e009480. Available from: <http://bmjopen.bmj.com/content/6/1/e009480.abstract>.
31. Scott J, Grov C, Minichiello V. *The Routledge handbook of male sex work, culture, and society*. London: Routledge; 2021.
32. Sanders T, Platt L, Grenfell P, Sherman S, Mwangi P, Cargo AL. Associations between sex work laws and sex workers' health: a systematic review and meta-analysis of quantitative and qualitative studies. 2018.
33. Rodriguez-Rincon D, Hocking L, Parks S, Amato-Gauci AJ, Semenza JC. Barriers for the MSM population to access testing for HIV in France, Poland, the UK and across Europe: a qualitative study. *J HIV/AIDS Infect Dis*. 2020;6:1–27.
34. Baral S, Sifakis F, Peryskina A, Mogilnii V, Masenior NF, Sergeyev B, et al. Risks for HIV infection among gay, bisexual, and other men who have sex with men in Moscow and St. Petersburg, Russia. *AIDS Res Hum Retroviruses*. 2012;28(8):874–9.
35. Dakpui HD, Shamrock OW, Aidoo-Frimpong G, Zigah EY, Kofi Agbemedu GR, Ahmed A, et al. A qualitative description of HIV testing and healthcare experiences among trans women in Ghanaian urban slums BSGH-012. *PLoS Glob Public Health*. 2024;4(12):e0003980.
36. Gallego N, Diaz A, Folch C, Meyer S, Vazquez M, Casabona J, et al. Factors associated with low levels of HIV testing among young men who have sex with men (MSM) participating in EMIS-2017 in Spain. *Sex Transm Infect*. 2022;98(7):518–24.
37. Dada D, Abu-Ba'are GR, Turner D, Mashoud IW, Owusu-Dampare F, Apreku A, et al. Scoping review of HIV-related intersectional stigma among sexual and gender minorities in sub-Saharan Africa. *BMJ Open*. 2024;14(2):e078794. Available from: <http://bmjopen.bmj.com/content/14/2/e078794.abstract>.
38. WorldHealth Organization. WHO recommends HIV self-testing - evidence update and considerations for success. World Health Organization; 2019. <http://www.who.int/publications/i/item/WHO-CDS-HIV-19-36>.
39. Jamil MS, Prestage G, Fairley CK, Grulich AE, Smith KS, Chen M, et al. Effect of availability of HIV self-testing on HIV testing frequency in gay and bisexual men at high risk of infection (FORTH): a waiting-list randomised controlled trial. *Lancet HIV*. 2017;4(6):e241–50.
40. Jamil MS, Guy RJ, Bavinton BR, Fairley CK, Grulich AE, Holt M, et al. HIV testing self-efficacy is associated with higher HIV testing frequency and perceived likelihood to self-test among gay and bisexual men. *Sex Health*. 2017;14(2):170–8.
41. Wang Z, Lau JTF, Ip M, Ho SPY, Mo PKH, Latkin C, et al. A randomized controlled trial evaluating efficacy of promoting a home-based HIV self-testing with online counseling on increasing HIV testing among men who have sex with men. *AIDS Behav*. 2018;22:190–201.
42. Figueroa C, Johnson C, Ford N, Sands A, Dalal S, Meurant R, et al. Reliability of HIV rapid diagnostic tests for self-testing compared with testing by health-care workers: a systematic review and meta-analysis. *Lancet HIV*. 2018;5(6):e277–90.
43. Pittalis S, Orchi N, De Carli G, Navarra A, Chiaradia G, Puro V, et al. HIV self-testing in Italy. *J Acquired Immune Defic Syndr*. 2017;76:e84 Lippincott Williams and Wilkins.
44. Lippman SA, Lane T, Rabede O, Gilmore H, Chen YH, Mlotshwa N, et al. High acceptability and increased HIV-testing frequency after introduction of HIV self-testing and network distribution among South African MSM. *JAIDS J Acquir Immune Defic Syndr*. 2018;77(3):279–87.
45. Dirisu O, Sekoni A, Vu L, Adebajo S, Njab J, Shoyemi E, et al. 'I will welcome this one 101%, I will so embrace it': a qualitative exploration of the feasibility and acceptability of HIV self-testing among men who have sex with men (MSM) in Lagos, Nigeria. *Health Educ Res*. 2020;35(6):524–37. <https://doi.org/10.1093/her/cyaa028>.
46. Shava E, Manyake K, Mdluli C, Maribe K, Monnapula N, Nkomo B, et al. Acceptability of oral HIV self-testing among female sex workers in Gaborone, Botswana. *PLoS One*. 2020;15(7):e0236052. <https://doi.org/10.1371/journal.pone.0236052>.
47. Stutterheim SE, van Dijk M, Wang H, Jonas KJ. The worldwide burden of HIV in transgender individuals: an updated systematic review and meta-analysis. *PLoS One*. 2021;16(12):e0260063.
48. Brugnoli A, Matteini M. Italy as a gateway to Europe for African migration: how to deal with the Doll's House effect? *Reg Sci Policy Pract*. 2018;10(4):253–69.
49. Jones CL, Jensen JD, Scherr CL, Brown NR, Christy K, Weaver J. The health belief model as an explanatory framework in communication research: exploring parallel, serial, and moderated mediation. *Health Commun*. 2015;30(6):566–76.
50. GreenEC, Murphy EM, Gryboski K. Health belief model. *Wiley Encyclopedia Health Psychol*. 2020;211–4. <https://doi.org/10.1002/9781119057840.ch68>.
51. Alizade M, Farshbaf-Khalili A, Malakouti J, Mirghafourvand M. Predictors of preventive behaviors of AIDS/HIV based on Health Belief Model constructs in women with high-risk sexual behaviors: a cross-sectional survey. *J Educ Health Promot*. 2021;10(1):446.
52. Appau R, Aboagye RG, Nyahe M, Khuzwayo N, Tarkang EE. Predictive ability of the health belief model in HIV testing and counselling uptake among youth aged 15–24 in La-Nkwantanang-Madina Municipality, Ghana. *BMC Public Health*. 2024;24(1):1825. <https://doi.org/10.1186/s12889-024-19362-4>.
53. Figueroa C, Johnson C, Verster A, Baggeley R. Attitudes and acceptability on HIV self-testing among key populations: a literature review. *AIDS Behav*. 2015;19(11):1949–65.
54. Myint WW, Washburn DJ, Colwell B, Maddock JE. Determinants of HIV testing uptake among women (aged 15–49 years) in the Philippines, Myanmar, and Cambodia. *Int J Maternal Child Health AIDS (IJMA)*. 2021;10(2):221.
55. Seif SJ, Oguma ED, Joho AA. Using health belief model to assess the determinants of HIV/AIDS prevention behavior among university students in Central, Tanzania: a cross-sectional study. *PLoS Glob Public Health*. 2025;5(2):e0004305. <https://doi.org/10.1371/journal.pgph.0004305>.
56. CreswellJW, Clark VLP. *Designing and conducting mixed methods research*. Sage publications; 2017. https://books.google.com.gh/books/about/Designing_and_Conducting_Mixed_Methods_R.html?id=eTwmDwAAQBAJ&redir_esc=y.
57. Fetters MD, Curry LA, Creswell JW. Achieving integration in mixed methods designs—principles and practices. *Health Serv Res*. 2013;48(6pt2):2134–56.
59. Fonseca-Pedrero E, Díez-Gómez A, Pérez-Albéniz A, Al-Halabi S, Lucas-Molina B, Debbané M. Youth screening depression: validation of the Patient Health Questionnaire-9 (PHQ-9) in a representative sample of adolescents. *Psychiatry Res*. 2023;328:115486.
60. Njau B, Covin C, Lisasi E, Damian D, Mushi D, Boule A, et al. A systematic review of qualitative evidence on factors enabling and deterring uptake of HIV self-testing in Africa. *BMC Public Health*. 2019;19(1):1289. <https://doi.org/10.1186/s12889-019-7685-1>.
61. Hsieh HF, Shannon SE. Three approaches to qualitative content analysis. *Qual Health Res*. 2005;15(9):1277–88.
62. Shrestha R, Galka JM, Azwa I, Lim SH, Guadamuz TE, Altice FL, et al. Willingness to use HIV self-testing and associated factors among transgender women in Malaysia. *Transgender Health*. 2020;5(3):182–90.
63. Lippman SA, Moran L, Sevelius J, Castillo LS, Ventura A, Treves-Kagan S, et al. Acceptability and feasibility of HIV self-testing among transgender women in San Francisco: a mixed methods pilot study. *AIDS Behav*. 2016;20:928–38.
64. Girault P, Misa Wong C, Jitttang S, Fongkaew K, Cassell MM, Lertpiriyasuwat C, et al. Uptake of oral fluid-based HIV self-testing among men who have sex with men and transgender women in Thailand. *PLoS One*. 2021;16(8):e0256094.
65. Bustamante MJ, Konda KA, Joseph Davey D, León SR, Calvo GM, Salvatierra J, et al. HIV self-testing in Peru: questionable availability, high acceptability but potential low linkage to care among men who have sex with men and transgender women. *Int J STD AIDS*. 2017;28(2):133–7.
66. Pal K, Ngin C, Tuot S, Chhoun P, Ly C, Chhim S, et al. Acceptability study on HIV self-testing among transgender women, men who have sex with men, and female entertainment workers in Cambodia: a qualitative analysis. *PLoS One*. 2016;11(11):e0166129.
67. Boisvert Moreau M, Kintin FD, Atchekpe S, Batona G, Béhanzin L, Guédou FA, et al. HIV self-testing implementation, distribution and use among female sex workers in Cotonou, Benin: a qualitative evaluation of acceptability and

- feasibility. *BMC Public Health*. 2022;22(1):589. <https://doi.org/10.1186/s12889-022-12917-3>.
68. Tun W, Vu L, Dirisu O, Sekoni A, Shoyemi E, Njab J, et al. Uptake of HIV self-testing and linkage to treatment among men who have sex with men (MSM) in Nigeria: A pilot programme using key opinion leaders to reach MSM. *J Int AIDS Soc*. 2018;21 Suppl 5(Suppl Suppl 5):e25124.
69. Laxmeshwar C, Hegde A, Dange A, Mariyappan K, Soosai M, Mane S, et al. Acceptability, usability, and willingness to pay for HIV self-test kits distributed through community-based, PLHIV network-led and private practitioners models in India: results from the STAR III initiative. *J Int AIDS Soc*. 2024;27(8):e26348. <https://doi.org/10.1002/jia2.26348>.
70. Morshed Hemel MM, Reza MM, Mohammad Pritom GS, Sarwar G, Morshed Khan MN, Khan S, et al. Full title- acceptability and feasibility of HIV self-testing (HIVST) among MSM and transgender women (hijra) in Bangladesh: A mixed-method study. *Heliyon*. 2024;10(10):e31477. Available from: <https://www.sciencedirect.com/science/article/pii/S240584402407508X>.
71. Zeleke EA, Stephens JH, Gesesew HA, Gello BM, Ziersch A. Acceptability and use of HIV self-testing among young people in sub-Saharan Africa: a mixed methods systematic review. *BMC Prim Care*. 2024;25(1):369. <https://doi.org/10.1186/s12875-024-02612-0>.
72. Njau B, Ostermann J, Brown D, Mühlbacher A, Reddy E, Thielman N. HIV testing preferences in Tanzania: a qualitative exploration of the importance of confidentiality, accessibility, and quality of service. *BMC Public Health*. 2014;14:1–9.
73. Steehler K, Siegler AJ. Bringing HIV self-testing to scale in the United States: a review of challenges, potential solutions, and future opportunities. *J Clin Microbiol*. 2019;57(11):10–1128.
74. Al-HanawiMK, Mwale ML, Kamninga TM. The effects of health insurance on health-seeking behaviour: evidence from the Kingdom of Saudi Arabia. *Risk Manag Healthc Policy*. 2020;595-607. <https://doi.org/10.2147/rmhp.s257381>.
75. EppsteinerHS, Hagan J. Religion as psychological, spiritual, and social support in the migration undertaking. In: *Intersections of religion and migration: Issues at the global crossroads*. Springer; 2016. pp. 49-70. https://doi.org/10.1057/978-1-137-58629-2_2.
76. Hirschman C. The Role of Religion in the Origins and Adaptation of Immigrant Groups in the United States. *Int Migr Rev*. 2004;1(38):1206–33.
77. Abu-Ba'areGR, Torpey K, Guure C, Nelson LE, Jeon S, McMahon J, et al. Status-neutral community-based multilevel intervention to address intersectional stigma and discrimination, and increase HIV testing, PrEP, and ART uptake among YGBMSM in Ghanaian Slums: A clustered randomized control trial protocol. *Res Sq*. 2024;rs-3. <https://doi.org/10.21203/rs.3.rs-4486078/v1>.
78. Stein R, Shapatava E, Williams W, Griffin T, Bell K, Lyons B, et al. Reduced sexual risk behaviors among young men of color who have sex with men: findings from the community-based organization behavioral outcomes of many men, many voices (CBOP-3MV) project. *Prev Sci*. 2015;16:1147–58.
79. Abubakari GMR, Turner DA, Ni Z, Conserve DF, Dada D, Otchere A, et al. Community-based interventions as opportunities to increase HIV self-testing and linkage to care among men who have sex with men – lessons from Ghana. *West Africa Front Public Health*. 2021;11:9.

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