Recalling, sharing and participating in a social media intervention promoting HIV testing: A longitudinal analysis of HIV testing among MSM in China

Abstract

Social media interventions may enhance HIV services among key populations, including men who have sex with men (MSM). This longitudinal analysis examined the effect of recalling, sharing, and participating in different components of a social media intervention on HIV testing among MSM. The social media intervention included six images/texts and information about an online local community contest to promote testing. Of the 1033 men, they recalled a mean of 2.7 out of six images and shared an average of one image online. 34.5% of men recalled information on the online local community contest and engaged in a mean of 1.3 contest. Recalling images/texts (aOR = 1.13, 95% CI: 1.02-1.25) and recalling a local contest (aOR = 1.59, 95% CI: 1.13-1.24) were associated with facility-based HIV testing. This study has implications for the development and evaluation of social media interventions to promote HIV testing.

Key words: HIV; MSM; China; Social Media; Intervention

INTRODUCTION

Social media is increasingly used to promote health [1–3]. Several studies suggest that social media interventions, broadly defined as interventions that are implemented on social media platforms, can improve health outcomes [3–7]. Social media interventions have been used to improve HIV services, especially HIV testing services [3,8]. Currently, approximately 30% of people living with HIV are unaware of their infection [9]. In order to end AIDS by 2030, UNAIDS has set a target of having 90% of people living with HIV know their serostatus [10].

Critical gaps in testing for HIV are partially due to difficulties in reaching key populations such as men who have sex with men (MSM). Social media interventions may efficiently reach individuals isolated by geography (e.g., distant rural individuals), stigma (e.g., sexual minorities), or other cultural norms (e.g., ethnic minorities) [1,2,11,12]. Social media is defined as an Internet-based platform that allows the creation and exchange of user-generated content, typically using either mobile or Web-based technologies [3]. Social media, particularly gay mobile dating apps, provide a way to reach MSM and connect them with HIV testing services [13–15], and previous research has suggested that social media interventions can increase HIV testing rates among MSM [8,16]. Social media interventions can promote HIV testing in several ways: 1) as an information platform allowing men to access information related to HIV testing [17,18]; 2) as a service provider linking men to HIV self-testing and facility-based HIV testing [14,19,20]; 3) as a platform for soliciting ideas from men to design tailored interventions [21]; and 4) as a community connecting men to social support and community-based organizations [4,22,23]. These functions are derived from the theory of Lasswell (1948) who listed three key media functions: surveillance of the environment (providing information), linking different parts of society (connecting people), and cultural transmission (cultivating social norms) [24]. In the context of health, social media can serve all three of these functions. [25].

Although many social media interventions have been implemented and found to be effective in pilots [4,5,17], few have been rigorously evaluated [3,16,26,27]. Evaluating social media interventions often consists of monitoring or tracking overall analytics and metrics (e.g., data on numbers of viewers, forwarders, and commenters) [7]. Lasswell's theory of communication states that one of the five key issues about communication is its effect on others (effect analysis). This type of analysis is critical to understand the downstream effects of communication on the audience. However,

how people respond to content from social media communication remains unclear [28]. Better understanding potential mechanisms of social media interventions is contingent on ascertaining the recipient's perspective. MSM reactions to social media interventions promoting HIV testing can range from drawing attention, comprehending messages, recalling messages, intending to get tested, and receiving HIV testing [29,30]. Determining how MSM cognitively or behaviorally respond to social media interventions promoting HIV testing is crucial to increase HIV testing uptake among MSM [31].

In addition, social media allows messages to be widely disseminated. In the context of HIV testing, messages could include images promoting testing, taglines to decrease barriers to testing, information on HIV testing sites, and information on local community HIV activities. These messages can be disseminated through text messages and image files using social media. The extent to which individual messages disseminated through social media influence HIV testing is unclear. Disaggregating which of these individual factors is associated with intervention effectiveness is important [32,33]. This study examines the relationships between MSM recall, sharing, and participating in different components of a social media intervention with facility-based HIV testing uptake among Chinese MSM. We hypothesized that recalling, sharing and participating in a social media intervention were all positively associated with facility-based HIV testing uptake among Chinese MSM.

METHODS

Participant Recruitment

This study is a secondary analysis of longitudinal data collected as part of a randomized controlled trial that is described in detail elsewhere [34]. The stepped wedge randomized controlled trial collected data from MSM over a 12-month period starting in July 2016 in eight Chinese cities: four cities in Guangdong Province (Guangzhou, Shenzhen, Zhuhai, and Jiangmen) and four cities in Shandong Province (Jinan, Qingdao, Yantai, and Jining). Overall, 1381 MSM were recruited through China's largest gay mobile dating application, Blued. Men were born biologically male, aged 16 or older, currently living and planning to live in one of the eight cities for 12 months post-enrollment, self-reported HIV-negative, had not been tested for HIV within the past 3 months, had anal sex with a man at least once during their lifetime, and were willing to provide their cell phone number. Participants

were asked to fill out a survey at baseline and every three months thereafter for 12 months. The eight cities were randomized to sequentially initiate an HIV testing intervention at 3-month intervals. At each interval, one city from Guangdong Province and one city from Shandong Province initiated the intervention. Each pair of cities received the intervention for three consecutive months. Individuals received 50 RMB (~$8.50 USD) for enrolling in the study and received the same amount after completing each subsequent follow-up survey.

Intervention Components

The intervention was implemented for three months in each city. Figure 1 illustrates the intervention period for each city on the basis of the stepped wedge design. The intervention's social media components included six images or texts that promoted HIV testing, a web link containing information on local HIV testing sites, and a web link containing information on an online local community contest to promote HIV testing. The intervention materials were developed using a series of crowdsourcing contests [34]. The purpose of these materials was to promote HIV testing, with dissemination through social media [35]. The intervention team created an account on WeChat (a multi-purpose messaging application) and friended all the eligible participants recruited from the baseline survey. Images and texts were sent every two weeks (six times in three months) to participants who accepted our WeChat invitation. Those who did not accept our invitation received only texts via SMS text message (Supplement 1). A web link with HIV testing site information was also disseminated every two weeks and consisted of the location, hours, contact information, and availability of local free HIV testing (Supplement 2). Study participants were also invited to participate in an online community contest organized by local community-based organizations. This community contest aimed to promote community engagement and HIV testing during the intervention period by sharing stories about HIV testing experiences from MSM. The intervention team expressed appreciation and responded briefly when the participants sent interactive messages. The pre- and post-intervention surveys were also distributed through WeChat. The participants received the first-round of social media intervention upon the completion of the baseline survey or the pre-intervention survey.

Measures

In this sub-analysis, we focus on data collected directly preceding the intervention and after the intervention. Pre-intervention data were collected through the pre-intervention surveys before the implementation of the social media intervention started and post-intervention data were collected through the post-intervention surveys. Figure 1 shows the timing of pre-intervention surveys, intervention, and post-intervention surveys. At pre-intervention surveys, we collected data on participant socio-demographics [i.e., age (as a continuous variable); legal marital status to a woman (not married, engaged or married, separated or divorced); annual personal income (<$3000 USD, $3000-$6000 USD, $6001-$9500 USD, $9501-$12500 USD, ≥$12501 USD); and highest level of education completed (high school or below, two years of college, four years of college, postgraduate)], self-reported sexual orientation (gay or other), whether they disclosed their sexuality or sexual history with men to anyone aside from their sexual partner (yes or no), and whether they disclosed their sexuality or sexual history with men to a healthcare provider (yes or no). The pre-intervention surveys also collected information about the following measures: any facility-based HIV testing in the three months prior to the intervention (yes or no), the number of different male partners they had anal sex with in the previous three months, and, if applicable, how frequently they used condoms when they had anal sex with their male partner in the last three months (0% condom use, less than 50% condom use, more than 50% condom use, or 100% condom use). The number of reported male sexual partners was classified as a binary outcome (multiple partners or not). For those with a male sexual partner at the time, self-reported condom use during anal sex was dichotomized into always used condoms or not always used condoms.

At the post-intervention survey, we asked study participants about their recall of social media intervention materials, whether they shared any materials, and how many online local community contest-related activities they participated in. Previous studies found that observation (recalling a message), endorsement (sharing a message) and contribution (participating in creating a message) are important aspects of social media interventions. These three measurements indicate participants' different degree of engagement in the social media intervention [6]. For each of the six images or texts, men were asked whether they saw or read that image or text in the last three months. If they reported seeing the image/text, they were asked whether they shared, forwarded, or chatted about that image/text to others. Two new variables were defined for the number of images or texts a participant said he recalled and for the number of images or texts a participant said he shared. Both

variables ranged from 0-6 and were treated as continuous. If a participant did not recall an image or text, he was not asked whether he shared it with anyone. Similarly, men were asked if they remembered receiving the web link containing information about local HIV testing sites in the last three months (yes or no). If they did, they were asked whether they forwarded, shared, or chatted about the HIV testing site information with others (yes or no).

Participants were also asked in the post-intervention survey if they heard about the advertised online local community contest that took place during the intervention period (yes or no). If they did hear about it, they were asked how many of the following activities they participated in regarding the contest: submitted entries, forwarded it to others, shared it on their timeline, one-on-one chatted about it with others, group chatted about it, or participated in in-person promotion events. A new variable to assess participant engagement in the advertised local community contest was defined as the total number of participatory behaviors they demonstrated (0, 1, or >1) and treated as continuous.

The main outcome of interest, asked at the post-intervention follow-up, was whether participants received any facility-based HIV testing during the 3-month intervention period (yes or no). We focused this analysis on facility-based testing because self-testing still requires a confirmatory facility-based HIV test according to World Health Organization guidelines [36].

Statistical Analysis

We conducted a secondary analysis to examine which components of the social media intervention were associated with facility-based HIV testing uptake. Generalized linear mixed models (GLMMs) with a binary outcome for self-reported facility-based HIV testing at the post-intervention survey, were used. A random effect for site was added to account for the correlation between participants within a city. All models were adjusted for confounding factors based on a hypothesized directed acyclic graph (DAG), and confounders included participant's age, income, highest level of education, marital status, and whether the participant was tested for HIV at a facility during the three months prior to the intervention. The social media components considered were participant recall of the number of images or texts, the number of images or texts they shared with others, whether they recalled receiving information on local HIV testing sites, whether they shared this information on local

HIV testing sites with others, whether they recalled receiving information about the local community contest, and the number of local community contest-related activities they participated in. Each GLMM examined a separate component of the social media intervention. Estimated social media component effect sizes were reported as odds ratios with 95% confidence intervals (95% CI) and associated *P*-value testing whether the odds ratio was significantly different from the null value of one. Statistical significance was set at $\alpha=0.05$. All odds ratios were estimated by fitting separate models for each social media component of the intervention. All models were computed using SAS version 9.4 (Cary, NC, USA).

RESULTS

Participant Characteristics

Participants were recruited and followed from July 28, 2016 to August 21, 2017. Of the 1381 men who participated, 1061 responded to the question in the post-intervention follow-up asking whether they had been facility-based HIV tested during the intervention period. Among these 1061 men, only those with complete data for age, education, income, marital status, and whether they got facility-based HIV tested in the three months before the intervention period were included in this study (N = 1033). These 1033 men were on average 25.3 ± 6.5 years old. The majority were unmarried (902/1033, 87.3%), had at least two years of college (666/1033, 64.5%), had an annual income less than or equal to $9500 (792/1033, 76.7%), had not been tested for HIV at a facility in the three months prior to social media intervention (915/1033, 88.6%), and self-identified as gay (744/1033, 72.0%). Descriptive data on additional behavioral characteristics of participants can be found in Table 1.

Recalling, Sharing, or Participating in Specific Components of the Social Media Intervention

In total, 205 (19.9%) men reported being tested for HIV in a facility during the three-month intervention period. Table 1 provides descriptive statistics on the level of engagement in components of the social media intervention for all participants included in this study. 91.4% of men recalled at least one image or text. Among men who recalled images or texts, 67.1% of men shared at least one image or text. In total, men recalled 2.7 ± 1.6 images or texts and shared 1.3 ± 1.4 image or texts

(Figure 2). In addition, 85.7% (884/1031) of men recalled information on HIV testing sites, and 46.8% (414/884) of those men shared HIV testing site information with others. Finally, 34.5% (356/1031) of men recalled information on the local community contest. Study participants who recalled information on the local community contest participated in an average of 1.2 ± 1.5 activities.

Social Media Components Associated with Facility-Based HIV Testing During the Intervention

After adjusting for age, education, income, marital status, city and facility-based HIV testing, individuals who were able to recall local contest information had a 59% greater odds of getting facility-based HIV tested during the intervention period than individuals who were not able to recall the local community contest information (aOR = 1.59; 95% CI: 1.13, 2.24*; P*=0.01). Similarly, the adjusted odds of getting facility-based HIV tested during the intervention period increased for every additional image or text individuals recalled (aOR = 1.13, 95% CI: 1.02, 1.25, *P*=0.02). No other component of the social media intervention was significantly associated with uptake of facility-based HIV testing during the intervention period (Table 2). We did an additional analysis examining the correlates of recalling social media intervention images or texts and local community contest information (See Supplementary Data 3 and 4).

DISCUSSION

Social media interventions to promote HIV testing have been piloted in several settings [3]. This study examines a three-month social media intervention and investigates the relationship between recalling, sharing, and participating in a social media intervention and subsequent facility-based HIV testing. We used a recipient-centered approach, in contrast to a sender-centered one, to investigate the effect of reactions to components of the social media intervention on facility-based HIV testing uptake.

We found that recalling social media intervention content was associated with an increase in facility-based HIV testing. This finding is consistent with other studies suggesting that Facebook and WeChat can help promote HIV testing [4,37,38]. Mass media interventions (e.g., newspaper or television) are generally passive [39], but social media interventions allow active interaction between information senders and recipients. While previous research has found that social media interventions

can promote HIV testing, most of these studies have been cross-sectional. Instead, this study used a longitudinal design to examine social media intervention effects over time, allowing us to make stronger inferences about causal relationships [4,23].

This study found that many men in the cohort not only recalled the social media intervention message, but also shared the message on social media. Over 90% of men could recall at least one image or text out of the six images or texts sent. This overall recall rate is higher than a previous community-level HIV prevention study which found 64% of participants recalled having read social media intervention materials [40]. The higher recall rate may be due to the crowdsourced nature of the intervention or the key idea being disseminated in different formats. In addition, nearly 70% of men who recalled the images or texts shared these messages with others. This dissemination rate is substantially higher than the results from a previous study that found around 15% of MSM in China had shared information they received on HIV testing via social media [6,43]. The images and texts distributed in this study were developed through crowdsourcing contests and the community-driven nature of the intervention may have contributed to higher sharing rates.

Within the comprehensive intervention package, we found that recalling images or texts or recalling local contest information was associated with HIV testing. Recalling more images or texts increased the likelihood of HIV testing, consistent with a dose-response effect. Other health communication research found a similar dose-response effect [32,44]. Recalling images or texts suggests that the participant was attentive and internalizing the information [45–47]. Prior research has shown that people better recall messages that are repeated and reflect a common theme [48]. In addition, recalling local contest information increased the likelihood of facility-based HIV testing. This effect may have been related to asking MSM to share stories on HIV testing, thus encouraging community participation and engagement [6,47]. However, we did not find an association between sharing or participating in social media components and facility-based HIV testing. The decision about whether to share a message on HIV testing is likely complex [36]. The lack of an association between participating in online activities and HIV testing may be related to a lack of online intentions being effectively translated into offline behaviors. In addition, subgroups without previous HIV testing may have been particularly likely to test as part of the intervention period [34]. Future studies on social media interventions should provide visual and textual information, engage local communities, and evaluate participant recall.

This study has several limitations. We did not include a comparator arm without social media interventions. As a result, we cannot exclude other confounding factors that may have contributed to HIV testing (e.g., other ongoing in-person or mass media interventions). In addition, the social media interventions were staggered in time across different cities as part of a stepped wedge randomized controlled trial. While all participants received the social media intervention for three months, temporal changes in cities could impact our results. Also, although we adjusted for whether participants received facility-based HIV testing in the three months prior to the social media intervention in our analyses, earlier HIV testing experiences might influence engagement with the social media intervention and affect the results. Finally, we evaluated each social media component separately, and did not examine potential synergy between factors.

CONCLUSION

Social media interventions to promote HIV testing have been used worldwide, but there are few longitudinal studies examining their effectiveness. We examined the effect of several components of a social media intervention and found that participant recall of images/texts and recall of local contest information were associated with increased facility-based HIV testing. More research and programs are needed to better understand HIV social media interventions.

Table 1: Participant Characteristics & Summary of Social Media Components of the Intervention (*N*=1033)

	Tested in HIV facility during intervention					
	Yes (*N*=205)		No (*N*=828)		Overall (*N*=1033)	
	n	%	*n*	%	*n*	%
Socio-Demographics and Prior HIV Testing						
Age	Mean = 25.7, SD = 6.9		Mean = 25.3, SD = 6.4		Mean = 25.3, SD = 6.5	
Highest Level of Education						
High school or below	76	37.1	291	35.1	367	35.5
2 years of college	60	29.3	235	28.4	295	28.6
4 years of college	63	30.7	275	33.2	338	32.7
Postgraduate	6	2.9	27	3.3	33	3.2
Annual Income (USD)						
<$3000	43	20.9	189	22.8	232	22.5
$3000-$6000	41	20.0	188	22.7	229	22.2
$6001-$9500	75	36.6	256	30.9	331	32.0
$9501-$12500	27	13.2	124	15.0	151	14.6
≥$12501	19	9.3	71	8.6	90	8.7
Legal Marital Status (with women)						
Not married	178	86.8	724	87.4	902	87.3
Engaged or Married	20	9.8	72	8.7	92	8.9
Separated or Divorced	7	3.4	32	3.9	39	3.8
Tested in HIV facility within 3 months prior to intervention						
No	151	73.7	764	92.3	915	88.6
Yes	54	26.3	64	7.7	118	11.4
Additional Characteristics and Sexual Behaviors						
Sexual Orientation						
Homosexual	153	74.6	591	71.4	744	72.0
Other	52	25.4	237	28.6	289	28.0
Sexual Orientation Disclosure						
No	66	32.2	288	34.8	354	34.3
Yes	139	67.8	540	65.2	679	65.7
Sexual Orientation Disclosure to Healthcare Providers						
No	158	77.1	664	80.2	822	79.6
Yes	47	22.9	164	19.8	211	20.4
Venues to Meet Male Sexual Partners						
Not Social Media	19	9.3	78	9.4	97	9.4
Social Media	157	76.6	592	71.5	749	72.5
No partner at the time	29	14.1	158	19.1	187	18.1
Condom use 3 months prior to intervention						
Never or not always	52	25.4	210	25.3	262	25.4
Always	80	39.0	249	30.1	329	31.8
No male sexual partner at the time	73	35.6	369	44.6	442	42.8
Multiple male sexual partners 3 months prior to intervention (*N*=1031)[1]						
No	144	70.2	628	76.0	772	74.9
Yes	61	29.8	198	24.0	259	25.1
Social Media Intervention Recall (*N*=1031)[2]						
Number of images/texts recalled (0-6)	Mean = 2.9, SD = 1.5		Mean = 2.7, SD = 1.6		Mean = 2.7, SD = 1.6	
Number of images/texts forwarded[3] (0-6)	Mean= 1.4, SD = 1.3		Mean = 1.3, SD = 1.4		Mean = 1.3, SD = 1.4	
HIV testing sites information recalled						
Yes	175	86.2	709	85.6	884	85.7
No	28	13.8	119	14.4	147	14.3
HIV testing sites information forwarded[4]						
Yes	92	52.6	322	45.4	414	46.8
No	83	47.4	387	54.6	470	53.2
City contest information recalled						
Yes	85	41.9	271	32.7	356	34.5
No	118	58.1	557	67.3	675	65.5
Number of city contest-related activities engaged[5] (out of 6)	Mean = 1.3, SD = 1.5		Mean = 1.2, SD = 1.5		Mean = 1.2, SD = 1.5	

1. Two participants stated they had anal sex with a male partner in the three months prior to intervention, but did not specify how many sexual partners they had.
2. Two participants had missing data for all social media component measures.

3. This question was asked only to the *N* = 942 participant who recalled encountering ≥1 image/text
4. This question was asked only to the *N* = 884 participants who recalled receiving HIV testing site information
5. This question was asked only to the *N* = 356 participants who recalled receiving information about a city contest

Table 2: Effect of Social Media Intervention Components on Facility-based HIV Testing (*N*=1033)

	Facility-based HIV-testing during intervention		**Analysis using Generalized Linear Mixed Models (GLMMs)**	
	n/N	%	Unadjusted odds ratio (95% CI), *P*-value	Adjusted odds ratio (95% CI), *P*-value
Number of images/texts recalled[1] (*N*=1031)	-	-	**1.14 (1.04, 1.26), 0.008**	**1.13 (1.02, 1.25), 0.020**
Number of images/texts shared[1] (*N*=942)	-	-	1.09 (0.97, 1.22), 0.140	1.05 (0.93, 1.18), 0.410
HIV testing sites information recalled (*N*=1031)				
Yes	175/884	19.8	1.10 (0.70, 1.73), 0.680	0.98 (0.62, 1.56), 0.930
No	28/147	19.0	*Ref*	*Ref*
HIV testing sites information shared (*N*=884)				
Yes	92/414	22.2	1.33 (0.95, 1.87), 0.100	1.18 (0.83, 1.67), 0.360
No	83/470	17.7	*Ref*	*Ref*
City contest information recalled (*N*=1031)				
Yes	85/356	23.9	**1.72 (1.24, 2.40), 0.001**	**1.59 (1.13, 2.24), 0.010**
No	118/675	17.5	*Ref*	*Ref*
Number of city contest-related activities participated[2] (*N*=356)	-	-	1.29 (0.94, 1.78), 0.120	1.23 (0.88, 1.72), 0.230

Note: Generalized Linear Mixed Models (GLMMs) were used to account for correlation of MSM within cities. Adjusted models had age (continuous), education (categorical), income (categorical), and marital status (categorical), and previous (i.e., within 3 months of intervention) HIV facility testing experience (categorical) as covariates. A separate model was computed for each component of social media considered.

1. These components of social media were considered continuous and taking values 0-6.
2. This component was considered continuous and taking values 0, 1, >1.
3. This question was asked only to the N = 942 participant who recalled encountering ≥1 image/text
4. This question was asked only to the N = 884 participants who recalled receiving HIV testing site information
5. This question was asked only to the N = 356 participants who recalled receiving information about a city contest

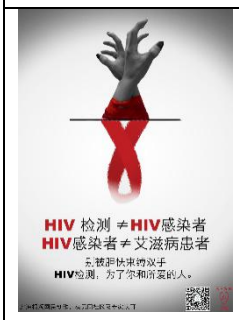
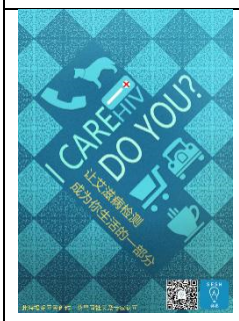
	Study Period							
	Baseline	**1-3 Months**	**FU 1**	**4-6 Months**	**FU 2**	**7-9 Months**	**FU 3**	**10-12 Months**	**FU 4**
Group 1	Pre-survey	Intervention period	Post-survey						
Group 2			Pre-survey	Intervention period	Post-survey				
Group 3					Pre-survey	Intervention period	Post-survey		
Group 4							Pre-survey	Intervention period	Post-survey

FU 1 refers to the first round of follow-up survey; FU 2 refers to the second round of follow-up survey; FU 3 refers to the third round of follow-up survey; and FU4 refers to the fourth round of follow-up survey.
Group 1 contained Guangzhou and Yantai; Group 2, Jiangmen and Jinan; Group 3, Zhuhai and Qingdao; Group 4, Shenzhen and Jining.
Shaded cells represent intervention periods and administration of follow-up surveys on the basis of the stepped wedge design. The pre-intervention survey asked questions about behaviors in the three months preceding the intervention, while the post-intervention survey asked questions about the three months of intervention. Follow-up surveys were administered after months three, six, nine, and 12.

Figure 1. Stepped wedge design of the crowdsourced intervention for promoting HIV testing in MSM in China in eight cities from July 2016 to August 2017

Figure 2. Recalling or sharing of the images or texts component of the social media intervention promoting HIV testing in MSM in China from July 2016 to August 2017. Above are the Number of images or texts recalled among all participants (*N* = 1031), and below are the Number of images or texts shared among those who recalled an image or text (*N* = 942).

Supplement 1. Intervention Images or Messages disseminated via WeChat or SMS Text Messages.

Images	Translation of text in the image	Translation of message sent along with the image
	Let's test for HIV together. Stop HIV from spreading in our community.	One community, one dream. We dream that this community will no longer be threatened by HIV. Protect yourself and protect others. Let's test for HIV together and stop AIDS from spreading in our community!
	HIV infected ≠ AIDS patients. Don't be bound by fear. Get an HIV test for your sake and the sake of your loved one.	HIV testing is not equal to HIV infection. HIV infection is not equal having AIDS. Free your hands. For the sake of you and your loved ones, let's get tested!
	Keywords in the word cloud: privacy, testing, respect, safety, care, reliable, rapid, accuracy. Cherish your life; stand up to HIV/AIDS; get timely treatment	The best love originates from cherishing each other. HIV testing is deidentified, safe, accurate, and reliable. Early detection, early prevention and early treatment will lead to long-lasting romance and long-lasting life.
	Let HIV testing become a part of your life.	Like having a cup of tea in the morning, going on a shopping spree, or getting word from an old friend, HIV testing can be a part of your daily life.
	Don't put your loved ones in danger.	It might look cool to live without regard for others, but life isn't complete without caring for your loved ones. Don't put your loved ones in danger: get an HIV test!

	Junior, what's your rank? HIV test: one line means negative; two or three lines means suspected positive. Please go and get HIV tested.	Hey junior, what was your rank in the Young Pioneers of China? In the HIV testing result, one band means negative, two or three bands means suspected positive. Please be proactive about getting tested!

Supplement 2. Local HIV Testing Information Shared During Intervention.

Below are the website links containing information on local HIV testing sites.

GUANGZHOU:

Main: https://seshgzjc.wordpress.com/

SHENZHEN:

Main: https://seshszjc.wordpress.com/

ZHUHAI:

Main: https://seshzhjc.wordpress.com/

JIANGMEN:

Main: https://seshjiangmenjc.wordpress.com/

QINGDAO:

Main: https://seshqdjc.wordpress.com/

YANTAI:

Main: https://seshyantaijc.wordpress.com/

JINAN:

Main: https://seshjnjc.wordpress.com/

JINING:

Main: https://seshjngjc.wordpress.com/

Supplement 3: Factors Associated with the Number of Images or Texts (0-6) Recalled Post-Intervention (*N*=1031)

	Analysis using Linear Mixed Models (LMMs)	
	Unadjusted Difference in Means, (95% CI), *P*-value	Adjusted Difference in Means, (95% CI), *P*-value
Age	-0.01 (-0.02, 0.01), 0.50	-
Highest Level of Education	*Joint Test: p^3 = 0.84*	
High school or below	*Ref*	
2 years of college	-0.04 (-0.28, 0.21), 0.78	-
4 years of college	-0.10 (-0.33, 0.14), 0.42	-
Postgraduate	-0.17 (-0.73, 0.40), 0.56	-
Annual Income	*Joint Test: p^3 = 0.47*	
<$3000	*Ref*	
$3000-$6000	-0.17 (-0.46, 0.12), 0.25	-
$6001-$9500	-0.10 (-0.37, 0.17), 0.45	-
$9501-$12500	-0.29 (-0.63, 0.04), 0.08	-
≥$12501	-0.04 (-0.43, 0.35), 0.84	-
Legal Marital Status (with women)	*Joint Test: p^3 = 0.84*	
Not married	*Ref*	
Engaged or Married	-0.10 (-0.44, 0.25), 0.89	-
Separated or Divorced	0.04 (-0.47, 0.54), 0.57	-
HIV facility testing 3 months prior to intervention		
Yes	0.26 (-0.05, 0.57), 0.10	-
No	*Ref*	
Sexual Orientation		
Gay	0.01 (-0.21, 0.22), 0.95	0.01 (-0.21, 0.23), 0.94
Other	*Ref*	*Ref*
Sexual Orientation Disclosure		
Yes	0.01 (-0.20, 0.21), 0.96	-0.02 (-0.22, 0.19), 0.89
No	*Ref*	*Ref*
Sexual Orientation Disclosure to Healthcare Providers		
Yes	0.01 (-0.23, 0.25), 0.95	<0.01 (-0.25, 0.25), >.99
No	*Ref*	*Ref*
Venues to meet sexual partners (*N*=844)[2]		
Social Media	-0.01 (-0.34, 0.32), 0.95	-0.01 (-0.34, 0.32), 0.97
Not social media	*Ref*	*Ref*
Condom use 3 months prior to intervention (*N*=590)[2]		
Always	0.06 (-0.19, 0.32), 0.64	0.07 (-0.18, 0.33), 0.58
Never or not always	*Ref*	*Ref*
Multiple sexual partners 3 months prior to intervention (*N*=1029)[1]		
Yes	-0.02 (-0.24, 0.21), 0.89	-0.01 (-0.24, 0.21), 0.92
No	*Ref*	*Ref*

Note: Linear Mixed Models (LMMs) were used to account for correlation of MSM within cities. All models were adjusted for age (continuous), education (categorical), income (categorical), and marital status (categorical), and previous (i.e., within 3 months of intervention) HIV facility testing experience (categorical). A separate model was computed for each factor. Missing data for a few factors resulted in a smaller sample sizes for the corresponding models.

1. Subpopulation of participants who were not missing data for multiple sexual partners
2. Subpopulation of participants who had male sexual partner(s) in the relevant time frame
3. p-value for the joint test of whether the expected number of images or texts recalled post-intervention differs across different levels of the factor.

Supplement 4: Factors Associated with the Recall of City Contest Information Post-Intervention (*N*=1031)

	Recalled City Contest Information post-intervention		**Analysis using Generalized Linear Mixed Models (GLMMs)**	
	Prop.	%	Unadjusted odds ratio (95% CI), *P*-value	Adjusted odds ratio (95% CI), *P*-value
Age	-	-	1.01 (0.99, 1.03), 0.49	-
Highest Level of Education			*Joint Test: $p^3 = 0.26$*	
High school or below	113/367	30.8	*Ref*	
2 years of college	114/294	38.8	1.40 (1.00, 1.97), 0.05	-
4 years of college	116/337	34.4	1.22 (0.87, 1.69), 0.25	-
Postgraduate	13/33	39.4	1.32 (0.62, 2.81), 0.48	-
Annual Income (USD)			*Joint Test: $p^3 = 0.15$*	
<$3000	76/232	32.8	*Ref*	
$3000-$6000	73/229	31.9	1.00 (0.66, 1.50), 0.99	-
$6001-$9500	128/329	38.9	1.51 (1.04, 2.19), 0.03	-
$9501-$12500	50/151	33.1	1.14 (0.72, 1.81), 0.59	-
≥$12501	29/90	32.2	1.22 (0.71, 2.11), 0.48	-
Legal Marital Status (with women)			*Joint Test: $p^3 = 0.90$*	
Not married	314/901	34.9	*Ref*	
Engaged or Married	27/91	29.7	0.89 (0.55, 1.46), 0.65	-
Separated or Divorced	15/39	38.5	1.03 (0.52, 2.05), 0.93	-
HIV facility testing 3 months prior to intervention				
Yes	48/117	41.0	**1.66 (1.08, 2.55), 0.02**	-
No	308/914	33.7	*Ref*	
Sexual Orientation				
Other	103/289	35.6	1.08 (0.80, 1.45), 0.64	1.12 (0.82, 1.53), 0.46
Gay	253/742	34.1	*Ref*	*Ref*
Sexual Orientation Disclosure				
Yes	240/678	35.4	1.12 (0.85, 1.49), 0.42	1.09 (0.82, 1.46), 0.55
No	116/353	32.9	*Ref*	*Ref*
Sexual Orientation Disclosure to Healthcare Providers				
Yes	82/211	38.9	1.23 (0.89, 1.70), 0.21	1.12 (0.80, 1.57), 0.51
No	274/820	33.4	*Ref*	*Ref*
Venues to meet sexual partners (*N*=844)[1]				
Not social media	39/97	40.2	1.36 (0.87, 2.15), 0.18	1.32 (0.83, 2.10), 0.24
Social media	252/747	33.7	*Ref*	*Ref*
Condom use 3 months prior to intervention (*N*=590)[1]				
Never or not always	92/262	35.1	1.11 (0.78, 1.59), 0.55	1.14 (0.80, 1.64), 0.47
Always	108/328	32.9	*Ref*	*Ref*
Multiple sexual partners 3 months prior to intervention (*N*=1029)[2]				
Yes	99/258	38.4	1.26 (0.93, 1.70), 0.14	1.24 (0.91, 1.69), 0.17
No	257/771	33.3	*Ref*	*Ref*

Note: Generalized Linear Mixed Models (GLMMs) were used to account for correlation of MSM within cities. All models were adjusted for age (continuous), education (categorical), income (categorical), and marital status (categorical), and previous (i.e., within 3 months of intervention) HIV facility testing experience (categorical). A separate model was computed for each factor. Missing data for a few factors resulted in a smaller sample sizes for the corresponding models.

1. Subpopulation of participants who were not missing data for multiple sexual partners
2. Subpopulation of participants who had male sexual partner(s) in the relevant time frame
3. *P*-value for the joint test of whether the odds of recalling city contest information post-intervention differs across different levels of the factor.

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