PROJECT REPORT

Knowledge, Attitude and Practices concerning mpox among high-risk groups in the Eastern Mediterranean Region (EMR)

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Contents

Abbreviations

Mpox: Monkeypox

PHEIC: Public Health Emergency of International Concern

MSM: Men Who Have Sex with Men

WHO: World Health Organization

NGO: Non-governmental Organization

CDC: Centers for Disease Control and Prevention

IQR: Interquartile range

STI: Sexually Transmitted Infections

HIV: Human Immunodeficiency Virus

Executive summary

Human monkeypox (mpox), a viral zoonotic infectious disease, was declared a public health emergency in July 2022. Men who have sex with men (MSM) are at higher risk of Mpox infection. Limited studies have been conducted in the Eastern Mediterranean Region (EMR) to assess knowledge, attitudes and practices towards mpox; importantly, where none of these studies were among MSM. The aim of this study is to assess the knowledge, attitudes, perceptions/practices concerning mpox among the MSM population in the EMR region. This is a cross-sectional study of MSM residing in the region. Participants were recruited through non-governmental organizations (NGOs), dating applications, and LGBTQ+ websites between July and October 2023. The outcome mpox knowledge (> score of 12 vs ≤12) was investigated. A total of 643 MSM participants of median age 31 (IQR: 26-37) participated in the study. Around 47.7% attended university/college, and 55.8% were employed. Among study participants, 131 (20.4%) had adequate mpox knowledge. The knowledge scores of study participants ranged from 0 to 16 indicating that none of the participants answered all 17 mpox knowledge questions correctly with a median knowledge score of 9 (IQR: 5-12). Most of the participants were knowledgeable about mpox symptoms (66.7%), mode of transmission (64.5%), and the importance of isolation to stop viral spread (61.6%). The key predictors of higher mpox knowledge score detected in our study were older age, being in a relationship, and knowing someone who had/has mpox. Living in a country with higher number of reported mpox cases and having a history of STI or viral hepatitis encouraged safer sex practices and willingness to get the mpox vaccine. Almost 49.2% of participants residing in countries with reported mpox cases did not know where to get tested for mpox compared to 62% of those residing in countries with no reported mpox cases. Vaccination programs and campaigns for MSM should increase in number, and prioritized for high-risk vulnerable groups. Integration of mpox into existing HIV and STI prevention programs is important specifically for vulnerable groups to ensure equitable access to care.

Background

On 23 July 2022, the World Health Organization (WHO) declared mpox as a public health emergency of international concern (PHEIC) [1, 2]. Mpox virus, a double stranded DNA virus, was first identified in humans in 1970 in the Democratic Republic of the Congo (DRC); since then, it has been reported in 26 countries worldwide [2, 3]. In 2022, mpox cases emerged in non-endemic countries including the United Kingdom (UK), Australia, Belgium, Canada, France, Germany, Italy, Netherlands, Portugal, Spain, Sweden, United States of America (USA), United Arab Emirates (UAE), Qatar, Lebanon and Morocco; after which the WHO declared a global outbreak of mpox that was mainly caused by the clade IIb strain, formerly known as the West African clade [2, 4-7]. In May 2023, the WHO declared the end of the PHEIC for mpox following constant decline in the global number of cases despite its continuous global spread [8]. In August 2024, the WHO redeclared mpox as a PHEIC due to the re-emergence of a mpoxclade Ib, in the DRC as well as its spread to neighboring countries [9]. As of March 10, 2025, 129,172 laboratory-confirmed cases and 283 deaths have been reported to WHO from 130 countries; 0.7% of those cases were reported in the Eastern Mediterranean region (EMR) [10]. Importantly, as of March 10, 2025, 85.5% of global mpox cases were reported among men who have sex with men (MSM) and around 52% were detected among people living with HIV [11]. An analysis of a subset of reported mpox cases in EMR shpwed that 60% were among MSM and 10% among people living with HIV [12]. The global hospitalization rate of mpox is 6% and the case-fatality rate can reach up to 10%, with a higher risk of death observed in children, young adults, elderly, and immunocompromised patients [7, 13-15].

Knowledge, attitudes and practices of at-risk populations are integral for the early diagnosis, prevention, and timely management of mpox. Despite the importance of these components, there is lack of comprehensive studies globally. Studies from the United States reported low and insufficient mpox knowledge levels among the general population and HCWs, respectively, with vaccination perceived as the only measure to prevent viral spread [16, 17]. Low mpox knowledge scores were also reported among Italian adults and HCWs from Italy, China and the Czech Republic with knowledge being negatively associated with older age, working or studying in a non-healthcare setting, and not being in a relationship [18-21]. Moreover, a moderate knowledge score was reported among university students in Bangladesh and Pakistan with knowledge, attitudes and perceptions towards mpox being associated with age, gender, school year, and area of residence of study participants [22, 23]. Importantly, few studies reported on knowledge, attitudes and perception towards mpox among MSM worldwide, the population group most affected by mpox during global outbreak. Inconsistent findings were reported among MSM whereby high knowledge scores were reported in the United Kingdom (UK), Australia and Brazil compared to low mpox knowledge scores in China, Italy, Taiwanand Nepal [24-30].

Limited studies have been conducted in the EMR to assess knowledge, attitudes and practices towards mpox. These studies were mainly conducted among the general population, HCWs and university students; importantly, none of these studies were specifically among the at-risk MSM population. A multicountry cross-sectional study recently conducted among medical students and clinicians reported a low knowledge towards mpox [31]. However, a medium knowledge score was reported among university students in the UAE [32]. Knowledge gaps about the clinical presentation of mpox and vaccination among Saudi HCWs were also recently reported [33, 34] in addition to high prevalence of conspiracy beliefs reported among university students, HCWs and the general population in Lebanon, Jordan and Kuwait [35-41].

To our knowledge, there are no studies assessing knowledge, attitudes and practices towards mpox among MSM in the EMR. The aim of this study is to identify gaps in the knowledge, attitudes, perceptions and behaviors of MSM concerning mpox in the EMR region. Identifying those gaps is crucial to spread awareness and implement public health interventions to reduce viral transmission among MSM.

Methods

Study Design, Study Population and Ethical Approval

This study was a cross-sectional survey of high-risk groups of mpox. MSM, ≥18 years old and residing in countries of EMR, were included in the study. MSM were identified based on the CDC definition (i.e., persons who are biologically male who engage in sexual relations with other men.Furthermore, it included transgender men and women on the basis of whether men are defined by sex at birth (i.e., transgender women included) or current gender identity (i.e., transgender men included)). The EMR countries were Afghanistan, Bahrain, Djibouti, Egypt, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Pakistan, Occupied Palestinian Territories, Qatar, Saudi Arabia, Somalia, Sudan, Tunisia, United Arab Emirates, and Yemen. Data were self reported by study participants. Data collection was conducted between July 5th 2023 and October 11th 2023. The study was approved by the Institutional Rreview Board (IRB) at the American University of Beirut (AUB) (reference SBS-2022-0347) and cleared by the WHO ethical board.

Sampling Design

The target population was invited to participate through two modalities. The first was through engagement with 12 non-governmental organizations (NGOs) from 7 EMR countries offering health services and providing counselling to MSM in their respective countries (Table S1). Engagement with NGOs included an introductory email followed by an online meeting to present the objectives of the study and discuss the possibility of disseminating survey tools among their beneficiaries. Once a preliminary approval for engagement was granted, documents were shared by email including the online survey, the dissemination announcement, the links and QR code to the survey, as well as a list of questions to be answered by each focal point following up on data collection. Participation was voluntary and consent was taken online. The survey was self-administered. Depending on existing forms of communication with their beneficiaries and on the literacy level of potential respondents, different NGOs resorted to different methods to disseminate the survey including sharing the links on WhatsApp groups, Facebook pages, Instagram accounts, sending SMS to beneficiaries, sending emails, printing posters and flyers with QR code to make available in waiting rooms at the healthcare centers providing services to MSM. A list of the NGOs is presented in supplementary material (Table S1). The Center for Public Health Practice (CPHP) conducted thorough monitoring and follow up with focal points in each country to measure progress made on data collection, identification of challenges, and estimating the number of beneficiaries reached from each country.

The second modality was through advertisements on social media dating applications and website platforms used by the MSM community. A list of these platforms and websites are provided in supplementary material (Table S2). A marketing company advertised the self-aministered survey on gay dating applications and LGBTQ+ (lesbian, gay, bisexual, transgender, queer or questioning persons) websites. Advertisements in the form of infographics were displayed for five weeks (September 7- October 16 2023) using GPS to advertise locations within countries of the EMR.

Survey Tools

The survey was built using LimeSurvey. Survey questions were adapted and developed based on previously published literature on knowledge, attitudes and perception towards mpox as well as other infectious diseases [34, 42-46]. The survey included questions based on the Integrated Behavioral Model (IBM) (to assess attitude, perception and behavioral intentions) and the Precaution Adoption Process Model (PAPM) (to assess readiness to get vaccinated) [42, 47, 48]. Context specific questions that covered the domains of knowledge, practice, beliefs and attitudes were tailored to fit countries of the EMR context. The survey was divided into four sections. The first section included 11 questions and assessed the sociodemographic characteristics of study participants. The second section included 17 questions and was used to assess the respondents' knowledge on mpox transmission, isolation, symptoms, prevention and vaccination. The third section of the survey assessed the attitudes towards mpox and risk perceptions among study participants in a total of 9 questions. The current behavior and practices toward prevention, detection, healthcare seeking behavior and management of mpox among study participants were assessed in section four of the survey (n=13 questions). The Survey was available in English, Arabic, and French.

Statistical Analysis

Data was cleaned and scrutinized for outliers and implausible values; normality was checked for continuous variables using histograms. A descriptive analysis was performed including presenting frequencies, percentages, median and interquartile ranges (IQR). The section on knowledge of mpox consisted of 17 questions. The knowledge items were scored as follows: zero if the answer was incorrect or "I don't know" and one if the answer was correct. The maximum score a participant could get for knowledge was 17. A higher knowledge score indicated more knowledge on mpox. Median value mpox knowledge score was presented per categories of socio-demographic and clinical characteristics, behavioral factors, risk perceptions and healthcare services of study participants.

Inferential statistics were applied to carry-out bivariate analysis. The latter was used to assess the associations between the following characteristics: behaviors after learning about mpox, mpox risk perceptions, access to healthcare, socio-demographics, risky behaviors, clinical characteristics and the following outcomes: reported mpox cases in participants' country of residence, and participants' STI or viral hepatitis status. Mann-Whitney U and Kruskal-Wallis tests were used to examine differences between the following characteristics: behaviors after learning about mpox, mpox perceptions, access to healthcare, socio-demographics, risky behavior, clinical characteristics, and mpox knowledge score.

Adaptive LASSO was used to predict participants' knowledge about mpox. The outcome mpox knowledge was binary, defined as highest 25^{th} percentile of mpox knowledge score vs other percentiles (score of >12 vs ≤12). Candidate predictors present in the literature and in the study questionnaire were incorporated for model development. Candidate predictors included were: age (18 to 30, 31 to 40, 41 to 50, more than 50), gender identity (male, female, other, prefer not to say), marital status (single, relationship, married, prefer not to say), employment status (student, unemployed, employed, retired, other, prefer not to say), education level (never, primary, middle and high school, technical, college, postgraduate, prefer not to say), residence area (rural, urban), current smokers (no, yes, prefer not to say), alcohol use within past 12 months (no, yes, prefer not to say), recreational drug use within past 12 months (no, yes, prefer not to say), think mpox vaccine is safe (no, yes, do not know), know someone infected with mpox (no, yes, prefer not to say), willing to get mpox vaccine (no, yes, unsure),willing to pay for mpox vaccine (no, yes, do not know), HIV history (no, yes, do not

know), Syphilis history (no, yes, do not know), COVID-19 vaccine uptake (no, yes, prefer not to say), Influenza vaccine uptake (no, yes, do not know), and source of healthcare information (TV, conversation with family and friends, social media, school or university, healthcare professional, NGO). Statistical analysis was performed using STATA v.18. A $p<0.05$ was considered statistical significance (Appendix 1).

Results

A total of 643 participants completed the survey and were included in the study. All participants were MSM as per the definition provided for eligibility to participate in this study. Participants who were not MSM were excluded from the analysis.

Demographic characteristics, Risky Behaviors and Status of STIs and Viral Hepatitis (of HIV Status and other STIs) Among Study Participants

Participants resided in 15 out of the 22 EMR countries with the country accounting for the highest proportion of participants being Morocco (30.9%). The median age of study participants (n=643) was 31 (IQR: 26-37). Almost all study participants identified their biological sex as males (98.8%) while around 0.9% were of female biological sex who are considered MSM since they identified themselves as gender fluid or transgender and had sex with at least one man in the past year. Moreover, 0.3% of the study participants included those who preferred not to mention their biological sex but belonged to the MSM community since they identified themselves as males and had sex with at least one man in the past year. Almost half of the study participants had a university or college degree (47.7%), and were employed (55.8%). More than half of the study participants were current smokers (51%) and consumed alcohol within the past 12 months (54.7%) (Table 1).

The majority had not been tested before for mpox (92.7%) with 38% being HIV-positive. The following STIs were reported among study participants: 23% previously infected with Gonorrhea, 19.8% with Syphilis, and 16% with Hepatitis B virus (HBV) among others. Results also showed that 22.6% and 18% of the participants had a history of 2 and 4 or more STIs/viral hepatitis, respectively (Table 1).

Knowledge in Relation to Socio-Demographics and Clinical Characteristics

The knowledge scores of study participants ranged from 0 to 16 indicating that none of the participants answered all 17 mpox knowledge questions correctly with a median knowledge score of 9 (IQR: 5-12). Most of the participants were knowledgeable about mpox symptoms (66.7%), mode of transmission (64.5%), and the importance of isolation to stop viral spread (61.6%) (Table 2).

The relationship between the socio-demographics, clinical characteristics, and risky behaviors of the study participants and their knowledge about mpox was also assessed (Table 3). Results showed a statistically significant difference between knowledge scores and country of residence, gender identity, risky behaviors, and educational level. Those of higher educational level showed a higher knowledge score. When looking at gender identity, those who were transgender/transsexual had a higher knowledge score compared to the remaining groups. Furthermore, non-smokers showed a higher knowledge score compared to smokers.

A significant difference was detected in relation to mpox knowledge and mpox testing history, history of STI or HBV among study participants. Those who previously tested for mpox had a higher knowledge score compared to those who did not. Furthermore, those who were infected with one STI or HBV had a higher mpox knowledge score compared to those who were infected with 2 or more STIs or HBV. However, there was no difference in mpox knowledge between HIV-positive and HIV-negative participants.

Knowledge in Relation to Risky Behaviors

The relationship between the participants' behaviors and their knowledge about mpox was assessed. Results showed that higher mpox knowledge scores were associated with lower-risk sexual activities including lower number of sexual partners and less engagement in sex parties and group sex, more likelihood of informing their partners in case of positive contact or positive results, and increasing condom use (Table 4). Moreover, participants who abstained from sexual activity in case of confirmed or suspected mpox infection had a higher knowledge mpox score compared to those who did not.

Knowledge in Relation to Perceptions and Practices

The relationship between mpox knowledge, perceptions and practices of study participants was assessed. Results showed a significant difference between participants' perceptions and practices while assessing their knowledge of mpox (Table 5). Participants who agreed that they "are susceptible to mpox" and that "mpox is lethal and dangerous yet easily preventable and controllable" had a higher knowledge score compared to those who disagree on these statements.

Knowledge in Relation to Access to Healthcare

Mpox knowledge and access to healthcare services and fear from getting tested for mpox was assessed among the study participants (Table 6). Participants who did not know where to receive the mpox vaccine had lower mpox knowledge compared to those who knew. Moreover, participants who had a fear of getting tested for mpox due to legal issues, cost of test, or stigma and discrimination had a lower knowledge score compared to those who didn't.

Mpox Knowledge Predictors

A prediction model was developed and validated to predict participants' knowledge about mpox. Out of 643 study participants, 131 (20.4%) had adequate mpox knowledge (score >12). Participants who were 31-50 years of age, in a relationship, employed, and think mpox vaccine is safe have statistically significant higher odds of adequate knowledge about mpox. Participants who preferred to withhold information about their recreational drug use within the past 12 months and those who did not declare their syphilis status had significantly higher odds of adequate knowledge OR 2.47 (95%CI: 1.34-4.55) and 3.57 (95%CI: 2.27-5.61), respectively. Moreover, participants who knew someone with mpox had 6.43 (95%CI: 4.20-9.85) times the odds of having adequate mpox knowledge than those who did not. Participants relying on friends/family and TV had twice the odds of adequate mpox knowledge than those who did not (Table 7).

Mpox Knowledge, Practices and Behaviors, Perceptions, Access to Healthcare Services and Stigma by Country of Residence

The relationship between mpox infection status by country of residence and mpox knowledge, practices and behaviors of study participants were assessed. Accordingly, study respondents were grouped according to their country of residence. Countries of the EMR were divided into two categories based on the WHO multi-country report published in October 2023; (1) countries with reported cases of mpox; (2) countries with no reported cases of mpox (Table S3). Results showed statistically significant differences between the two groups in relation to their knowledge about mpox and the number of sex partners, group sex and casual sex behavior, wearing of clothing during sex, frequenting sex venues, and ability to abstain from sexual activity in case of infection or positive contact. Participants from countries with reported mpox cases had higher knowledge score compared to those with no mpox cases; median (IQR): 10 (6-12) vs. 5 (0-9), p-value<0.001, respectively. Furthermore, 43.9% of participants from countries with mpox reported cases have decreased their number of sex partners compared to 22.5% of participants from countries without mpox cases.

Our results also showed a statistically significant difference between participants who resided in countries with reported cases and those who resided in countries with no reported mpox cases in relation to perception and practices. Almost half of those residing in countries with reported mpox cases perceived the virus as *"dangerous yet easily preventable and controlled",* considered themselves *"susceptible to mpox",* and agreed that *"mpox vaccine is safe"* compared to around 30% of those residing in countries with no reported cases. When assessing access to healthcare services among the 2 groups, most participants, regardless of their country of residence, were willing to get the mpox vaccine if available. However, 49.2% of participants residing in countries with reported mpox cases did not know where to get tested for mpox compared to 62% of those residing in countries with no reported mpox cases (Table 8).

Socio-Demographics, Risky Behaviorss, mpox Knowledge, Practices, Perceptions and Healthcare Access According to Participants' History of STIs and Viral Hepatitis (of HIV Status and other STIs)

The relationship between socio-demographics, risky behavior and clinical characteristics of participants was also assessed in relation to their STI and viral hepatitis status. Study participants were grouped into 2 groups: 1) those with any STI or viral hepatitis history and 2) those without any STI or viral hepatitis history. The latter was defined based on the participants' self-reporting to the history of STI and viral hepatitis question while targeting previous HIV, Hepatitis B, Hepatitis C, Syphilis, Chlamydia, and Gonorrhoea infections.

Results showed that risky behaviors characteristics were significantly different among participants with or without STI or viral hepatitis history. Around 54.3% of participants who had previous STI or viral hepatitis were current smokers with 59.1% and 30% consuming alcohol and using recreational drugs within the past 12 months, respectively. However, there was no significant difference among participants with or without any STI or viral hepatitis history in relation to age, biological sex at birth, gender identity, education level and COVID-19 vaccination history.

Mpox knowledge and practices were also assessed among the two groups. Participants with previous STI or viral hepatitis had significantly higher mpox knowledge score compared to those without. Moreover, most of the practices and behaviors of participants were significantly different between the two groups. The majority of those with STI or viral hepatitis history (70%) expressed their ability to abstain from sexual activity if tested positive or were in contact with mpox positive cases compared to 50% of those without any STI or viral hepatitis history. Moreover, more than half of those with STI or viral hepatitis history were willing to share details of their last sexual encounter for medical tracing compared to 27.1% of those without any STI or viral hepatitis history.

Results also showed a statistically significant difference between those with previous STI or viral hepatitis and those without in relation to participants' perceptions towards susceptibility to mpox along with their thoughts about the disease as preventable and controlled or being an attempt to reduce population size. Those with previous STI or viral hepatitis were more likely to consider themselves *"susceptible to mpox"*, the *"vaccine as safe and the mpox disease as lethal and dangerous yet controllable and preventable"*. They were also less likely to think that the *"virus is lab-made"* and that the *"media propagate unnecessary fear about the virus"*. Regardless of history of STIs or viral hepatitis infections, most participants were willing to get the mpox vaccine while not knowing where to get tested for mpox (Table 9).

Discussion

This is the first study to explore the knowledge, attitudes and behaviours of MSM in the EMR. Older age, being in a relationship, being employed, and having at least middle and highschool education were associated with higher knowledge scores. Moreover, higher knowledge scores correlated with perceiving mpox vaccine to be safe, knowing someone infected with mpox, engaging in low-risk sexual behavior and not believing in mpox conspiracies. The key predictors of higher knowledge scores were older age, being in a relationship and knowing someone who had/has mpox. Living in a country with higher number of reported mpox cases was also associated with higher knowledge scores, the former along with having a history of STI or viral hepatitis encouraged safer sex practices and willingness to get the mpox vaccine.

Data showed that 20% of the study participants had high mpox knowledge score; the latter is lower than the overall prevalence of good mpox knowledge worldwide (33%) [49]. These results were in agreement with previous data reporting low knowledge scores among MSM in Italy, China, Taiwan and Nepal [25, 27-29]. However, these findings contradict previous studies reporting high mpox knowledge scores among MSM in Australia, UK, and Brazil [24, 26, 30]. In the EMR, mpox knowledge was mainly assessed among the general population, university students and healthcare professionals and resulted in inconsistent findings [15, 31-35, 38, 39, 41, 50-53]. Good mpox knowledge was reported among university students in the UAE and the general population in the Kingdom of Saudi Arabia (KSA) [32, 33], while moderate mpox knowledge was reported among the general population in Iraq [35]. Poor mpox knowledge was reported among medical students in KSA and healthcare professionals in Lebanon [36, 51].

The findings of this study also showed a correlation between educational levels, age, being in relationship, and having a history of STI with high mpox knowledge. The latter are in agreement with data reported among MSM in China and Taiwan [27, 29]. Patients with STIs, especially those with HIV infection, might have access to information related to transmission, symptoms and prevention of various STIs, including mpox [27]. Older age and education were also associated with higher mpox knowledge among medical students in KSA [36]. Higher knowledge scores among MSM of older age and having at least middle or high school education might be linked to their ability to acquire health literacy through information access or attendance of educational programs on disease transmission and prevention [57]. Factors associated with mpox knowledge among the general Iraqi population included age, gender, marital status, and level of education [35]. MSM who are 33 years and above were more likely to have more mpox knowledge than younger ages. This result was in agreement with data reported among university students in the UAE and among MSM in China [27, 32]. Addressing the knowledge gaps among young age groups through enhanced awareness is important to prevent and control the spread of mpox.

Results also reported employment as a predictor of high mpox knowledge score. This is similar to data reported in KSA whereby being employed and residing in countries with recent mpox cases were key predictors of higher knowledge [34, 54]. This might be due to the ability of employed people to gain access to different healthcare services and thus better information. Our results are also in agreement with data reported in KSA [33]and China [54] whereby knowledge of someone with mpox was associated with higher mpox knowledge. Participants who know someone with mpox or reside in countries with reported mpox cases might have higher awareness of the risks associated with disease pathogenicity and modes of transmission [27, 55]. Moreover, knowing someone infected with mpox could predict higher mpox knowledge, potentially through

increased health-seeking behaviours and health awareness [27, 56]. Additionally, participants from countries with mpox cases had higher awareness of risks associated with infectious diseases, and this may be due to mpox community awareness and promotion campaigns of healthy practices, and reduced stigma towards mpox testing [54, 57].

Predictors of higher knowledge included knowing someone who had/has mpox, which was consistent with a systematic review on healthcare professionals, where staff exposed to mpox cases had highest mpox knowledge levels compared to other professionals [58]. Participants who were in contact with mpox-infected people may learn and focus their attention on mpox related information and preventive behaviors. Being in a relationship was also associated with higher mpox knowledge. This evidence is in contrast to a previous study that reported the association between good mpox knowledge and being single among male sex workers (MSW) [59]. Furthermore, the study participants who had a previous STI including HIV tended to have safer sexual practices (decreased number of sex partners, casual sex and going to sex venues) after learning about mpox and hence, had a higher mpox knowledge score than those who did not. This was consistent with previous studies reporting higher mpox knowledge scores among MSM who had previous HIV infection compared to others. In addition, this may also be the result of increased health-seeking behaviors and health awareness [27, 60].

Perceiving mpox vaccine to be safe and knowing someone infected with mpox were also predictors of higher mpox knowledge; this was also in accordance with previous studies whereby participants who are in contact with positive mpox cases may become aware of symptoms, mode of transmission, pathogenicity and prevention of the infection [33, 54]. Stigma and access to healthcare were important barriers to adequate mpox knowledge [61]. Stigma could have limited MSM from seeking healthcare providers for information and participation in prevention programs [62, 63]. Moreover, MSM could have feared meeting acquaintances at healthcare centers, feared disclosing clinical information such as mpox and HIV status, and lacked trust in the confidentiality of healthcare providers about the former [59].

Residing in a country where there was a higher prevalence of mpox appeared to encourage safer sexual activities and willingness to undergo mpox vaccination. A similar association was shown among those who had a history of a STI or viral hepatitis, where those who had these infections consideredthemselves susceptible to mpox. This agrees with previous studies where participants in countries with mpox infection and those with STI or viral hepatitis history are aware of the mode of transmission of MPXV and believe they are at increased risk of infection [64-66]. Moreover, a global meta-analysis of LGBTQ+ participants including MSM indicated that participants who know someone infected with mpox or had received a recent STI diagnosis were more likely to indulge in safer sexual activities and accept mpox vaccination [67].

Nearly half of the participants who perceived the mpox vaccine as safe did not know where to get the vaccine in their respective EMR country. This result was consistent with the results of an online survey on 1,856 MSM in the Netherlands where 81.5% were willing to accept vaccination but recommended accessible communication and anonymous vaccine self-registration [68]. Similar results were reported among studies conducted within the MSM community in the WHO European Region and the US, within the healthcare workers in Vietnam, GBQ in Australia, and within students in China [69-72]. In the EMR, perceptions towards mpox were studied among the general population, medical students, and healthcare workers [73-78]. Studies whose

participants perceive mpox vaccine is safe learned about mpox through awareness campaigns, MSM social media channels, and information spread on social media campaigns [76, 79, 80].

Study Limitations

The study had several limitations. This study used a convenience sampling approach; it recruited some participants who were affiliated with an NGO and thus, may have had access to awareness and educational materials. In addition, participants were also recruited through dating applications and LGBTQ+ websites, which may limit generalizability of the results among MSM. Self-reporting, misclassification and recall bias may have impacted the response to the survey. Finally, participants may have exhibited social desirability bias, tailoring their answers to align with social norms or expectations rather than expressing their genuine opinions. However, participants completed this survey online through a device, which may limit the impact of this bias.

Recommendations

This study illustrated knowledge gaps about mpox among MSM in the EMR. These findings highlight the need for trusted sources of information to facilitate clear non-stigmatized communication. It also emphasizes the need to target MSM community members with social media campaigns or flyers as a form of risk communication when there are future infectious diseases [50, 66, 81]. The study also amplifies the importance of providing healthcare services in a friendly non-stigmatizing manner where MSM feel safe and comfortable requesting and sharing information [82].

Vaccination campaigns and programs and for MSM should be promoted in the region. Efforts should be made with the help of HCWs and other stakeholders to improve vaccine distribution channels, and enhance vaccine education and easy access specifically for MSM, a high risk group for mpox [82].

Integration of mpox into existing HIV and STI prevention programs is important specifically for vulnerable groups to ensure equitable access to care. This is important to align the role of NGOs providing services to high-risk groups with other national healthcare providers including but not limited to awareness campaigns addressing misconceptions as well as knowledge gaps about mpox. This supports efforts to reduce stigma [50]. Another approach to reduce stigma includes working with the community through local media outlets to feature key messages aiming to normalize seeking health information and care among the MSM community [82]. Such media outlets could range from interviews with community members who have read and comprehended and implemented mpox preventive measures, to discussions with healthcare professionals promoting empathy and understanding the needs of MSM.

Conclusion

This study is the first to investigate the knowledge, attitudes, and behaviors of MSM in the EMR addressing a significant gap in existing research. It offers valuable insights to guide public health strategies in the region. The findings of this study highlight the need for implementing inclusive health education campaigns, targeted prevention efforts, and improved access to healthcare services for MSM communities. Furthermore, these results have significant implications for multisectoral decision making including prioritizing research on mpox in the EMR for the development of a comprehensive plan for mpox prevention and control. This study will aid

in guiding future public health interventions and policies to mitigate the impact of emerging infectious diseases on vulnerable populations in the EMR.

Author Contributions

SJM, NMM, and JH conceptualized the study and oversaw all aspects of the study. SJM, NMM, MN, and JH designed the survey, contributed to the study methodology and oversaw the data collection. MN led the community engagement components with NGOs. HS and MBH implemented the project administration. The formal analysis and literature search were conducted by HS and MBH. SJM, NMM, HS, and MBH drafted the manuscript. JD, JH, MSJ, ASA, and MN reviewed the manuscript. SJM and NMM critically reviewed and finalized the manuscript. All authors approved the final version.

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Tables

Table 1. Demographic, clinical and risky behavior characteritics among study participants

	n	(%)
Total Participants	643	(100)
SOCIO-DEMOGRAPHICS		
Age		
18 to 30	308	(47.9)
31 to 40	240	(37.3)
41 to 50	82	(12.7)
More than 50	13	(2.1)
Country of residence		
Morocco	199	(30.9)
Egypt	169	(26.3)
Lebanon	97	(15.1)
Tunisia	62	(9.6)
United Arab Emirates	37	(5.8)
Pakistan	20	(3.1)
Kingdom of Saudi Arabia	18	(2.8)
Jordan	15	(2.3)
Other EMR countries**	23	(3.8)
Prefer not to say	3	(0.5)
Sex at birth		
Male	635	(98.8)
Female	6	(0.9)
Prefer not to say	2	(0.3)
Gender identity		
Male	472	(73.4)
Trans (transgender)	95	(14.8)
Gender fluid	36	(5.6)
Female	12	(1.9)
Other	5	(0.8)
Prefer not to say	23	(3.6)
Marital status		
Single, widowed or divorced	392	(61.0)
In a relationship	104	(16.2)
Married to a woman	50	(7.8)
Married to a man	11	(1.7)
Co-habiting	7	(1.1)
Prefer not to answer	86	(13.4)
Education level		
Never attended school	5	(0.8)
Primary school	24	(3.7)

Middle school	37	(5.8)
High school	98	(15.2)
Technical vocational school	47	(7.3)
University/college	307	(47.7)
Postgraduate	117	(18.2)
Prefer not to say	8	(1.2)
Employment status		
Student	99	(15.4)
Employed	359	(55.8)
Unemployed	122	(19.0)
Retired	5	(0.8)
Other	25	(3.9)
Prefer not to say	33	(5.1)
MPOX TESTING HISTORY		
Ever had a test for mpox		
No	596	(92.7)
Yes	13	(2.0)
Prefer not to say	34	(5.3)
VACCINATION		
COVID-19 vaccine history		
No	65	(10.1)
Yes	559	(86.9)
Prefer not to say	19	(3.0)
Influenza vaccine history		
No	337	(52.4)
Yes	180	(28.0)
I don't remember	93	(14.5)
Prefer not to say	33	(5.1)
STI and VIRAL HEPATITIS HISTORY		
STI testing history		
No	74	(11.5)
Yes	504	(78.4)
I don't know	20	(3.1)
Prefer not to say	45	(7.0)
HIV status		
Negative	313	(48.7)
Positive	244	(37.9)
I don't know	19	(3.0)
Prefer not to say	67	(10.4)
Hepatitis B status		
Negative	431	(67.0)
Positive	103	(16.0)
I don't know	36	(5.6)
Prefer not to say	73	(11.4)

History of Hepatitis C		
Negative	440	(68.4)
Positive	93	(14.5)
I don't know	35	(5.4)
Prefer not to say	75	(11.7)
History of Syphilis		
Negative	398	(61.9)
Positive	127	(19.8)
I don't know	39	(6.1)
Prefer not to say	79	(12.3)
History of Chlamydia		
Negative	437	(68.0)
Positive	72	(11.2)
I don't know	56	(8.7)
Prefer not to say	78	(12.1)
History of Gonorrhoea		
Negative	365	(56.8)
Positive	148	(23.0)
I don't know	46	(7.2)
Prefer not to say	84	(13.1)
Total history of STIs and viral hepatitis		
No STI or viral hepatitis	107	(16.6)
1 STI or viral hepatitis	207	(32.2)
2 STIs or viral hepatitis	145	(22.6)
3 STIs or viral hepatitis	68	(10.6)
4 or more STIs or viral hepatitis	116	(18.0)
Risky Behaviors		
Current smokers		
No	299	(46.5)
Yes	327	(50.9)
Prefer not to say	17	(2.6)
Alcohol use within the past 12 months		
No	277	(43.1)
Yes	352	(54.7)
Prefer not to say	14	(2.2)
Recreational drug use within the past 12 months		
No	428	(66.6)
Yes	165	(25.7)
Prefer not to say	50	(7.8)

**Other EMR countries: Countries with 10 or less participants; Bahrain, Iran, Iraq, Kuwait, Qatar, Sudan, Yemen

Table 2. Mpox-related knowledge among study participants

	Answer	n	(%)
Mpox circulates in monkeys and humans	***True***	385	(59.9)
	False		
Mpox causes mild flu like symptoms	***True***	360	(56.0)
	False		
Mpox is deadly in most cases	True		
	False	184	(28.6)
Mpox may cause diarrhoea	***True***	288	(44.8)
	False		
Mpox may cause severe systematic complications	***True***	357	(55.5)
	False		
Most common symptom for mpox are fever, rash, swollen lymph nodes, muscle aches and lesions	***True***	429	(66.7)
	False		
Mpox and chickenpox have similar signs and symptoms	***True***	214	(33.3)
	False		
Isolating patients with mpox is essential to stop spread	***True***	396	(61.6)
	False		
Mpox can be transmitted during sex	***True***	415	(64.5)
	False		
Mpox is mostly common in men who have sex with men	***True***	301	(46.8)
	False		
Asymptotic individuals may transmit mpox	***True***	364	(56.6)
	False		
Mpox is highly contagious	True		
	False	72	(11.2)
Mpox is transmitted through skin contact	***True***	364	(56.6)
	False		
Mpox is transmitted through bedding and linens	***True***	243	(37.8)
	False		
There is a vaccine for mpox	***True***	319	(49.6)
	False		
Condoms can prevent acquiring mpox during sex	***True***	275	(42.8)
	False		
Mpox can be treated with medicines	***True***	322	(50.1)
	False		

*Correct answers are in bold

Table 3. Mpox knowledge among study participants

	n	(%)	Median knowledge score	IQR	P-value
Mpox Knowledge score (ranged 0 to 16) *	643	(100.0)	9	(5-12)	
SOCIO-DEMOGRAPHICS					
Age					**<0.001**
18 to 30	308	(47.9)	4	(8-11)	
31 to 40	240	(37.3)	6	(10-13)	
41 to 50	82	(12.7)	4	(9-12)	
More than 50	13	(2.1)	9	(10-11)	
Country of residence					**<0.001**
Morocco	199	(30.9)	9	(6-11)	
Egypt	169	(26.3)	9	(5-13)	
Lebanon	97	(15.1)	9	(6-11)	
Tunisia	62	(9.6)	5	(0-9)	
United Arab Emirates	37	(5.8)	10	(4-14)	
Pakistan	20	(3.1)	9	(7.5-11.5)	
Kingdom of Saudi Arabia	18	(2.8)	12	(10-14)	
Jordan	15	(2.3)	10	(6-12)	
Other EMR	23	(3.8)	11	(6-15)	
Prefer not to say	3	(0.5)	2	(0-13)	
Sex at birth					0.425
Male	635	(98.8)	9	(5-12)	
Female	6	(0.9)	6.5	(5-10)	
Prefer not to say	2	(0.3)	11.5	(11-12)	
Gender identity					**<0.001**
Male	472	(73.4)	9	(4-12)	
Trans (transgender)	95	(14.8)	11	(8-14)	
Gender fluid	36	(5.6)	9	(6-11)	
Female	12	(1.9)	2	(0-10)	
Other	5	(0.8)	8	(7-9)	

Prefer not to say	23	(3.6)	10	(1-11)	
Education level					**<0.001**
Never attended school	5	(0.8)	5	(1-6)	
Primary school	24	(3.7)	8	(2-10.5)	
Middle school	37	(5.8)	6	(1-11)	
High school	98	(15.2)	8	(1-10)	
Technical vocational school	47	(7.3)	10	(6-12)	
University/college	307	(47.7)	10	(5-12)	
Postgraduate	117	(18.2)	11	(8-13)	
Prefer not to say	8	(1.2)	6.5	(3-15)	
MPOX TESTING HISTORTY					
Ever had a test for mpox					**0.014**
No	596	(92.7)	9	(5-12)	
Yes	13	(2.0)	11	(8-13)	
Prefer not to say	34	(5.3)	11	(8-14)	
STI and VIRAL HEPATITIS HISTORY					
HIV status					**0.022**
Negative	313	(48.7)	9	(6-12)	
Positive	244	(37.9)	9	(4-11)	
I don't know	19	(3.0)	5	(1-10)	
Prefer not to say	67	(10.4)	10	(4-14)	
Hepatitis B status					**<0.001**
Negative	431	(67.0)	9	(5-11)	
Positive	103	(16.0)	9	(4-12)	
I don't know	36	(5.6)	5.5	(2-12.5)	
Prefer not to say	73	(11.4)	12	(8-15)	
History of Hepatitis C					**<0.001**
Negative	440	(68.4)	9	(5-11)	
Positive	93	(14.5)	8	(2-11)	
I don't know	35	(5.4)	10	(2-13)	
Prefer not to say	75	(11.7)	12	(9-15)	
History of Syphilis					**<0.001**

Negative	398	(61.9)	9	(5-11)	
Positive	127	(19.8)	8	(1-11)	
I don't know	39	(6.1)	10	(2-13)	
Prefer not to say	79	(12.3)	12	(10-15)	
History of Chlamydia					**<0.001**
Negative	437	(68.0)	9	(5-11)	
Positive	72	(11.2)	9.5	(4.5-13)	
I don't know	56	(8.7)	10	(4-12)	
Prefer not to say	78	(12.1)	12	(9-15)	
History of Gonorrhoea					**<0.001**
Negative	365	(56.8)	9	(4-11)	
Positive	148	(23.0)	9	(6-11)	
I don't know	46	(7.2)	10	(4-13)	
Prefer not to say	84	(13.1)	12	(7.5-14.5)	
Total history if STIs and Viral Hepatits					**0.002**
No STI or viral hepatitis	107	(16.6)	7	(2-12)	
1 STI or viral hepatitis	207	(32.2)	10	(7-13)	
2 STIs or viral hepatitis	145	(22.6)	9	(5-11)	
3 STIs or viral hepatitis	68	(10.6)	9	(6-12)	
4 or more STIs or viral hepatitis	116	(18.0)	8	(1.5-11.5)	
RISKY BEHAVIOR					
Current smokers					**<0.001**
No	299	(46.5)	10	(6-12)	
Yes	327	(50.9)	8	(3-11)	
Prefer not to say	17	(2.6)	11	(2-14)	
Alcohol use within the past 12 months					0.319
No	277	(43.1)	9	(5-12)	
Yes	352	(54.7)	9	(5-12)	
Prefer not to say	14	(2.2)	7.5	(1-13)	
Recreational drug use within the past 12 months					**<0.001**
No	428	(66.6)	9	(5-12)	

Yes	165	(25.7)	8	(3-11)
Prefer not to say	50	(7.8)	11	(5-14)

Table 4. Practices and behaviors among study participants by knowledge

	n	(%)	Median knowledge score	IQR	P-value
Mpox Knowledge score (ranged 0 to 16)	643	(100.0)	9	(5-12)	
Since learning about mpox how has any of the following changed:					
Number of sex partners					**<0.001**
Not changed	236	(36.7)	9	(4-12)	
Decreased	266	(41.4)	11	(8-13)	
Increased	18	(2.8)	7.5	(4-11)	
Not applicable	63	(9.8)	7	(1-9)	
Prefer not to say	60	(9.3)	2	(0-10)	
Having group sex					**<0.001**
Not changed	143	(22.2)	8	(3-12)	
Decreased	223	(34.7)	11	(8-13)	
Increased	35	(5.4)	11	(6-13)	
Not applicable	191	(29.7)	8	(4-10)	
Prefer not to say	51	(7.9)	2	(0-10)	
Use of condoms					**<0.001**
Not changed	203	(31.6)	9	(5-11)	
Decreased	81	(12.6)	11	(9-14)	
Increased	266	(41.4)	10	(6-12)	
Not applicable	55	(8.6)	7	(1-10)	
Prefer not to say	38	(5.9)	2.5	(0-10)	
Sex with casual partner/ one-time sexual encounter					**<0.001**
Not changed	208	(32.3)	9	(5-12)	
Decreased	229	(35.6)	11	(8-13)	
Increased	66	(10.3)	9	(5-12)	
Not applicable	88	(13.7)	8	(1-10)	

Prefer not to say	52	(8.1)	3.5	(0-9)	
Wore clothing during sex to reduce skin to skin contact					**<0.001**
Not changed	221	(34.4)	9	(6-12)	
Decreased	112	(17.4)	11	(8-14)	
Increased	111	(17.3)	11	(7-13)	
Not applicable	139	(21.6)	8	(2-10)	
Prefer not to say	60	(9.3)	2.5	(0-9.5)	
Going to sex venues or events					**<0.001**
Not changed	159	(24.7)	9	(4-12)	
Decreased	193	(30.0)	11	(8-13)	
Increased	60	(9.3)	10.5	(5-13.5)	
Not applicable	186	(28.9)	8	(4-11)	
Prefer not to say	45	(7.0)	6	(0-10)	
Ever injected drugs in the past 12 months					0.438
No	3	(9.1)	8	(6-10)	
Yes	30	(90.9)	6	(1-10)	
Ever had a test for Monkeypox					**0.014**
No	596	(92.7)	9	(5-12)	
Yes	13	(2.0)	11	(8-13)	
Prefer not to say	34	(5.3)	11	(8-14)	
Able to abstain from any sexual activity, if <u>tested positive</u> for mpox					**<0.001**
No	95	(14.8)	8	(3-13)	
Yes	477	(74.2)	10	(6-12)	
I don't know	57	(8.9)	5	(0-10)	
Prefer not to say	14	(2.2)	3	(0-9)	
Able to abstain from any sexual activity if respondent have been <u>in contact</u> with someone with mpox					**<0.001**
No	120	(18.7)	9	(3-13)	
Yes	440	(68.4)	10	(6-12)	
I don't know	69	(10.7)	7	(1-10)	
Prefer not to say	14	(2.2)	4	(1-7)	

Inform sexual partner(s) if <u>tested positive</u> for mpox					**0.047**
No	120	(18.7)	9	(5-13)	
Yes	432	(67.2)	9	(5.5-12)	
I don't know	77	(12.0)	9	(3-11)	
Prefer not to say	14	(2.2)	5	(1-10)	
Inform sexual partner(s) if respondent was <u>in contact</u> with someone with mpox					**0.002**
No	155	(24.1)	9	(4-12)	
Yes	387	(60.2)	10	(6-12)	
I don't know	81	(12.6)	9	(4-11)	
Prefer not to say	20	(3.1)	3.5	(0.5-8)	
Willing to share details of last sexual encounter					**0.014**
No	161	(25.0)	9	(5-12)	
Yes	300	(46.7)	9	(5-11)	
I don't know	147	(22.9)	10	(4-13)	
Prefer not to say	35	(5.4)	6	(1-10)	

Table 5. Mpox perceptions by mpox knowledge among study participants

	n	(%)	Median knowledge score	IQR	P-value
Mpox Knowledge score (ranged 0 to 16)	643	(100.0)	9	(5-12)	
Vaccines are safe and effective					**0.001**
No	113	(17.6)	9	(4-11)	
Yes	434	(67.5)	10	(6-13)	
I don't know	96	(14.9)	6	(0.5-10)	
Mpox vaccine is safe					**0.001**
No	101	(15.7)	10	(5-12)	
Yes	314	(48.8)	11	(8-13)	
I don't know	228	(35.5)	6	(1-9)	
I consider myself to be susceptible to mpox					**<0.001**
Disagree	165	(25.7)	9	(5-11)	
Neutral	183	(28.5)	9	(4-12)	
Agree	259	(40.3)	10	(6-13)	
Prefer not to say	36	(5.6)	4	(0-9)	
Mpox is dangerous and lethal					**<0.001**
Disagree	89	(13.8)	10	(6-12)	
Neutral	169	(26.3)	7	(1-10)	
Agree	345	(53.7)	10	(7-13)	
Prefer not to say	40	(6.2)	2	(0-8)	
Mpox is a laboratory made virus					**<0.001**
Disagree	166	(25.8)	10	(7-12)	
Neutral	214	(33.3)	8	(2-11)	
Agree	209	(32.5)	11	(7-13)	
Prefer not to say	54	(8.4)	6	(0-10)	
Mpox is easily preventable and controlled					**<0.001**
Disagree	80	(12.4)	9	(6-11)	
Neutral	181	(28.1)	6	(2-10)	

Agree	349	(54.3)	11	(8-13)	
Prefer not to say	33	(5.1)	1	(0-6)	
Mpox is an attempt to reduce the population size					**<0.001**
Disagree	188	(29.2)	9.5	(7-12)	
Neutral	198	(30.8)	8	(2-11)	
Agree	199	(30.9)	10	(5-13)	
Prefer not to say	58	(9.0)	7.5	(1-11)	
Pharmaceutical companies create epidemics to increase their profits					**<0.001**
Disagree	167	(26.0)	10	(7-12)	
Neutral	205	(31.9)	9	(3-11)	
Agree	208	(32.3)	9	(5-13)	
Prefer not to say	63	(9.8)	8	(1-11)	
Mainstream media propagate unnecessary fear					**<0.001**
Disagree	158	(24.6)	10	(7-12)	
Neutral	210	(32.7)	8	(3-11)	
Agree	218	(33.9)	10	(6-13)	
Prefer not to say	57	(8.9)	8	(0-11)	

Table 6. Access to healthcare services and stigma related to mpox by knowledge among study participants

	n	(%)	Median knowledge score	IQR	P-value
Mpox Knowledge score (ranged 0 to 16)	643	(100.0)	9	(5-12)	
ACCESS TO CARE					
Respondent knows where to receive the mpox vaccine					0.169
No	333	(51.8)	9	(5-11)	
Yes	42	(6.5)	10	(7-12)	
I don't know	242	(37.6)	9	(4-12)	
Prefer not to say	26	(4.0)	4	(0-12)	
Willingness to get mpox vaccine					**0.03**
No	73	(11.5)	10	(6-13)	
Yes	477	(74.2)	9	(5-12)	
Unsure	93	(14.4)	8	(1-12)	
FEAR/STIGMA					
Primary reason preventing from receiving the mpox test					**0.003**
Afraid of legal issues	73	(11.4)	11	(5-14)	
Cost of the test	123	(19.1)	10	(6-12)	
Don't know where to get tested	326	(50.7)	9	(4-11)	
I would be worried about others finding out I got tested	58	(9.0)	9.5	(4-12)	
Stigma and discrimination	63	(9.8)	10	(7-12)	
Willing to share details of last sexual encounter					**0.013**
No	161	(25.0)	9	(5-12)	
Yes	300	(46.7)	9	(5-11)	
I don't know	147	(22.9)	10	(4-13)	
Prefer not to say	35	(5.4)	6	(1-10)	

Table 7. Mpox knowledge and candidate predictors

	Mpox knowledge				Unadjusted Odds Ratio	95% CI	P-value
	Low (score ≤12) n=512	(79.63)	Adequate (score >12) n=131	(20.37)			
Country of residence							
Morocco	173	(33.80)	26	(19.80)	1.00	…..…	
Egypt	120	(23.40)	49	(37.40)	2.72	(1.60-4.61)	**<0.001**
Lebanon	80	(15.60)	17	(13.00)	1.41	(0.73-2.75)	0.31
Tunisia	59	(11.50)	3	(2.30)	0.34	(0.10-1.16)	0.08
UAE	23	(4.50)	14	(10.70)	4.05	(1.85-8.85)	**<0.001**
Pakistan	16	(3.10)	4	(3.10)	1.66	(0.52-5.36)	0.39
KSA	10	(2.00)	8	(6.10)	5.32	(1.93-14.72)	**<0.001**
Jordan	13	(2.50)	2	(1.50)	1.02	(0.22-4.80)	0.98
Other EMR	16	(3.10)	7	(5.30)	2.91	(1.09-7.75)	**0.03**
Prefer not to say	2	(0.40)	1	(0.80)	3.33	(0.29-38.0)	0.33
Age							
18 to 30	274	(53.50)	34	(26.00)	1.00	…..…	
31 to 40	164	(32.00)	76	(58.00)	3.73	(2.39-5.85)	**<0.001**
41 to 50	64	(12.50)	18	(13.70)	2.27	(1.20-4.27)	**0.01**
More than 50	10	(2.00)	3	(2.30)	2.42	(0.63-9.22)	0.20
Gender identity							
Male	387	(75.60)	85	(64.90)	1.00	…..…	
Female	10	(2.00)	2	(1.50)	0.91	(0.20-4.23)	0.91
Other	94	(18.40)	42	(32.10)	2.03	(1.32-3.14)	**<0.001**
Prefer not to say	21	(4.10)	2	(1.50)	0.43	(0.10-1.88)	0.27
Marital status							
Single	351	(68.60)	41	(31.30)	1.00	…..…	
Relationship	65	(12.70)	39	(29.80)	5.14	(3.08-8.57)	**<0.001**
Married	50	(9.80)	11	(8.40)	1.88	(0.91-3.90)	0.09
Prefer not to say	46	(9.00)	40	(30.50)	7.44	(4.37-12.69)	**<0.001**
Employment status							

Student	90	(17.60)	9	(6.90)	1.00	…..…	
Unemployed	113	(22.10)	9	(6.90)	0.80	(0.30-2.09)	0.64
Employed	252	(49.20)	107	(81.70)	4.25	(2.06-8.74)	**<0.001**
Retired	5	(1.00)	0	(0.00)	1.00	…..…	
Other	23	(4.50)	2	(1.50)	0.87	(0.18-4.30)	0.86
Prefer not to say	29	(5.70)	4	(3.10)	1.38	(0.40-4.81)	0.61
Education level							
Never	5	(1.00)	0	(0.00)	1.00	…..…	
Primary	22	(4.30)	2	(1.50)	0.15	(0.02-1.16)	0.07
Middle and High School	124	(24.20)	11	(8.40)	0.15	(0.03-0.70)	**0.02**
Technical School	37	(7.20)	10	(7.60)	0.45	(0.09-2.21)	0.33
College	235	(45.90)	72	(55.00)	0.51	(0.12-2.19)	0.37
Postgraduate	84	(16.40)	33	(25.20)	0.65	(0.15-2.90)	0.58
Prefer not to say	5	(1.00)	3	(2.30)	1.00	…..…	…..…
Residence area							
Rural	56	(10.90)	17	(13.00)	1.00		
Urban	456	(89.10)	114	(87.00)	0.82	(0.46-1.47)	0.51
Current smokers							
No	228	(44.50)	71	(54.20)	1.00	…..…	
Yes	274	(53.50)	53	(40.50)	0.62	(0.42-0.92)	**0.02**
Prefer not to say	10	(2.00)	7	(5.30)	2.25	(0.83-6.12)	0.11
Alcohol consumption within the past 12 months							
No	211	(41.20)	66	(50.40)	1.00	…..…	
Yes	291	(56.80)	61	(46.60)	0.67	(0.45-0.99)	0.05
Prefer not to say	10	(2.00)	4	(3.10)	1.28	(0.39-4.21)	0.69
Recreational drug use within the past 12 months							
No	337	(65.80)	91	(69.50)	1.00	…..…	
Yes	145	(28.30)	20	(15.30)	0.51	(0.30-0.86)	**0.01**
Prefer not to say	30	(5.90)	20	(15.30)	2.47	(1.34-4.55)	**<0.001**
Think mpox vaccine safe							
No	99	(19.30)	14	(10.70)	1.00	…..…	

Yes	323	(63.10)	111	(84.70)	2.43	(1.33-4.43)	**<0.001**
I don't know	90	(17.60)	6	(4.60)	0.47	(0.17-1.28)	0.14
Know someone infected with mpox							
No	420	(82.00)	60	(45.80)	1.00	…..…	
Yes	74	(14.50)	68	(51.90)	6.43	(4.20-9.85)	**<0.001**
Prefer not to say	18	(3.50)	3	(2.30)	1.17	(0.33-4.08)	0.81
Willingness to get mpox vaccine							
No	49	(9.60)	24	(18.30)	1.00	…..…	
Yes	392	(76.60)	85	(64.90)	0.44	(0.26-0.76)	**<0.001**
Hesitant	71	(13.90)	22	(16.80)	0.63	(0.32-1.25)	0.19
Willingness to pay for mpox vaccine							
No	201	(39.30)	45	(34.40)	1.00	…..…	
Yes	196	(38.30)	64	(48.90)	1.46	(0.95-2.24)	0.09
I don’t know	115	(22.50)	22	(16.80)	0.85	(0.49-1.49)	0.58
HIV status							
No	249	(48.60)	64	(48.90)	1.00	…..…	
Yes	202	(39.50)	42	(32.10)	0.81	(0.53-0.25)	0.34
Prefer not to say and I don't know	61	(11.90)	25	(19.10)	1.59	(0.93-2.74)	0.09
Syphilis status							
No	332	(64.80)	66	(50.40)	1.00	…..…	
Yes	111	(21.70)	16	(12.20)	0.73	(0.40-1.30)	0.28
Prefer not to say and I don't know	69	(13.50)	49	(37.40)	3.57	(2.27-5.61)	**<0.001**
Source of healthcare information							
Discussion with family and friends							
No	375	(73.20)	77	(58.80)	1.00	…..…	
Yes	137	(26.80)	54	(41.20)	1.92	(1.29-2.86)	**<0.001**
TV							
No	388	(75.80)	80	(61.10)	1.00	…..…	
Yes	124	(24.20)	51	(38.90)	1.99	(1.33-2.99)	**<0.001**
Social media							
No	175	(34.20)	33	(25.20)	1.00	…..…	
Yes	337	(65.80)	98	(74.80)	1.54	(1.00-2.38)	0.05
Healthcare provider							

No	175	(34.20)	33	(25.20)	1.00	…..…	
Yes	337	(65.80)	98	(74.80)	1.54	(1.00-2.38)	0.05
School or university							
No	462	(90.20)	125	(95.40)	1.00	…..…	
Yes	50	(9.80)	6	(4.60)	0.44	(0.19-1.06)	0.07
NGO							
No	342	(66.80)	95	(72.50)	1.00	…..…	
Yes	170	(33.20)	36	(27.50)	0.76	(0.50-1.17)	0.21

Table 8. Knowledge, practices, perceptions and healthcare acces among study participants by countries with or without reported mpox cases

	Participants in countries with no reported cases n=71	**(%)**	**Participants in countries with 1 or more reported cases n=569**	**(%)**	**P-value**
Knowledge about mpox median (IQR)	5	(0-9)	10	(6-12)	**<0.001**
Since learning about mpox how has any of the following changed:					
Number of sex partners					**0.003**
Not changed	29	(40.8)	206	(36.2)	
Decreased	16	(22.5)	250	(43.9)	
Increased	3	(4.2)	15	(2.6)	
Not applicable	11	(15.5)	51	(9.0)	
Prefer not to say	12	(16.9)	47	(8.3)	
Having group sex					**0.004**
Not changed	14	(19.7)	128	(22.5)	
Decreased	14	(19.7)	209	(36.7)	
Increased	2	(2.8)	33	(5.8)	
Not applicable	32	(45.1)	158	(27.8)	
Prefer not to say	9	(12.7)	41	(7.2)	
Use of condoms					0.519
Not changed	20	(28.2)	181	(31.8)	
Decreased	10	(14.1)	71	(12.5)	
Increased	26	(36.6)	239	(42.0)	
Not applicable	9	(12.7)	46	(8.1)	
Prefer not to say	6	(8.5)	32	(5.6)	
Sex with casual/ one-time sexual encounter					**0.003**
Not changed	22	(31.0)	184	(32.3)	
Decreased	13	(18.3)	216	(38.0)	

Increased	11	(15.5)	55	(9.7)	
Not applicable	15	(21.1)	72	(12.7)	
Prefer not to say	10	(14.1)	42	(7.4)	
Wore clothing during sex to reduce skin to skin contact					**<0.001**
Not changed	21	(29.6)	200	(35.1)	
Decreased	7	(9.9)	105	(18.5)	
Increased	4	(5.6)	107	(18.8)	
Not applicable	29	(40.8)	107	(18.8)	
Prefer not to say	10	(14.1)	50	(8.8)	
Going to sex venues or events					**0.001**
Not changed	18	(25.4)	140	(24.6)	
Decreased	11	(15.5)	181	(31.8)	
Increased	2	(2.8)	58	(10.2)	
Not applicable	30	(42.3)	155	(27.2)	
Prefer not to say	10	(14.1)	35	(6.2)	
Ever injected drugs in the past 12 months					0.999
No	0	(0.0)	3	(9.7)	
Yes	2	(100.0)	28	(90.3)	
Ever had a test for mpox					0.203
No	66	(93.0)	527	(92.6)	
Yes	3	(4.2)	10	(1.8)	
Prefer not to say	2	(2.8)	32	(5.6)	
Able to abstain from any sexual activity, if tested positive for mpox					**0.007**
No	3	(4.2)	92	(16.2)	
Yes	55	(77.5)	419	(73.6)	
I don't know	10	(14.1)	47	(8.3)	
Prefer not to say	3	(4.2)	11	(1.9)	
Able to abstain from any sexual activity if respondent have been in contact with someone with mpox					**0.008**
No	5	(7.0)	115	(20.2)	
Yes	51	(71.8)	386	(67.8)	
I don't know	11	(15.5)	58	(10.2)	

Prefer not to say	4	(9.9)	10	(1.8)	
Inform sexual partner(s) if <u>tested positive</u> for mpox					0.085
No	6	(8.5)	114	(20.0)	
Yes	51	(71.8)	379	(66.6)	
I don't know	12	(2.8)	64	(2.1)	
Prefer not to say	2	(16.9)	12	(11.2)	
Inform sexual partner(s) if respondent have been <u>in contact</u> with someone with mpox					0.136
No	12	(16.9)	143	(25.1)	
Yes	42	(59.2)	343	(60.3)	
I don't know	13	(5.6)	67	(2.8)	
Prefer not to say	4	(18.3)	16	(11.8)	
Willing to share details of last sexual encounter					0.775
No	15	(21.1)	143	(25.1)	
Yes	37	(52.1)	263	(46.2)	
I don't know	16	(22.5)	131	(23.0)	
Prefer not to say	3	(4.2)	32	(5.6)	
Mpox Perceptions					
Vaccines are safe and effective					0.496
No	12	(16.9)	100	(17.6)	
Yes	45	(63.4)	387	(68.0)	
I don't know	14	(19.7)	82	(14.4)	
Mpox vaccine is safe					**<0.001**
No	8	(11.3)	93	(16.3)	
Yes	24	(33.8)	288	(50.6)	
I don't know	39	(54.9)	188	(33.0)	
I consider myself susceptible to mpox					**0.023**
Disagree	20	(28.2)	145	(25.5)	
Neutral	21	(29.6)	161	(28.3)	
Agree	21	(29.6)	236	(41.5)	
Prefer not to say	9	(12.7)	27	(4.7)	
Mpox is dangerous and lethal					**0.001**

Disagree	8	(11.3)	81	(14.2)	
Neutral	27	(38.0)	140	(24.6)	
Agree	26	(36.6)	318	(55.9)	
Prefer not to say	10	(14.1)	30	(5.3)	
Mpox is easily preventable and controlled					**0.002**
Disagree	12	(16.9)	68	(12.0)	
Neutral	26	(36.6)	154	(27.1)	
Agree	25	(35.2)	322	(56.6)	
Prefer not to say	8	(11.3)	25	(4.4)	
Mpox is a laboratory made virus					**0.036**
Disagree	23	(32.4)	143	(25.1)	
Neutral	24	(33.8)	189	(33.2)	
Agree	14	(19.7)	194	(34.1)	
Prefer not to say	10	(14.1)	43	(7.6)	
Mpox is an attempt to reduce the population size					0.171
Disagree	25	(35.2)	163	(28.6)	
Neutral	19	(26.8)	178	(31.3)	
Agree	17	(23.9)	181	(31.8)	
Prefer not to say	10	(14.1)	47	(8.3)	
Pharmaceutical companies create epidemics to increase their profits					0.361
Disagree	23	(32.4)	144	(25.3)	
Neutral	18	(25.4)	186	(32.7)	
Agree	21	(29.6)	186	(32.7)	
Prefer not to say	9	(12.7)	53	(9.3)	
Mainstream media propagate unnecessary fear					0.066
Disagree	21	(29.6)	136	(23.9)	
Neutral	28	(39.4)	181	(31.8)	
Agree	14	(19.7)	203	(35.7)	
Prefer not to say	8	(11.3)	49	(8.6)	
Access to Healthcare Services					
Respondent knows where to receive the mpox vaccine					0.373
No	40	(56.3)	291	(51.1)	

Yes	4	(5.6)	38	(6.7)	
I don't know	22	(31.0)	219	(38.5)	
Prefer not to say	5	(7.0)	21	(3.7)	
Willingness to get mpox vaccine					**0.009**
No	4	(5.6)	69	(12.1)	
Yes	54	(76.1)	420	(73.8)	
I don't know	6	(8.5)	64	(11.2)	
Prefer not to say	7	(9.9)	16	(2.8)	
Primary reason preventing from receiving the mpox vaccine					**0.004**
Afraid of legal issues	5	(7.0)	67	(11.8)	
Cost of the test	3	(4.2)	120	(21.1)	
Don’t know where to get tested	44	(62.0)	280	(49.2)	
I would be worried about others finding out I got tested	8	(11.3)	50	(8.8)	
Stigma and discrimination	11	(15.5)	52	(9.1)	

Total number of participants in this table is 640 since 3 participants did not mention their country of residence

Table 9. Knowledge, practices, perceptions and access to healthcareamong study participants by history of any STI or viral hepatitis

	No history of STI or viral hepatits n=107	(%)	History of any STI or viral hepatits n=536	(%)	P-value
Knowledge about mpox median (IQR)	7	(2-12)	9	(6-12)	**0.018**
Since learning about mpox how has any of the following changed:					
Number of sex partners					**0.037**
Not changed	37	(34.6)	199	(37.1)	
Decreased	43	(40.2)	223	(41.6)	
Increased	3	(2.8)	15	(2.8)	
Not applicable	6	(5.6)	57	(10.6)	
Prefer not to say	18	(16.8)	42	(7.8)	
Having group sex					**0.011**
Not changed	29	(27.1)	114	(21.3)	
Decreased	34	(31.8)	189	(35.3)	
Increased	8	(7.5)	27	(5.0)	
Not applicable	21	(19.6)	170	(31.7)	
Prefer not to say	15	(14.0)	36	(6.7)	
Use of condoms					**0.022**
Not changed	35	(32.7)	168	(31.3)	
Decreased	20	(18.7)	61	(11.4)	
Increased	34	(31.8)	232	(43.3)	
Not applicable	5	(4.7)	50	(9.3)	
Prefer not to say	13	(12.1)	25	(4.7)	
Sex with a casual partner/ one-time sexual encounter					0.073
Not changed	33	(30.8)	175	(32.6)	
Decreased	32	(29.9)	197	(36.8)	

Increased	16	(15.0)	50	(9.3)	
Not applicable	12	(11.2)	76	(14.2)	
Prefer not to say	14	(13.1)	38	(7.1)	
Wore clothing during sex to reduce skin to skin contact					**0.004**
Not changed	34	(31.8)	187	(34.9)	
Decreased	18	(16.8)	94	(17.5)	
Increased	24	(22.4)	87	(16.2)	
Not applicable	13	(12.1)	126	(23.5)	
Prefer not to say	18	(16.8)	42	(7.8)	
Going to sex venues or events					**0.002**
Not changed	27	(25.2)	132	(24.6)	
Decreased	27	(25.2)	166	(31.0)	
Increased	18	(16.8)	42	(7.8)	
Not applicable	22	(20.6)	164	(30.6)	
Prefer not to say	13	(12.1)	32	(6.0)	
Ever injected drugs in the past 12 months					…
No	0	(0.0)	3	(9.1)	
Yes	0	(0.0)	30	(90.9)	
Ever had a test for mpox					0.381
No	98	(91.6)	498	(92.9)	
Yes	1	(0.9)	12	(2.2)	
Prefer not to say	8	(7.5)	26	(4.9)	
Able to abstain from any sexual activity, if tested positive for mpox					**<0.001**
No	27	(25.2)	68	(12.7)	
Yes	61	(57.0)	416	(77.6)	
I don't know	14	(13.1)	43	(8.0)	
Prefer not to say	5	(4.7)	9	(1.7)	
Able to abstain from any sexual activity if respondent have been in contact with someone with mpox					**<0.001**
No	26	(24.3)	94	(17.5)	

Yes	57	(53.3)	383	(71.5)	
I don't know	19	(17.8)	50	(9.3)	
Prefer not to say	5	(4.7)	9	(1.7)	
Inform your sexual partner(s) if <u>tested positive</u> for mpox					**<0.001**
No	19	(17.8)	101	(18.8)	
Yes	60	(56.1)	372	(69.4)	
I don't know	23	(21.5)	54	(10.1)	
Prefer not to say	5	(4.7)	9	(1.7)	
Inform your sexual partner(s) if respondent have been <u>in contact</u> with someone with mpox					**<0.001**
No	24	(22.4)	131	(24.4)	
Yes	50	(46.7)	337	(62.9)	
I don't know	26	(24.3)	55	(10.3)	
Prefer not to say	7	(6.5)	13	(2.4)	
Willing to share details of last sexual encounter					**<0.001**
No	26	(24.3)	135	(25.2)	
Yes	29	(27.1)	271	(50.6)	
I don't know	42	(39.3)	105	(19.6)	
Prefer not to say	10	(9.3)	25	(4.7)	
Mpox Perceptions					
Vaccines are safe and effective					0.309
No	19	(17.8)	94	(17.5)	
Yes	67	(62.6)	367	(68.5)	
I don't know	21	(19.6)	75	(14.0)	
Mpox vaccine is safe					0.383
No	20	(18.7)	81	(15.1)	
Yes	46	(43.0)	268	(50.0)	
I don't know	41	(38.3)	187	(34.9)	
I consider myself susceptible to mpox					**0.001**
Disagree	37	(34.6)	128	(23.9)	
Neutral	28	(26.2)	155	(28.9)	

Agree	30	(28.0)	229	(42.7)	
Prefer not to say	12	(11.2)	24	(4.5)	
Mpox is dangerous and lethal					0.051
Disagree	8	(7.5)	81	(15.1)	
Neutral	26	(24.3)	143	(26.7)	
Agree	62	(57.9)	283	(52.8)	
Prefer not to say	11	(10.3)	29	(5.4)	
Mpox is easily preventable and controlled					**0.008**
Disagree	9	(8.4)	71	(13.2)	
Neutral	33	(30.8)	148	(27.6)	
Agree	53	(49.5)	296	(55.2)	
Prefer not to say	12	(11.2)	21	(3.9)	
Mpox is a laboratory made virus					0.06
Disagree	20	(18.7)	146	(27.2)	
Neutral	36	(33.6)	178	(33.2)	
Agree	36	(33.6)	173	(32.3)	
Prefer not to say	15	(14.0)	39	(7.3)	
Mpox is an attempt to reduce the population size					**0.022**
Disagree	21	(19.6)	167	(31.2)	
Neutral	37	(34.6)	161	(30.0)	
Agree	33	(30.8)	166	(31.0)	
Prefer not to say	16	(15.0)	42	(7.8)	
Pharmaceutical companies create epidemics to increase their profits					0.065
Disagree	18	(16.8)	149	(27.8)	
Neutral	41	(38.3)	164	(30.6)	
Agree	34	(31.8)	174	(32.5)	
Prefer not to say	14	(13.1)	49	(9.1)	
Mainstream media propagate unnecessary fear					0.085
Disagree	16	(15.0)	142	(26.5)	
Neutral	41	(38.3)	169	(31.5)	
Agree	39	(36.4)	179	(33.4)	

Prefer not to say	11	(10.3)	46	(8.6)	
					Access to Healthcare
Respondent knows where to receive the mpox vaccine					**<0.001**
No	41	(38.3)	292	(54.5)	
Yes	5	(4.7)	37	(6.9)	
I don't know	47	(43.9)	195	(36.4)	
Prefer not to say	14	(13.1)	12	(2.2)	**<0.001**
Willingness to get mpox vaccine					
No	20	(18.7)	53	(9.9)	
Yes	60	(56.1)	417	(77.8)	
I don't know	15	(14.0)	55	(10.3)	
Prefer not to say	12	(11.2)	11	(2.1)	
Primary reason preventing from receiving the mpox vaccine					**<0.001**
Afraid of legal issues	33	(30.8)	40	(7.5)	
Cost of the test	14	(13.1)	109	(20.3)	
Don’t know where to get tested	42	(39.3)	284	(53.0)	
I would be worried about others finding out I got tested	9	(8.4)	49	(9.1)	
Stigma and discrimination	9	(8.4)	54	(10.1)	

Supplementary Material

Table S1. List of the NGOs that aided in data collection

Name	Country	List of Services Provided
Mawjudin	Tunisia	Provides victims of discrimination with safe spaces for support and psychological follow-up. It suggests locations for peer listening among community members and offers details on the legal rights of LGBTQI+ individuals
Association de Lutte Contre le Sida (ALCS)	Morocco	Provides HIV services (Testing, counselling and support for people living with HIV)
ATL MST Sida Section (ATL)	Tunisia	Provides support including medical services for key populations (LGBTI, sex workers, etc.) It deals with detoxification, drug rehabilitation and psychosocial support for people living with HIV diagnosed during their hospitalization.
Association Tunisienne De Prévention Positive (ATP+)	Tunisia	Areas of intervention: 1- Prevention and promotion of risk minimization behaviors among HIV and key populations 2- Assistance in the psychosocial, legal and medical care of HIV and key populations 3- Advocacy with elected officials, deputies and political institutions for the change of laws and the preservation of the dignity and individual freedoms of HIV and key populations.
ASSOCIATION RÊVE DE VIVRE POSITIVE (ARV+)	Algeria	Provides HIV Services for people living with HIV
ElHayet	Algeria	Provides HIV Services for people living with HIV

Society for Inclusion and Development in Communities and Care for All (SIDC)	Lebanon	**1- Sexual & Reproductive Health & Rights** Clinical Services: Anonymous HIV/Hepatitis B&C and Syphilis voluntary testing and counseling. Medical specialist consultations: STI testing, treatment and follow up. Gynecological & Midwife consultations and follow-up Other services including vaccines, pap smear, blood tests. Distribution of preventive materials & kits. Referral **2-Human and Gender Rights:** Documentation of human rights violations and abuse. Offering legal support. Referring and reporting cases to other human rights organizations. Advocacy and stigma & discrimination elimination campaigns. Research, policy development and law reform. **3-Quality Care Services for PLHIV** **4-Harm Reduction Services** **5- Mental Health** Scale-up evidence-based and multidisciplinary approaches to Mental Health and substance use for youth and targeted populations (Prevention, treatment and promotion) Psycho-education and awareness Scaling-up innovative mental health prevention interventions targeting vulnerable populations and vulnerable adolescents and youth to prevent harmful substance use and other risky behaviors Ensure Culturally-adapted standards for mental healthcare and support for the vulnerable populations **6-Meaningful Engagement** Empower vulnerable populations to lead and drive their own solutions and reach their potential Ensure economic stimulus packages social connectedness Increase diversity, inclusion and participation of vulnerable populations in

		governance and civic engagement Ensure agile and flexible services adapting to emergencies and pandemic situations with focus on social protection schemes and support Introducing activities and services that cover the basic livelihoods needs: cash for protection, cash to pay rent and food and provide referrals (Social protection) Develop preparedness and risk plan (test and treatment) to mitigate emerging issues and ensure that services are not interrupted

National Aids Program (NAP)	Lebanon	**The Voluntary Counseling and Testing (VCT)** VCT is an ongoing activity whereby the National AIDS Program team trains healthcare workers and nurses from various NGO's, health centers and clinics on VCT service delivery. This activity is done, with the support of UN agencies including WHO and UNICEF. The workshops help to develop new capacities for VCT services, increasing the availability and spread of VCT centers all around Lebanon. The service offers: Information and brochures about HIV/AIDS and STIs; Pre- test counseling, testing and post-test counseling in a private anonymous setting; and Referral to the needed healthcare and social services. **Center for the Distribution of HIV/AIDS Medications** As a step towards reducing stigma and discrimination associated with People living with HIV/AIDS, the NAP opened a center for the distribution of HIV/AIDS medications; a center that is independent of the Ministry's dispensary. The NAP dispensary team always provides a continuous follow up with the drug companies to ensure continuous sustainability and availability of treatment for people living with HIV/AIDS **Drop-in Center (DIC)** In coordination with UNODC and specialized NGO's like SIDC, SKOUN and AJEM, the NAP opened a drop-in center (DIC) to host people who use drugs especially injecting and other high-risk groups. The DIC is a place where beneficiaries feel comfortable and are given awareness and education sessions. Also, they can use the VCT facility that exists in the DIC and later on if needed, can be referred to more specialized services. This DIC is a pioneer in the region and Lebanon and plans are being put to later open in other geographical area in Lebanon. **Awareness Sessions** NAP is constantly raising awareness lectures to the young generation through lectures in schools and universities.

Proud Lebanon	Lebanon	**1- Legal Support** Proud Lebanon provides legal support and representation to the all beneficiaries despite their nationality or sexual orientation (including Syrian, Iraqi and Palestinian refugees) LGBTIQ+ individuals and prisoners (cases will be selected based on set vulnerability criteria) **2-Free-of-charge rapid HIV and other STI tests** **3- Psycho-social Support** **4- Empowerment Activities**
Humraz Male Health Society	Pakistan	Humraz targets males who have sex with males and their partners by providing services which include volunteer counseling and testing, sexually transmitted infection diagnosis and treatment, psychosocial counseling, distribution of condoms and water-based lubricant as well as advocating for sexual, welfare and human rights.

Forearms of Change Center to Enable Community (FOCCEC)	Jordan	Offers: **Outreach** FOCCEC carries out the outreach program via social media platforms and field visits conducted by outreach workers. The outreach program aims to raise the target communities' SRHR awareness and make the SRHR knowledge resources and services accessible to people living with HIV and key populations in Jordan. **Voluntary Counseling and Testing** The VCT service is free and aims to address beneficiaries' concerns about HIV and STIs through voluntary testing and counseling**.** **Psychosocial Support** **Hotline** FOCCEC has a hotline handled by specialists who answer calls about various concerns related to HIV/STIs and other SRHR issues. **Case Management** FOCCEC listens to the beneficiaries, identifies their problems, and works with them to design customized plans to help them deal with the challenges that they encounter in accessing SRHR services. **Cash Assistance for Protection** **Follow-up and Aftercare** **Home Visits** **Legal Consultation** **REAct** FOCCEC trains outreach workers and counselors in the field to observe and support individuals who are victims of human rights violations. FOCCEC is focused on supporting these individuals, reporting human rights violations due as a member of national coalitions, and advocating for changes in policy to prevent future gender-based violence issues. **Safe Space** The safe space service provides a relaxing and comfortable place to all genders, ages, and nationalities in Jordan. During opening hours, clients have access to FOCCEC’s facilities such as the TV, running machine, and free Wi-Fi.

		Medical Consultants **Referral Services** **Media Awareness**
Al Shehab Institution for Comprehensive Development	Egypt	Al Shehab offers three distinct services: **Voluntary Counseling and Testing (VCT)** addressing the growing importance of HIV/AIDS prevention, care, and support. **Psychological services** to the target groups (Women, youth, and children) who experienced physical and/or expose to GBV.

		Legal **support** includes different services such as legal education and consultation, support to issue official documents and representation in lawsuits.

Table S2. List of the dating applications and LGBTQ+ websites the mpox survey was advertised on

Dating application names	**LGBTQ+ website names**
Grindr	thepinknews.com
Hornet	out.com
Blued: Gay Live Chat and Dating	sdlgbtn.com
Growlr	lgbtqnation.com
Shuggr-Gay Chat and Dating	towleroad.com
Tinder	
Adam4Adam	
Manhunt	
Boyahoy	
Wapo	

Table S3. Distribution of mpox confirmed cases and study participants among EMR countries

Country	WHO confirmed mpox cases[1]	Participants from each EMR country (Using the study data)
1-Afghanistan	0	0
2-Djibouti	0	0
3-Somalia	0	0
4-Syria	0	0
5-Libya	0	0
6-Oman	0	0
7-Palestine	0	0
8-Yemen	0	1
9-Kuwait	0	1
10-Iraq	0	7
11-Tunisia	0	62
12-Iran	1	1
13-Jordan	1	15
14-Bahrain	2	2
15-Egypt	3	169
16-Morocco	3	199
17-Qatar	5	10
18-Pakistan	7	20
19-Saudi Arabia	8	18
20-United Arab Emirates	16	37
21-Sudan	19	1
22-Lebanon	27	97

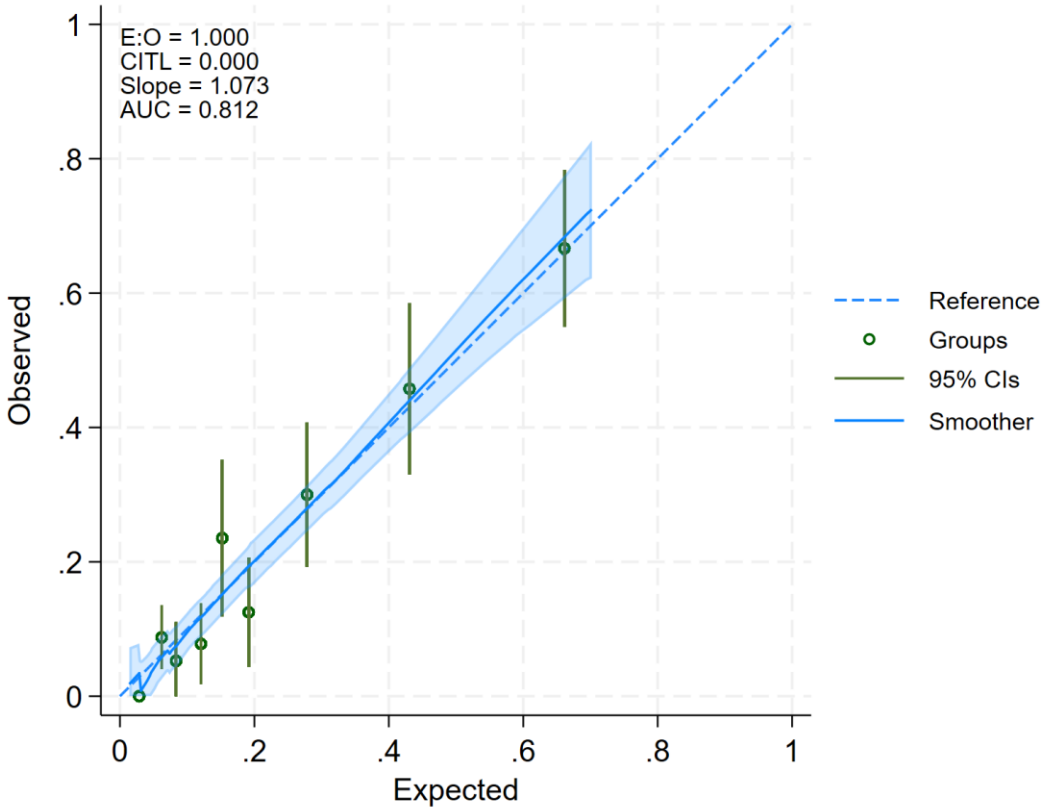
[1] WHO. Multi-country outbreak of mpox October 2023

Appendix 1.

This model had very good discrimination where AUC was 0.81 (95% CI; 0.77-0.85) meaning that the model can accurately tell whether the participant has adequate mpox knowledge or not.

The model's calibration slope was 1.073 (95% CI; 0.87-1.27) which is close to 1 indicating that the model is replicable indicating that if the model were to be run on a new data set, similar results are expected (Figure S1).

Figure S1. Model Performance in the Optimized-Adjusted Model



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