



Opportunities to Harness Technology to Deliver HIV Prevention / Healthy Sexuality Programming to Sexual and Gender Minority Adults Living in East Africa

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Abstract

Because of stigmatization of and discrimination against lesbian, gay, bisexual, transgender, and other sexual and gender minority (SGM) people in East Africa, there is paucity of SGM-focused sexual health research. Technology-based outreach efforts may represent a feasible way to reach and engage this population. They also may be a way to deliver important yet sensitive sexual health information in a stigma-free, anonymous atmosphere. We explored the feasibility of recruiting and surveying East African SGM adults online, and examined their interest in technology-based sexual health programming. Over a 14-month period, 2451 respondents were surveyed. They were, on average, 26.7 years of age. Fifty-four percent identified as lesbian, gay, and/or bisexual (LGB); a similar percentage (49%) reported having sex with a same-sex partner. Sixteen percent identified as gender minority (i.e. transgender or non-binary); and 29% were assigned female at birth. Almost half (48%) of SGM adults expressed interest in an SGM-focused healthy sexuality program delivered online. Enthusiasm also was noted for email (43%) and text messaging (41%). Compared to face-to-face settings, technology-based settings were more commonly appraised as the safest mode through which one could engage in sexual health programming. People who had a same sex partner and those who identified as sexual minority were especially likely to want to engage in technology-based programs. Interest in technology-based programming was similar for adults across gender identities, sex assigned at birth, and age however. Findings suggest that technology may be an underutilized opportunity to reach and engage SGM East Africans in a safe and private manner. Given levels of acceptability indicated by SGM adults across age, sex assigned at birth, and gender and sexual identities in this study, it seems possible that technology-based sexual health and HIV prevention and intervention programs could have the potential to be transformative in East Africa.

Keywords HIV prevention · mHealth · East africa · SGM · Technology · LGBT

Abstracto

Debido a la estigmatización y discriminación contra lesbianas, gays, bisexuales, transgénero y otras personas de minorías sexuales y de género en África Oriental, hay limitadas investigaciones sobre salud sexual centradas en minorías sexuales y de género. Los esfuerzos de divulgación basados en la tecnología pueden representar una forma factible de llegar e involucrar a esta población. También pueden ser una forma de entregar información importante pero sensible sobre la salud sexual en

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una atmósfera anónima y libre de estigma. Exploramos la viabilidad de reclutar y encuestar a adultos de minorías sexuales y de género de África Oriental en línea y examinamos su interés en la programación de salud sexual basada en tecnología. Durante un período de 14 meses, 2451 personas fueron encuestadas. Tenían, en promedio, 26.7 años. El cincuenta y cuatro por ciento se identificó como lesbiana, gay y / o bisexual (LGB); un porcentaje similar (49%) reportó haber tenido relaciones sexuales con una pareja del mismo sexo. El dieciséis por ciento se identificó como una minoría de género (es decir, transgénero o no binario); y al 29% se les asignó mujeres al nacer. Casi la mitad (48%) de los adultos de minorías sexuales y de género expresaron interés en un programa de sexualidad saludable centrado en minorías sexuales y de género que se ofrece en línea. También se notó entusiasmo por el correo electrónico (43%) y los mensajes de texto (41%). En comparación con los entornos cara a cara, los entornos basados en la tecnología se consideraban más comúnmente el modo más seguro a través del cual uno podía participar en programas de salud sexual. Las personas que tenían una pareja del mismo sexo y las que se identificaban como minorías sexuales eran especialmente propensas a querer participar en programas basados en tecnología. Sin embargo, el interés en la programación basada en tecnología fue similar para los adultos en todas las identidades de género, sexo asignado al nacer y edad. Este estudio sugiere que la tecnología podría ser una oportunidad aún subutilizada para llegar e involucrar a los africanos del este de minoría sexual y de género de una manera segura y privada. Dados los niveles de aceptabilidad indicados por los adultos de minoría sexual y de género de todas las edades, el sexo asignado al nacer, y las identidades sexuales y de género en este estudio, parece posible que los programas de prevención e intervención del VIH basados en la tecnología puedan ser transformadores en África Oriental.

Introduction

Homosexuality is highly stigmatized in East Africa. Prevalent stereotypes of individuals who are same-sex attracted include: “immoral, evil, deviant, decadent, degenerate, diseased, poor and insane [1].” Furthermore, homosexuality has long been asserted as being “un-African [1–4].” The stigmatization of and discrimination against homosexuality in some countries, specifically Tanzania, Uganda, Kenya, and South Sudan, where same-sex acts are punishable by life imprisonment, 14 or 10 years of jail time, respectively- is especially high [5, 6]. Recent efforts to strengthen these laws, particularly in Uganda, have concerned many [7, 8]. Public activities have further emphasized the social prohibitions against being gay: In 2018, the government of Dar es Salaam in Tanzania organized an anti-gay surveillance squad to identify suspects and make arrests [9]. A year earlier, attendees of a gay pride parade in Kampala, Uganda were beaten and jailed [10]. It is perhaps not surprising then, that social isolation and family ostracism force many sexual minority East African men to keep their sexual identity a secret from friends as well as health workers [11].

There is a paucity of sexual health research in East Africa that includes lesbian, gay, bisexual, transgender, and other sexual and gender minority people (SGM) given these and other sociocultural-legal challenges. Extant literature largely relies on data from respondents living in large urban settings such as Dodoma [12], Kampala [13, 14], and other major cities [15–19], as people are easier to reach and engage compared to those who live elsewhere. SGM health indicators are largely lacking for those living in smaller townships and rural areas. There also is a dearth of data at the national and international level in East Africa.

Technology-based outreach efforts represent an opportunity to reach and engage SGM adults in East Africa because

such efforts have the potential to overcome noted obstacles to access and privacy [17]. Indeed, Internet access has grown exponentially over the past two decades such that rates of Internet usage within nations range from 46% in Rwanda to 87% in Kenya; South Sudan is the outlier at 8% [20]. Cell phone technology also has increased in usage. The number of cell phone subscriptions per 100 people ranges from 60 in Uganda to 97 in Kenya [21, 22]. South Sudan is again the outlier at 37 subscriptions per 100 people [23]. Not only could health and other types of research data be collected online and via text messaging, but access to important yet sensitive sexual health information could be provided in a stigma-free, anonymous manner.

To our knowledge, online data collection as well as online health programming do not currently exist for SGM East Africans. As a first step in this regard, it is important to explore how to reach and engage SGM adults online, and also to examine their interest in technology-based sexual health programming. To this end, here we report findings from one of the first multi-national surveys of SGM adults across East Africa. We examine interest in LGBT-focused sexual health programming if it were to be delivered via technology as well as through traditional routes (e.g. health centres). Results have the potential to inform future opportunities to reach and engage East African SGM adults in sexual health research, particularly those who are living in settings outside of country capitals and other large urban areas.

Methods

The Healthy Relationships Africa survey was fielded across five East African countries with the aim of identifying opportunities to use technology to deliver HIV prevention/

healthy sexuality programming. The protocol was reviewed and approved by Advarra IRB in the US state of Maryland.

Eligibility included being 18 years of age or older; living in Uganda, Tanzania, Rwanda, South Sudan, or Kenya; and consenting to participate. Sexual and gender identity were not included as explicit eligibility criteria because it was not feasible to include measures of identity and sexual behaviors in the screener given the cultural sensitivity of these questions.

Recruitment

Social Media Recruitment

Between October 2, 2017 and December 24, 2018, respondents were recruited through Facebook and Instagram advertisements targeted to people who reported being 18 years of age or older and living in the five countries of interest. Among social media sites, Facebook is the most popular platform across East Africa. That said, only an estimated 3–13% of the population uses Facebook across these countries, as compared to 29% across the world [20, 24].

People who were interested could click on the social media ad and be hyperlinked to the study website. There, a description of the survey was provided including the following text: *This survey is for people who are lesbian, gay, bisexual, attracted to people of the same sex, transgender, or a gender that is different than the sex they were born (LGBT). LGBT people are not often included in health research in East Africa. We want to fix this today.* Once users confirmed that they were 18 years of age or older, they were routed to the consent form and then to the survey. \$75,000 was spent on social media advertising.

Mobile Phone Recruitment

To further invigorate recruitment, we partnered with GeoPoll [25], a survey research firm that has relationships with mobile phone companies in Kenya and Tanzania. Text messages were sent to a random subset of their subscribers. Those who were interested to learn more about the survey clicked on a weblink embedded in the invitation text message and were taken to the online consent form and survey. The survey was described thusly: *The survey is about sex and dating. Some questions are sensitive. Your answers will be kept in confidence. Thanks for your honesty. To take part, please press Next.* We did not explicitly indicate that the survey was for and about LGBT people because of concerns that it would result in high initial dropout rates. That said, sexual and gender minority identities were queried early in the survey (see next section); this likely resulted in a higher completion rate among SGM compared to non-SGM respondents.

A pilot was conducted in October 2018 and a larger field effort, in November 2018. \$26,000 was spent on the GeoPoll effort.

Description of the Survey Development and Final Instrument

To develop the survey instrument, online focus groups were conducted with SGM East African adults across the five countries of interest to understand how they talked about their sexual experiences, and also to identify challenges they noted specific to their SGM identity. Questions were then vetted by a different group of SGM East African adults, who were asked to read through a section of the survey and indicate which questions were confusing, offensive, or otherwise not advised. Findings were integrated into the final survey instrument.

Given the goals of the study, survey respondents first were asked questions about their interest in LGBT-focused healthy sexuality programs. This maximized the amount of data collected about communication preferences even if respondents subsequently exited the survey before completing it. The next sections of the survey queried one's sexual and gender identity, and sexual behavioral experiences. Contextual questions (e.g., stigma) were answered subsequently, and demographic characteristics (e.g., education) were asked at the end of the survey. For those in the social media cohort, respondents included in the current analytical sample spent, on average, 38.4 min in the survey. Length of interview was not available for the GeoPoll cohort.

Measures Included in the Current Study

Birth Sex and Gender Identity

Respondents were asked the sex written on their birth certificate. Response options were: Male, Female, and Intersex. Note that intersex is acknowledged but highly stigmatized in East Africa [26]. People then were asked: "What is your gender?" Additional information was provided: "Your gender is how you feel inside and can be the same or different than what your birth certificate says. Gender refers to cultural values (roles, behaviors, activities and attributes) that a society associates with being male (like wearing a tie) or female (like wearing a dress)." Response options were: Male, Female, Male-to-female transgender (transwoman), Female-to-male transgender (transman), Gender fluid or gender non-conforming, gender queer, Other, and I don't understand this question. People who identified as transgender male or transgender female and reported the opposite sex at birth; or those who identified as gender fluid, gender non-conforming, or gender queer were coded as gender minority. People who were intersex were coded as SGM

irrespective of their gender or sexual identity, or sexual behavior [27].

Sexual Identity

People were asked: “Which of these commonly used terms would you use to describe your sexuality or sexual orientation?” Response options were: Straight / heterosexual, Gay, Lesbian, Bisexual, Pansexual, Asexual / not sexually attracted to anyone, Queer, Other, and I don’t understand this question. People could choose multiple responses. Those who identified as lesbian, gay, and/or bisexual were coded as LGB. Those who identified as Pansexual, Asexual, Queer or Other were coded as ‘other sexual minority identity.’

Sexual Behavioral Experiences

Sexual experiences were queried based upon one’s sex on their birth certificate. People assigned male at birth were coded as engaging in same-sex behavior if they said they had ever had sex when: (1) their penis went into another man’s anus, (2) someone else’s penis went in their anus, (3) they performed oral sex on someone else’s penis, or (4) they performed oral sex on another man’s anus. People assigned female sex at birth were coded as engaging in same-sex behavior if they said they had ever had sex when: (1) their fingers went into someone else’s vagina, (2) they performed oral sex on someone else’s vagina or clitoris, (3) they performed oral sex on another woman’s anus, or (4) they had sex with a dildo / object in another person’s vagina.

Interest in Healthy Sexuality Programming

Interest in sexual health programming was queried across six different modes: a health centre, an LGBT resource centre, email, text messaging, a website, and at work. As an example, one question asked: “If a sexual health programme designed for LGBT people was available at work, how likely would you be to enroll?” Other modes were queried similarly. Response options ranged from (1) very unlikely to (4) very likely. Those who responded ‘very likely’ were compared to all other respondents. Respondents also were asked to identify which of the options would be *the safest* for them to engage with this type of content.

Incentives

Initially, incentives were not offered to respondents in the social media cohort to protect the anonymity of the participants and to reduce the likelihood of duplicate responses.

In March 2018, to improve completion rates, we started offering ~\$3 USD in airtime. Only people who completed the survey and provided answers indicating they were sexual and/or gender minority based upon their identity or sexual behavioral experiences were offered an incentive. To protect their privacy and render it impossible to match survey responses with personally identifiable information, those who were eligible for an incentive were sent to a separate ‘incentive’ survey after they completed the behavioral survey. In this second survey, respondents provided their name, email, and mobile number. There was not a clear pattern for how incentives impacted response: The rates of women who reporting having had sex with women were similar before (69%) and after (68%; $\chi^2(1) = 0.06$, $p = 0.81$) the incentive was added to the protocol. Rates of men reporting they had had sex with men after incentives were offered (78%) were higher compared to before incentives were offered (58%; $\chi^2(1) = 23.5$, $p < 0.001$). The same was true of people who identified as lesbian, gay, and or bisexual (82% vs. 71%, respectively; $\chi^2(1) = 15.6$, $p < 0.001$). On the other hand, rates of people who identified as gender minority were lower after (13%) compared to before (23%; $\chi^2(1) = 15.6$, $p < 0.001$) the incentive was offered. Respondents to the GeoPoll survey were given a 0.50 USD incentive irrespective of their reported sexual or gender identity, or sexual behaviors.

Identifying the Analytical Sample

Several data cleaning activities were undertaken. Duplicate responses, defined by overlapping contact information supplied in the incentive section with previously completed surveys, were deleted. We also compared phone numbers of those in the social media and GeoPoll samples to identify duplicates; none were overlapping. As an indication of whether respondents were paying attention to their answers, we identified those who straight lined their answers (i.e., provided the same answer for each item on the 5-point Likert scale provided) on the last scale in the survey. We also identified surveys that had a preponderance of numeric answers that were ‘7’, particularly in the sexual behavior section. These responses were censored. Finally, open-end responses were examined for the indication of potential bots (i.e., with garbled language). None were flagged.

Across the 15 months of field, 9506 people clicked into the survey description from the Facebook / Instagram (i.e. social media) advertisements, 5378 of whom provided their age. Less than 1% ($n = 36$) reported their age to be less than 18 years; all were censored. Of the 3656 who answered the consent question, 3557 respondents (97%) consented. 261 responses (7%) were deleted during the data cleaning process described above, resulting in 3296 respondents. To maximize the number of respondents included in the

analyses, everyone who answered the analytical questions were included, irrespective of whether they completed the full survey. 1685 completed the survey questions about access preferences in regards to sexual health programs, and also answered questions about their sexual and/or gender minority identity and sexual behaviors: 973 were identified as SGM adults and were included in the final analytical sample.

Across Kenya and Tanzania, the two countries included in the GeoPoll field recruitment, 198,160 survey invitations were sent. Seven respondents reported being under 18 years of age. 7180 people provided consent; no one actively declined to consent. 91 (1%) were deleted during the data cleaning process described above, resulting in 7089 respondents. Of these, 4198 completed the survey questions about access preferences in regards to sexual health programs, and also answered questions about their sexual and/or gender minority identity and sexual behaviors: 1478 were identified as SGM adults and included in the final analytical sample.

Thus, the total analytical sample comprised 2451 sexual and/or gender minority adults: 973 from the social media-recruited sample and 1478 from the mobile phone-recruited sample.

Data Analysis

Chi-square tests were used to examine differences between dichotomous variables. Multi-variate logistic regression models were estimated to predict the relative odds of appraising one to be very likely to engage in a healthy sexuality program for SGM people delivered via technology given respondent characteristics.

Results

The 2451 respondents were, on average, 26.7 years of age (SD: 6.1; Range: 18–65 years). Fifty-four percent ($n = 1325$) identified as lesbian, gay, and/or bisexual (LGB); 25% ($n = 619$) identified with a sexual minority identity other than LGB. Almost half (49%, $n = 1204$) reported having sex with a same-sex partner (See Table 1). Sixteen percent ($n = 400$) identified as gender minority (i.e., transgender or non-binary); and 29% ($n = 708$) were assigned female sex at birth. One percent ($n = 29$) were assigned intersex at birth, half of whom ($n = 15$) did not endorse a sexual and/or gender minority identity or report same-sex sexual behavior.

Intervention Communication Mode Preference

As shown in Table 1, the Internet was associated with the greatest interest: 48% of SGM adults said they would be

very likely to attend a healthy sexuality program for LGBT adults if it were offered online. Enthusiasm also was noted for email (43%) and text messaging (41%). One third (33%) said they would be very likely to attend this type of program if it were offered at a local health centre, or LGBT centre (36%), although an additional 12% and 11%, respectively, said that there was not a centre near them. Thirty-two percent also said they would be very likely to attend a work-based program; 8% said they did not work.

Respondents were asked where they could take part in a sexual health program most safely. Almost twice as many respondents (58%) endorsed a technology-based setting compared to a face-to-face option (31%). Importantly, 7% said that there would be no safe place for them to enroll in an LGBT-focused sexual health program. Online was the most common place people said would be safest to take part in a sexual health program (28%). A health centre (17%) and via text messaging (15%) were the second and third most commonly noted places, respectively. More than one in ten thought email (14%) or an LGBT resource centre (11%) would be the safest place for them to engage with a healthy sexuality program. Perhaps unsurprisingly, very few (3%) thought work would be the safest place to access this type of programming.

As shown in Table 2, the relative odds of appraising oneself to be very likely to engage in technology-based programs (i.e., web-based, text messaging-based, and email-based) were significantly higher for people who identified with a sexual minority identity versus those who identified as heterosexual. Those who reported having a same-sex partner also were significantly more likely to deem themselves very likely to engage in technology-based programs should they be available. On the other hand, interest in technology-based programming was similar for adults across gender identities, sex assigned at birth, and age.

Preferences for those Recruited by Mobile Carrier Versus Social Media

As shown in Table 1, more than 50% of those who were recruited through social media said they would be very likely to engage with a sexual health program online or via email compared to about one in three in the mobile carrier-recruited sample. Indeed, when sex, sexual behavior, and gender and sexual minority identities were held constant, the relative odds of being very likely to access web- and email-based interventions were significantly lower for those recruited through mobile carriers as compared to social media outreach efforts. Interestingly, those who were recruited through mobile carriers were no more likely to say they would engage in a text messaging-based program than those recruited through social media.

Table 1 Demographic characteristics and prevention communication preferences among sexual and gender minority East African adults (n = 2451)

Participant characteristics	All respondents n = 2451	Social media-recruited n = 973	Mobile carrier-recruited n = 1478	Test statistic	p-value
<i>Demographic characteristics</i>					
Sexual identity				$\chi^2(2) = 370.15$	< 0.001
Lesbian, gay, bisexual	54.1% (1,325)	77.9% (758)	38.4% (567)		
Other sexual minority identity (e.g., pangender)	25.3% (619)	11.4% (111)	34.4% (508)		
Heterosexual	20.7% (507)	10.7% (104)	27.3% (403)		
Gender identity				$\chi^2(2) = 32.6$	< 0.001
Transgender	9.3% (229)	7.1% (69)	10.8% (160)		
Non-binary, pangender	7.0% (171)	10.2% (99)	4.9% (72)		
Cisgender	83.7% (2,051)	82.7% (805)	84.3% (1,246)		
Sexual behavior					
Men who have sex with men	44.9% (760)	70.3% (396)	32.3% (364)	$\chi^2(1) = 219.9$	< 0.001
Women who have sex with women	62.7% (444)	68.8% (267)	55.3% (177)	$\chi^2(1) = 13.7$	< 0.001
Sex					
Male sex at birth	69.0% (1,691)	57.9% (563)	76.3% (1128)	$\chi^2(5) = 114.1$	< 0.001
Female sex at birth	28.9% (708)	39.9% (388)	21.7% (320)		
Intersex	1.2% (29)	0.6% (6)	1.6% (23)		
Unknown	0.9% (23)	1.6% (16)	0.5% (7)		
Age (M:SD)	26.7 (6.1)	26.7 (6.6)	26.6 (5.7)	$t(2449) = 0.41$	0.68
Living in a rural setting	n/a	n/a	33.4% (494)	n/a	
Country				n/a	
Kenya	33.3% (817)	21.4% (208)	41.2% (609)		
Rwanda	0.8% (19)	2.0% (19)	0.0% (0)		
South Sudan	0.1% (2)	0.2% (2)	0.0% (0)		
Tanzania	36.1% (884)	1.5% (15)	58.8% (869)		
Uganda	1.7% (42)	4.3% (42)	0.0% (0)		
Not answered +	28.0% (687)	70.6% (687)	0.0% (0)		
<i>Likelihood of engaging in a sexual health programme for LGBT people if it were offered</i>					
Health centre				$\chi^2(2) = 16.8$	p < 0.001
Very likely	33.1% (812)	33.0% (321)	33.2% (491)		
Less enthusiastic*	55.2% (1353)	58.5% (569)	53.0% (784)		
No health centre near me	11.7% (286)	8.5% (83)	13.7% (203)		
LGBT Resource center				$\chi^2(2) = 0.52$	0.77
Very likely	35.9% (881)	36.8% (358)	35.4% (523)		
Less enthusiastic*	53.5% (1312)	52.7% (513)	54.1% (799)		
No resource centre near me	10.5% (258)	10.5% (102)	10.6% (156)		
Email					
Very likely	43.1% (1057)	54.2% (527)	35.9% (530)	$\chi^2(1) = 80.1$	< 0.001
Less enthusiastic*	56.9% (1394)	45.8% (446)	64.1% (948)		
Text messaging				$\chi^2(1) = 11.4$	0.001
Very likely	41.1% (1007)	45.2% (440)	38.4% (567)		
Less enthusiastic*	58.9% (1444)	54.8% (533)	61.6% (911)		
Online				$\chi^2(1) = 100.9$	< 0.001
Very likely	47.9% (1175)	60.4% (588)	39.7% (587)		
Less enthusiastic*	52.1% (1276)	39.6% (385)	60.3% (891)		

It also is notable that the social media-recruited sample was more balanced on sex at birth and had higher rates of people identifying with a sexual minority identity and reporting same-sex behavior than those in the mobile phone-recruited sample.

Discussion

The use of technology is gaining popularity in sexual health research, including in developing economies [28, 29]. To our knowledge, this has yet to be extended to sexual and

Table 1 (continued)

Participant characteristics	All respondents n = 2451	Social media-recruited n = 973	Mobile carrier-recruited n = 1478	Test statistic	p-value
Work				$\chi^2(2) = 6.8$	0.03
Very likely	32.3% (792)	29.3% (285)	34.3% (507)		
Less enthusiastic*	59.9% (1468)	62.7% (610)	58.1% (858)		
I do not work	7.8% (191)	8.0% (78)	7.7% (113)		

Interest in sexual health programmes measured on a 4-point scale. Most enthusiastic compared to the other three categories

N/A = not applicable; rural versus urban setting was assessed in the mobile but not social media sample

+ As described in the manuscript, all respondents who answered the questions of interest are included in the analysis. Those who did not answer this question reflect those who did not complete the survey as this was asked at the end of the survey

*Includes those who say: Very unlikely, somehow unlikely, somehow likely, do not want to answer

gender minority populations in settings such as East Africa where being SGM is highly stigmatized. The current study suggests that technology might be an as-of-yet underutilized opportunity to reach and engage SGM East Africans in a safe and private manner. Given levels of acceptability indicated by SGM adults across age, sex assigned at birth, and gender and sexual identities in this study, it seems possible that technology-based sexual health and HIV prevention and intervention programs could be transformative in East Africa.

It is free to receive text messages whereas accessing websites requires mobile data. Nonetheless, there was a stronger preference for Internet-based interventions than for text messaging-based programming; and email- and text messaging-based programming were associated with

similar rates of interest. Moreover, when asked to identify the safest place for SGM adults to engage in sexual health programming, websites were endorsed more than all other places. A meta-analysis of web-based HIV prevention programs found reason for optimism that these types of programs may have a positive impact on HIV preventive behavior for young sexual minority boys [30]. Given the number of East African SGM adults in this study who indicated they would be very likely to engage with this type of program, the development and subsequent evaluation of an Internet-based intervention, perhaps with emails and/or text messaging as adjunct communication methods, appears warranted.

It seems notable that age was not a defining factor for any of the three technology-based intervention options

Table 2 East Africa SGM adult characteristics associated with being very likely to engage in healthy sexuality programming if it were available, by communication mode (n = 2451)

Participant characteristics	Web-based interventions aOR (95% CI)	Text messaging-based interventions aOR (95% CI)	Email-based interventions aOR (95% CI)
Sexual identity			
Lesbian, gay, bisexual	1.6 (1.3, 2.0)***	1.5 (1.2, 1.9)***	1.5 (1.1, 1.8)**
Other sexual minority identity (e.g., pangender)	1.4 (1.1, 1.8)*	1.4 (1.0, 1.8)*	1.2 (0.9, 1.6)
Heterosexual	1.0 (RG)	1.0 (RG)	1.0 (RG)
Gender identity			
Transgender	1.2 (0.9, 1.6)	1.0 (0.8, 1.3)	0.8 (0.6, 1.0)
Non-binary, pangender	1.1 (0.8, 1.5)	1.0 (0.7, 1.4)	1.6 (1.1, 2.2)**
Cisgender	1.0 (RG)	1.0 (RG)	1.0 (RG)
Same-sex partner (versus other sex partner)	1.5 (1.2, 1.8)***	1.5 (1.2, 1.8)***	1.4 (1.1, 1.6)**
Female sex (versus male sex)	0.9 (0.8, 1.1)	0.9 (0.7, 1.1)	0.9 (0.8, 1.1)
Age	1.0 (1.0, 1.0)	1.0 (1.0, 1.0)	1.0 (1.0, 1.0)
Mobile phone-recruited (versus social media-recruited) cohort	0.5 (0.4, 0.6)***	0.9 (0.8, 1.1)	0.6 (0.5, 0.7)***

Point estimates are adjusted for all other participant characteristics shown

aOR adjusted Odds Ratio, RG Reference group

*p ≤ 0.05, **p ≤ 0.01, ***p ≤ 0.001

assessed. This may be because the cohorts were recruited by, and therefore reflect those who are comfortable with, technology. Either way, it suggests that a range of ages could be targeted, not just adolescents and young adults. This could be important for programming aiming to improve medication adherence, retention in care, and other issues that older adults who are living with HIV may be facing.

It also bears noting that one in five adults who were identified as SGM reported a heterosexual identity. This perhaps reflects the number of people who are engaging in same sex behavior but are not taking on a sexual minority identity. It highlights the importance of including same sex behaviors and not just identities when identifying SGM populations, particularly in East Africa.

The two samples of survey respondents are different: Both are self-selected but one is from a group of mobile phone users of specific carriers in Kenya and Tanzania, and the other is from social media users across the five countries of interest. While they represent two unique groups of people, it is useful to understand how they are similar and dissimilar as this may inform one's recruitment methodology for future research endeavors. Our experience suggests that East African SGM adults recruited via social media were more enthusiastic about technology-based interventions than those recruited through mobile phone carriers. The former group also appeared to be better balanced on sex and have higher rates of sexual minority identities and same-sex behaviors reported. As such, social media might be the preferred recruitment method to reach and engage a diverse group of SGM adults who are interested in technology-based sexual health programming. That said, recruitment over social media took much longer and was much more expensive than the mobile carrier effort. From this perspective, it may be useful to use both recruitment methodologies, especially if time and budget are constrained.

Limitations

The survey was conducted among those who have access to the Internet and mobile phones. Findings likely do not generalize to those who do not currently have access to these technologies, or even to those who do have access but are not responding to research recruitment messaging. It also is difficult to characterize how these samples are similar and different to the larger sample of mobile phone users in East Africa as well as those who viewed the social media advertisement and did not click on it. That said, the findings are perhaps representative of those we could reach and engage using these types of recruitment methods. Additionally,

although we assume that we were able to reach and engage people across a variety of settings, we do not know the percent of respondents who were recruited via social media and living in rural settings.

Conclusion

The access to and interest in technology as a delivery mechanism for sexual health programming among SGM adults in East Africa suggest this may be an under-utilized opportunity to reach this vulnerable population. The current data support a greater exploration of applications of technology, particularly web-based programming, in delivering sexual health and HIV prevention and intervention content in East Africa. Given the unlikelihood that a 'single bullet' will be sufficient to curb the HIV incidence rates in East Africa, technology-based efforts could be developed in conjunction with innovative efforts to identify and recruit SGM adults using face-to-face methodologies in order to maximize reach and impact [31].

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Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical Approval Approval was obtained from Advarra IRB in the United States. The procedures used in this study adhere to the tenets of the Declaration of Helsinki.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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