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## Implementation and impact of a technology-based HIV risk-reduction intervention among Thai men who have sex with men using ‘Vialogues’: A randomized controlled trial

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### Abstract

We conducted a randomized control trial to evaluate the impact of a novel technology-based intervention on HIV risks and condom use behaviors among Thai men who have sex with men (MSM). Between April 2016 and August 2017, participants aged 18 years and above, and having engaged in unprotected sex in past six months were randomly assigned to control and intervention arm, and received HIV testing at baseline, month 6 and 12. Intervention arm participants engaged in 12-monthly HIV/STI prevention educational sessions delivered via [Vialogues.com](https://vialogues.com). Of 76 MSM enrolled, 37 were randomized to intervention and 39 to control arm. Median age was 28 (IQR 24-32) years. Thirty-three (89.2%) intervention arm participants completed all 12-monthly Vialogues sessions. At month 12, intervention arm had higher retention rate ( $p = 0.029$ ) and higher median percentage of condom use for anal intercourse ( $p = 0.023$ ) versus control arm. Over the 12-month period, intervention arm reported significant reduction in self-perceived HIV risk ( $p = 0.001$ ), popper usage ( $p = 0.002$ ), median number of sexual partners ( $p = 0.003$ ), and increased median condom use percentage ( $p = 0.006$ ). Our study highlights that “Vialogues” intervention significantly reduced number of sexual partners and condomless anal intercourse rates among Thai MSM, and has positive implications for reducing epidemic among key populations.

### Keywords

Behavior change; condomless anal intercourse; HIV testing and counseling; men who have sex with men; Internet and communications technologies

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## Introduction

Condoms have long been considered a gold standard for HIV prevention. Consistent and correct condom use is a highly effective strategy to reduce the risk of HIV transmission among vulnerable populations (Smith DK, 2015). However, despite wide and prolonged public awareness efforts, condomless anal intercourse (CLAI) remains an inherent risk of HIV transmission for men who have sex with men (MSM) and transgender women (TGW), populations bearing the brunt of the global HIV epidemic (Fettig, Swaminathan, Murrill, & Kaplan, 2014; Hallett, Smit, Garnett, & de Wolf, 2011).

In Thailand, CLAI remains the primary driver of the HIV epidemic among MSM who account for approximately 41% of new HIV infections (Thai National AIDS Committee, 2014). Biomedical interventions such as pre-exposure prophylaxis (PrEP), post-exposure prophylaxis (PEP) and antiretroviral medications (ART) are increasingly accessible, and have demonstrated expanding evidence of effectiveness to prevent HIV transmission and reduce disease progression (Chomchey et al, 2017; Zablotska et al, 2016).

To reverse the pandemic, it is vital to determine how best to integrate all available prevention strategies - behavioural, biomedical and structural, with special focus on delivering risk reduction counseling in non-judgmental and non-stigmatizing settings to reinforce safe behaviors. To date, behavior change interventions such as offline motivational interviewing, peer-led education and outreach program together with condom distribution have commonly been deployed in Thailand, and to an extent proven effective means of reducing sexual risks among MSM and TGW (Pawa et al, 2013; Rongkavilit et al, 2013; Sherman, Sutcliffe, Sriroj, Latkin, Aramratanna, & Celentano, 2009). However, their in-person mode of service delivery limits the reach, engagement and impact, especially among stigmatized populations, and calls for more innovative modes of intervention delivery.

Thais, especially MSM spend highest time online, both on their personal computers (PCs) and smartphones, more than any other nation (Leesa-nguansuk, 2018). To date, novel interventions harnessing the potential of Internet and communications technologies have shown impact in engaging previously unreached Thai MSM, seamlessly linking them to offline HIV services and retaining them in HIV cascades (Phanuphak et al., 2018; Anand et al., 2017; Anand et al., 2017; Anand et al., 2015). However, unlike in the US (Hightow-Weidman, LeGrand, Simmons, Egger, Choi, & Muessig, 2017; Hightow-Weidman et al, 2012), technology-based HIV risk reduction interventions targeting Thai MSM remain scarce and research on their impact in encouraging behavior change is relatively unexplored (Nugroho, Erasmus, Zomer, Wu, & Richardus, 2017).

Asynchronous online discussion has become one of the major means of supporting learning in online environments, especially in health care education (Kleftodimos & Evangelidis, 2016; Gao, 2014). Given, surging technology adoption and utilization rates among Thai MSM, interventions such as asynchronous video discussions with demonstrated learning impact (Agarwala, Hsiao, Chae, & Natriello, 2012) could have immense potential in engaging online MSM in sexual health and behavior change discussions, enable enriched

experiences and longer consultation periods, primary challenges faced in offline interventions.

We leveraged a randomized control trial of technology-based HIV risk reduction intervention using ‘Vialogues’ ([www.vialogues.com](http://www.vialogues.com)) asynchronous video discussion tool and tested empirical evidence of intervention impact for supporting retention in HIV testing and behavior change among Thai MSM. Evidence of the impact of the intervention in reducing HIV risk behaviors and factors associated with CLAI are reported.

## Methods

### Overall study design

We conducted a 12-monthly randomized controlled two arm trial, with six-monthly visits to compare retention rates in HIV testing (primary outcome), and changes in HIV/AIDS knowledge, behavioral intentions, attitudes and extent of motivation for engaging in safer sexual behaviors, condom use self-efficacy (person’s ability to negotiate condom use), and sexual risk and substance use behaviors among participants receiving private clinic-based HIV counseling and testing and a monthly technology-based HIV risk reduction intervention (intervention arm) with those receiving clinic-based HIV counseling and testing alone (control arm). Outcome measures were assessed at month-6 and month-12 during the one-year follow-up period. The Institutional Review Board (IRB) of the Faculty of Medicine, Chulalongkorn University in Bangkok, Thailand approved the study protocol number IRB No.539/58. All participants were reimbursed \$15 per study visit.

### Recruitment and eligibility criteria

Between April 2016 to August 2017, Adam’s Love ([www.adamslove.org](http://www.adamslove.org)) eCounseling and private clinic staffs approached via telephone HIV-negative MSM and TG participants who were existing clients of the Thai Red Cross Anonymous Clinic in Bangkok. Eligibility criteria included, 1) Thai national aged 18 and above, 2) being MSM and TG women, 3) not known to be HIV-positive at the time of enrollment and 4) ever engaged in unprotected anal sex or had three or more partners in the past 6 months. Participants interested in enrolling into the study scheduled their baseline clinic visit with the clinic staffs.

### Randomization, informed consent process, and enrolment

Participants meeting preliminary criteria visited the private clinic and provided informed consent. Participants were randomized using simple randomization procedures (computerized random numbers) and randomly assigned, using concealed allocation to intervention arm (n=37) and control arm (n=39). Randomization occurred after informed consent and was revealed to participants by the clinic staff during a face-to-face session at the clinic.

The sample size calculation was estimated based on the primary objective of the study and assuming proportions of repeat HIV testing in every 6 months for the intervention group and control group are 90% and 65%, respectively, a sample size of 100 (intervention group =50, control group =50) will ensure that a two-sided test with alpha =0.05 has at least 80% power

to detect this difference. Our final sample size (n=76) was lower than projected because of eligible participants declining to enroll in the study, primarily due to reasons including scheduling conflicts and greater time commitments needed to engage in the intensive 12-monthly Vialogues intervention sessions with the online counselors.

### Data collection and study measures

Participants completed a baseline questionnaire at the clinic using Qualtrics software which solicited information on socio-demographic characteristics, risk behavior, technology use and time spent using internet/day, online sex seeking behavior, HIV/STI testing history, attitudes towards HIV prevention, substance use and condom use behavior. Follow-up questionnaires were conducted at six and 12 months after enrollment, at the clinic visit.

### Study intervention delivery and follow-up

Intervention arm participants received once per month online intervention over the one year study period which included online video-based, monthly HIV/sexually transmitted infections (STI) prevention awareness and educational sessions integrated with behavioral change counseling, psychosocial support services and risk reduction strategies delivered via Vialogues video and discussion tool ([www.vialogues.com](http://www.vialogues.com)) (EdLab, 2010) (Box 1).

### Implementation and essential components of the intervention

Two key features of Adam's Love technology-based HIV risk reduction intervention included:

1. Online video-based 12-monthly educational sessions delivered using asynchronous 'Vialogues' video and discussion platform (Box 1). The videos focused on increasing participants' HIV prevention and transmission awareness and reducing risk behaviors, and was developed based on critical analysis of the sexual health topics, commonly asked questions and inquiries by Thai MSM on Adam's Love eCounseling and support platforms (Anand et al., 2015). Each session featured two Adam's Love medical and community expert advise videos, with video topics selected from Adam's Love educational video resources ([youtube.com/adamslovethailand](https://youtube.com/adamslovethailand)), and
2. eCounseling and asynchronous discussions with a health educator during the Vialogues sessions focused on deepening STI/HIV knowledge, improve correct and consistent condom use, reduce sexual risks, and set long-term goals to utilize knowledge and skills learned during the session.

### How to "Vialogues"

At baseline clinic visit, the participants randomized to intervention arm were assisted by the study staffs to create a 'Vialogues' account using pseudoname to ensure privacy, added to the main study 'Vialogues' room and briefly trained on how to access and participate in 12-monthly video sessions. The staffs felt this step was necessary as none of the participants had prior experience with the 'Vialogues' tool. The intervention was designed to support risk reduction behaviors by increasing the client's perception of personal risks. The counselor scheduled online appointment for Vialogues video and discussion session using phone call

and instant messaging application (LINE, Line Corporation, Japan) at the beginning of each month and engaged in an interactive video discussion and conversation with the client to: 1) expose clients to a HIV awareness videos delivered by medical/community experts and encourage participants to inquire and determine what behaviors place the client at risk for HIV (or STIs); 2) use a “teachable moment” to engage in conversation, reduce myths and increase the client’s perception about HIV risk; and 3) reinforce safe behaviors and offer support when needed.

### Statistical analysis

All statistical analysis was performed using Stata version 14 (Stata Corporation, College Station, Texas, USA). Descriptive statistics were performed to describe baseline characteristics among study groups of participants. Frequencies, percentages, mean (standard deviation, SD) and median (interquartile range, IQR) were provided according to nature of the variables. The differences in behavioral outcomes between the intervention and control groups were assessed using standard statistical comparison tests (the chi-square test or the Fisher’s exact test for categorical variables and two-sample t-tests or Wilcoxon Rank-Sum tests for continuous variables as appropriate). To assess the change in behavioral outcomes over time, we used a generalized estimation equation (GEE) approaches. Logistic regression was performed to investigate the relationship between selected predictors and having no CLAI. Odds ratios (OR) and 95% confidence intervals (CI) were calculated. The threshold for statistical significance was set at  $p < 0.05$ .

### Results

Among 172 participants approached to participate in the study, 26 (15.1%) did not meet the study inclusion criteria, and 70 eligible MSM and TG (40.7%) declined to participate primarily due to reasons including scheduling conflicts and greater time commitments needed to engage in the intensive 12-monthly Vialogues intervention sessions with the online counselors. Of 76 participants, including 75 MSM and one TGW, successfully enrolled in the study, 37 were randomized to intervention and 39 to control arm, and received HIV testing at baseline. In the intervention arm, one participant changed phone number without informing study staffs and was lost to follow-up. In the control arm eight participants were lost to follow-up for reasons including being no longer interested, changed contact number or moved to another province (Figure 1).

### Baseline socio-demographics and risk behaviors

Overall, the random allocation produced comparable intervention and control study groups (Table 1). Median (IQR) age was 28 (24-32) years and 89.5% had a bachelor degree or higher. Around half (46%) reported spending more than 7 h per day on the Internet, mainly through smartphones (89.5%). Majority (>60%) had ever sought sex online, mostly via applications. Almost half (42.5%) of the participants had been diagnosed with STI in the past reflecting a high-risk population.

### Retention rates at month 6, and month 12 clinic visit

Almost all (97.3%) intervention arm participants completed month 6 clinic visit and received HIV testing as compared to 92.3% participants from the control arm ( $p=0.62$ ). At month 12, intervention arm had significantly higher clinic visit retention rates versus control arm (97.3% vs. 79.5%,  $p=0.029$ ) (Table 2). Among 37 intervention arm participants, 33 participants (89.2%) received all of the intervention components. Duration for Vialogues session varied between 20 and 180 min per participant (mean 37.45 minutes, SD 6.9). Almost one-third (30%) of participants preferred to do Vialogues between 18.00 – 21.00 h.

### Changes in behavioral outcomes among intervention and control arm subjects at baseline, month 6, and month 12 clinic visit

Both control and intervention arm participants exhibited high knowledge and awareness of HIV/AIDS at baseline, which remained unchanged during the study (Table 3).

At month 6, change in median percentage of condom use for anal intercourse did not differ between the control vs. intervention arms ( $p=0.52$ ). At month 12, the median percentage of condom use for anal intercourse was higher in the intervention versus control arm (100% vs. 93.3%,  $p=0.023$ ). Over the 12-month period, intervention arm reported significant reduction in self-perceived risk for HIV (3.08 on 5-point LIKERT scale to 2.6,  $p=0.001$ ), popper usage (29.7% to 13.9%,  $p=0.002$ ), seeking sex online (59.5% to 44.4%,  $p=0.017$ ), median number of sexual partners in the past three months (2 to 1,  $p=0.003$ ), and increased median percentage of condom use (88.9% to 100%,  $p=0.006$ ). There were no significant changes in attitudes towards condom use, condom use self-efficacy, intentions to use condoms, sexual risk norms, and substance use behaviors among intervention arm participants. No significant behavioral changes were reported at month-12 among control arm participants.

### Logistic regression for association between selected predictors and no CLAI in the past 3 month (reported at month 12 visit)

In a multivariate logistic regression model analysis (Table 4), having less than four episodes of sexual intercourse (aOR 4, 95%CI 1.1-13.8,  $p=0.031$ ) and being randomized to intervention arm (aOR 3.8, 95%CI 1.1-12.7,  $p=0.032$ ) were predictors independently associated with having no CLAI in the last three months. Sociodemographic characteristics, HIV/AIDS knowledge, attitudes (self-perceived risk for HIV/AIDS, attitudes towards condom use and condom use self-efficacy), and not using substance were not associated with having no CLAI.

### Intervention feasibility, acceptability and satisfaction

Process measures yielded high participant satisfaction of Vialogues (mean 4.67 on a 5-point scale, SD 0.48). Study team also conducted exit interviews with intervention participants at month 12-clinic visit. Some of the participants' feedbacks include:

“Joining Vialogues with online counselor is a fun activity, I gain new knowledge every month. Interestingly, each monthly video session has its own significance, and so when I participate and engage in Vialogues, I am very focused and

concentrate on the video and related dialogue with counselor” N.M., 22 years old MSM.

“Joining Vialogues gives me awareness about HIV and STI prevention, and actually helps me reduce my risk behaviors” P.P., 21 years old MSM.

“Engaging in Vialogues every month doesn’t disturb my daily life, it rather provides information that I didn’t know before joining this study” W.S., 21 years old MSM.

“I like that this study uses technology and social networking to engage participants in HIV knowledge and risk reduction counseling, it suits my generation needs and it’s very convenient” J.P., 25 years old MSM.

## Discussion

Clinic visit and intervention level retention rates were high in the intervention arm in our study implying that Vialogues has the potential to be an effective strategy to retain MSM in routine HIV counseling and testing. Higher retention rates reported among intervention arm participants are consistent with previously conducted randomized trial of online interventions among MSM (Liu et al., 2018). The study results highlight that a technology-based HIV risk reduction intervention integrated with online counseling, psychosocial support services and risk reduction strategies has the potential to change behaviors, lower CLAI rates and reduce number of sexual partners among MSM with high baseline use of Internet. Our results are consistent with previous findings supporting that effective interventions increasing condom use comprise educational information and discussions of the positive implication of using condoms (Long et al., 2016; Johnson, Michie, & Snyder, 2014; Abraham, Johnson, de Bruin, & Luszczynska, 2014; Albarracín, Gillette, Earl, Glasman, Durantini, & Ho, 2005).

Having no CLAI was independently associated with being randomized to the intervention arm and having lesser episodes of sexual intercourse in the past 3 months. Interestingly in the US, a randomized trial of an online risk reduction intervention for young black MSM reported similar results with lower self-reported CLAI among the intervention group at 3 months; however, unlike Thai MSM in our study, behavioral changes among US black MSM were not sustained over 12 month period (Hightow-Weidman et al., 2019). In addition, our results are broadly aligned with the findings from RCTs in the Cochrane review by Johnson and colleagues (Johnson et al., 2008), and behavioral outcome literature by Kalichman and colleagues, confirming positive effects of HIV risk-reduction interventions (Kalichman, Carey, & Johnson, 1996).

There is a controversy in the literature about the inter-relations between perceived risk, knowledge, and risk behavior. Increased knowledge of HIV doesn’t always translate into protective behaviors (Ferrer et al, 2007; Braithwaite & Thomas, 2001; Salgado de Snyder, Díaz Pérez, & Maldonado, 1996) and knowledge alone is not sufficient to change risky behavior (Bandura A, 1990). Although our sample of MSM reported high levels of HIV/AIDS knowledge at baseline yet this did not translate into actual reduced risk behaviors. Participants perceived themselves to be at risk for and engaged in high-risk behaviors.

Furthermore, although HIV/AIDS awareness measured by the baseline questionnaires was high, MSM participants specifically noted during clinical visits and qualitative interviews that Vialogues intervention helped enhance and deepen their practical knowledge on HIV risk behaviors they were previously unaware of, and safe sex measures they could adopt to prevent transmission.

It is widely acknowledged that changes in attitudes towards condom use influences condom use behaviors and perceived safer sex self-efficacy is associated with decreases in CLAI (Arnold, Struthers, McIntyre, & Lane, 2013; Harvey & Henderson, 2006). Paradoxically, in our study, although the intervention did not yield any significant changes in attitudes towards condom use, condom use self-efficacy, and behavioral intentions, participants reported significant reductions in number of sexual partners and increase in condom use behaviors. Significant reduction in popper usage among participants engaged in Vialogues has important implications for future design and delivery of interventions targeting popper-using Thai MSM, a population with high reported educational level and multiple sexual partners (Anand et al, 2017).

Being randomized to Intervention arm reduced CLAI among the participants as shown in both bivariate and multivariate models. Interestingly, a recent study at a Bangkok based clinic observed a significant reduction in sexual partners and a significant increase in condom use among acutely infected HIV positive Thai MSM, but couldn't establish whether this was impacted by the behavioral counseling at the clinic (Kroon et al, 2017). Given emerging evidence, we propose that behavioral counseling interventions should be tailored for both online and offline delivery and their potential to reduce risk behaviors should be further assessed among both HIV-negative and positive MSM.

The technology-based intervention was acceptable, feasible and demonstrated impact. Also, intervention arm participants attended majority of the sessions, implying that such interventions are feasible and acceptable to be widely scaled-up in Thailand and in settings with similar epidemic among MSM and technology use. The intervention not only enriched online learning experiences but also successfully retained participants and created knowledge enhancing opportunities. Similar acceptability and feasibility outcomes, high quality of online participation and engagement rates were reported in a recently conducted randomized control trial of an electronically directly observed therapy (e-DOT) for optimizing PrEP adherence among Thai MSM (Anand et al., 2019).

Overall, the findings support the acceptability and feasibility of delivering this prevention program to a group that has few interventions despite bearing a significant burden of the epidemic. Tailored online interventions for this target group are long overdue, making ours a very timely study.

## Limitations

Substance use behaviors except popper usage remained unaffected in our study pointing to the need for refining our technology-based intervention with special attention to substance users. Furthermore, although the intervention proved effective in short-term among a



relatively small sample, we are uncertain whether it would sustain long-term safe sex behaviors. On a positive note, the randomized control trial provides first evidence of a technology based intervention in reducing HIV risk behaviors and has implications for reducing epidemic among MSM. Furthermore, the intervention has high potential to be scaled up in settings with similar epidemic and Internet and technology use among key populations.

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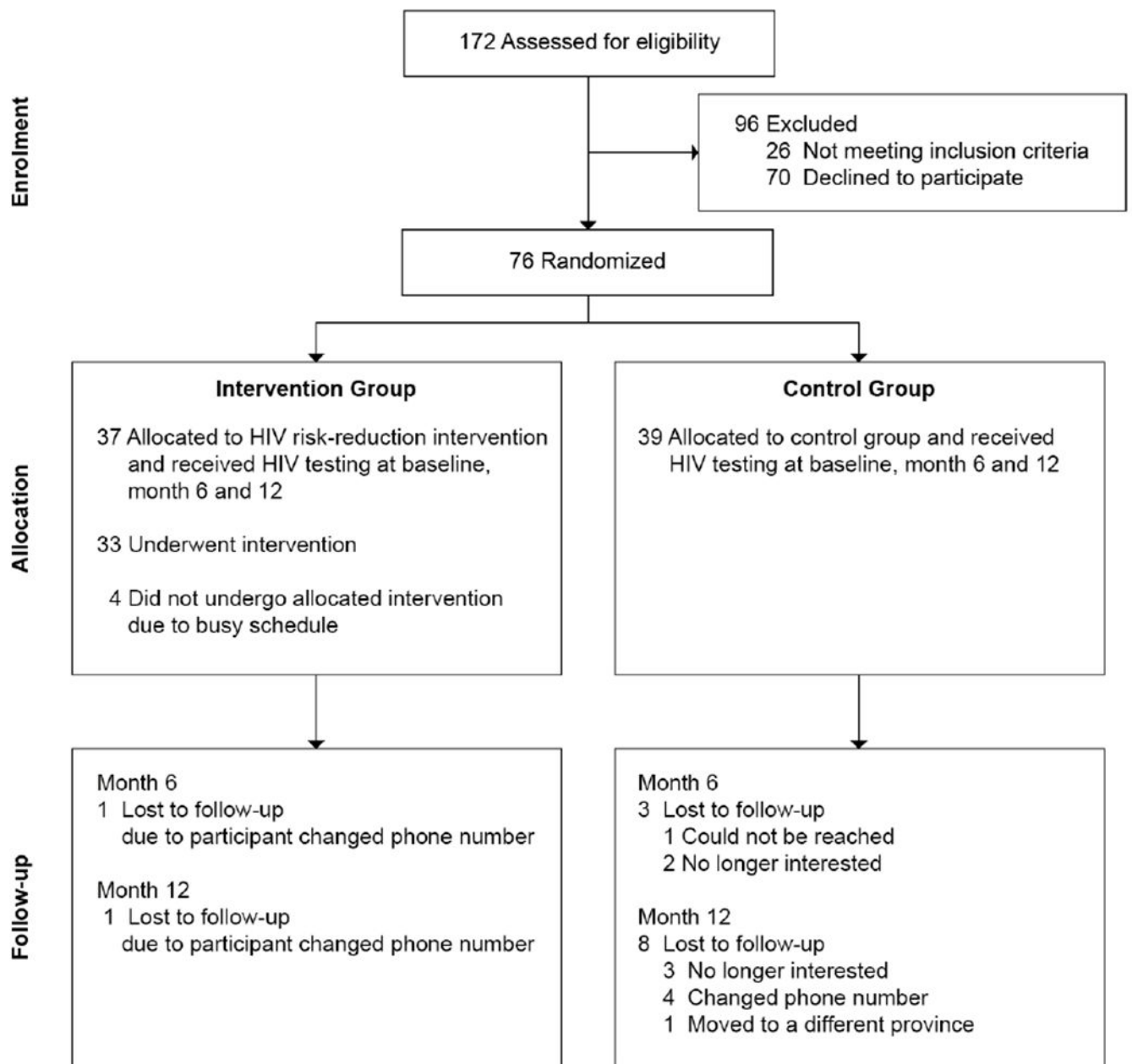
**Box 1.****How to “Vialogues”**

Vialogues ([vialogues.com](http://vialogues.com)), derived from “video dialogues”, is an asynchronous Video discussion and interaction platform which can be used for leveraging digital videos for learning by adding group interaction as part of the online video experience. Vialogues lets users upload videos (file formats supported are: .mov, .flv, .mp4, .mpeg, and .avi.) as well as use videos from sources such as YouTube. Video information component along with message transmission differentiates Vialogues from other video buffering software such as YouTube.

Questions can be posted at certain points of the video and the range of question types includes multi-choice (poll) as well as open-ended (text) questions. Private weblinks enable restricting questions/answers to a particular group. User created Vialogues appear in a list on the right side of the screen under My Vialogues upon initial log on, and clicking on the red Vialogues speech bubble takes one back to the home page with users listed Vialogues.

**Four key steps:**

1. **Create:** To get started, study counselor added YouTube links from existing Adam’s Love expert advise YouTube channel (<https://www.youtube.com/user/AdamsLoveThailand/videos>)
2. **Invite:** Counselor invite the participants to join the Vialogue session and added to the Vialogues main room
3. **Watch:** Participant and counselor start watching the selected video
4. **Interact:** Counselor encourage conversations over the video by adding timestamped comments, and surveys, to the discussion with participants. Time-code clicks helped reference to specific video fragment and the comment.



**Figure 1.**  
Study CONSORT flow diagram

**Table 1.**

Basic sociodemographic, technology use, HIV/STI testing of samples at baseline

Baseline (N=76)	Total (N=76)	Control (N=39)	Intervention (N=37)	p-value
<b>Socio-demographics</b>				
Age				
Minimum, Maximum	21, 49	22, 41	21, 49	
Median (IQR)	28 (24-32)	27 (25-33)	28 (24-32)	0.44 <sup>c</sup>
<b>Education</b>				0.28 <sup>b</sup>
High school	5 (6.6)	3 (7.7)	2 (5.4)	
Diploma	3 (3.9)	3 (7.7)	0 (0)	
Bachelor's degree	61 (80.3)	31 (79.5)	30 (81.1)	
Master's degree or higher	7 (9.2)	2 (5.1)	5 (13.5)	
<b>Occupation</b>				0.022 <sup>b</sup>
Unemployed	2 (2.6)	1 (2.6)	1 (2.7)	
Student	9 (11.8)	2 (5.1)	7 (18.9)	
Full-time worker	39 (51.3)	18 (46.2)	21 (56.8)	
Part-time worker	1 (1.3)	0 (0)	1 (2.7)	
Freelancer	14 (18.4)	12 (30.8)	2 (5.4)	
Own business	11 (14.5)	6 (15.4)	5 (13.5)	
<b>Monthly income</b>				0.07 <sup>b</sup>
No salary as studying	9 (11.8)	2 (5.1)	7 (18.9)	
No salary as unemployed	2 (2.6)	1 (2.6)	1 (2.7)	
500 USD	4 (5.3)	1 (2.6)	3 (8.1)	
501-1,000 USD	28 (36.8)	20 (51.3)	8 (21.6)	
1,001-1,500 USD	21 (27.6)	10 (25.6)	11 (29.7)	
1,500 USD	12 (15.8)	5 (12.8)	7 (18.9)	
<b>Relationship status</b>				0.65 <sup>b</sup>
Not in relationship	42 (55.3)	19 (48.7)	23 (62.2)	
In serious relationship	26 (34.2)	15 (38.5)	11 (29.7)	
Seeing someone	1 (1.3)	1 (2.6)	0 (0)	
Multiple relationship	7 (9.2)	4 (10.3)	3 (8.1)	
<b>Technology use</b>				0.87 <sup>b</sup>
<b>Time spent using Internet/day</b>				
1-3 hours a day	8 (10.5)	4 (10.3)	4 (10.8)	
3-5 hours a day	20 (26.3)	11 (28.2)	9 (24.3)	
5-7 hours a day	13 (17.1)	6 (15.4)	7 (18.9)	
More than 7 hours a day	26 (34.2)	12 (30.8)	14 (37.8)	
Online on the mobile phone all the time	9 (11.8)	6 (15.4)	3 (8.1)	

Baseline (N=76)	Total (N=76)	Control (N=39)	Intervention (N=37)	p-value
<b>Technology devices used</b>				0.92 <sup>b</sup>
Smartphone	68 (89.5)	35 (89.7)	33 (89.2)	
Laptop	3 (3.9)	1 (2.6)	2 (5.4)	
Personal computer	4 (5.3)	2 (5.1)	2 (5.4)	
Tablet	1 (1.3)	1 (2.6)	0 (0)	
<b>Health seeking behaviors</b>				
Don't use internet for health in 3 months	21 (27.6)	13 (33.3)	8 (21.6)	0.25 <sup>a</sup>
Search about HIV/STI information	33 (43.4)	16 (41)	17 (45.9)	0.67 <sup>a</sup>
Search about general health information	49 (64.5)	24 (61.5)	25 (67.6)	0.58 <sup>a</sup>
Online chat group about health	18 (23.7)	8 (20.5)	10 (27)	0.50 <sup>a</sup>
Receive reminder or message about health	4 (5.3)	1 (2.6)	3 (8.1)	0.35 <sup>b</sup>
<b>Online sex seeking behaviors</b>				
Have ever seek sex online	46 (60.5)	24 (61.5)	22 (59.5)	0.85 <sup>a</sup>
Application used for seeking sex online (for those who have ever seek sex online only)				
Jack'd	26 (56.5)	11 (45.8)	15 (68.2)	0.13 <sup>a</sup>
Grindr	20 (43.5)	6 (25)	14 (63.6)	<b>0.008<sup>a</sup></b>
Facebook	18 (39.1)	12 (50)	6 (27.3)	0.12 <sup>a</sup>
Blued	11 (23.9)	7 (29.2)	4 (18.2)	0.38 <sup>a</sup>
Hornet	9 (19.6)	4 (16.7)	5 (22.7)	0.72 <sup>b</sup>
Postjung	5 (10.9)	0 (0)	5 (22.7)	<b>0.019<sup>b</sup></b>
GThai.net	3 (6.5)	0 (0)	3 (13.6)	0.10 <sup>b</sup>
Palm Plaza	3 (6.5)	0 (0)	3 (13.6)	0.10 <sup>b</sup>
Camfrog	2 (4.3)	0 (0)	2 (9.1)	0.22 <sup>b</sup>
Beetalk	2 (4.3)	2 (8.3)	0 (0)	0.49 <sup>b</sup>
Twitter	2 (4.3)	1 (4.2)	1 (4.5)	>0.99 <sup>b</sup>
Instagram	1 (2.2)	0 (0)	1 (4.5)	0.48 <sup>b</sup>
Frequency in seeking sex online (for those who have ever seek sex online only)				0.88 <sup>b</sup>
Several times a day	4 (8.7)	3 (12.5)	1 (4.5)	
About once a day	6 (13)	4 (16.7)	2 (9.1)	
3-5 days a week	3 (6.5)	1 (4.2)	2 (9.1)	
1-2 days a week	13 (28.3)	6 (25)	7 (31.8)	
Once in few weeks	9 (19.6)	4 (16.7)	5 (22.7)	
Once a month or less	11 (23.9)	6 (25)	5 (22.7)	

Baseline (N=76)	Total (N=76)	Control (N=39)	Intervention (N=37)	p-value
<b>HIV/STI testing history</b>				
<b>Last HIV test</b>				0.56 <sup>b</sup>
Within 3 months	24 (31.6)	11 (28.2)	13 (35.1)	
3-6 months ago	14 (18.4)	7 (17.9)	7 (18.9)	
6-12 months ago	30 (39.5)	15 (38.5)	15 (40.5)	
More than 12 months ago	8 (10.5)	6 (15.4)	2 (5.4)	
<b>Times of tested HIV in past year before joining Cascade study</b>				
Minimum, Maximum	0, 8	0, 8	1, 5	
Median (IQR)	2 (1-3)	2 (1-3)	2 (1-3)	0.15 <sup>c</sup>
<b>Reason for previous HIV test</b>				
				0.22 <sup>b</sup>
I test regularly	34 (44.7)	21 (53.8)	13 (35.1)	
I got some risk exposure	18 (23.7)	6 (15.4)	12 (32.4)	
I started new relationship	10 (13.2)	4 (10.3)	6 (16.2)	
I had STI	5 (6.6)	4 (10.3)	1 (2.7)	
My partner disclose his HIV-positive status to me	4 (5.3)	2 (5.1)	2 (5.4)	
I had symptoms of HIV	2 (2.6)	1 (2.6)	1 (2.7)	
I got some information about HIV testing	2 (2.6)	0 (0)	2 (5.4)	
Because of work	1 (1.3)	1 (2.6)	0 (0)	
<b>Have ever tested for STI</b>	73 (96.1)	36 (92.3)	37 (100)	0.24 <sup>b</sup>
<b>Last HIV test (for those who have ever tested for STI only)</b>				
				0.41 <sup>b</sup>
Within 3 months	19 (26)	7 (19.4)	12 (32.4)	
3-6 months ago	11 (15.1)	6 (16.7)	5 (13.5)	
6-12 months ago	33 (45.2)	16 (44.4)	17 (45.9)	
More than 12 months ago	10 (13.7)	7 (19.4)	3 (8.1)	
<b>Ever diagnosed with STI (for those who have ever tested for STI only)</b>				
				0.96 <sup>b</sup>
None	42 (57.5)	20 (55.6)	22 (59.5)	
Genital or anal warts	10 (13.7)	4 (11.1)	6 (16.2)	
Chlamydia	9 (12.3)	5 (13.9)	4 (10.8)	
Syphilis	7 (9.6)	4 (11.1)	3 (8.1)	
Gonorrhea	4 (5.5)	2 (5.6)	2 (5.4)	
Genital herpes	1 (1.4)	1 (2.8)	0 (0)	

<sup>a</sup>P-values are from Chi-square test

<sup>b</sup>P-values are from Fisher's Exact test

<sup>c</sup>P-values are from Two-sample Wilcoxon rank-sum (Mann-Whitney) test

IQR, interquartile range; USD, United States dollar; STI, sexually transmitted infections.



**Table 2.**

Visit attendance by study arm

Follow up visit	Control group (N=39)	Intervention group (N=37)	P-values <sup>[1]</sup>
<b>Month 6</b>			0.62
Visit shows	36 (92.3)	36 (97.3)	
Visit no-shows	3 (7.7)	1 (2.7)	
<b>Month 12</b>			<b>0.029</b>
Visit shows	31 (79.5)	36 (97.3)	
Visit no-shows	8 (20.5)	1 (2.7)	

<sup>[1]</sup> P-values are from Fisher's exact test to compare proportions between two arms

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**Table 3.** Changes in behavioral outcomes among Participants at Baseline, and Six and 12-Months Post-Intervention

Variable	Baseline			6 month			12 month			p-value <sup>e</sup>	
	Control (N=39)	Intervention (N=37)	p-value	Control (N=36)	Intervention (N=36)	p-value	Control (N=31)	Intervention (N=36)	p-value	Control	Intervention
<b>HIV/AIDS Knowledge</b> (total scores =16)											
Mean scores	14.3	14.1	0.647 <sup>c</sup>	14.3	14.3	0.923 <sup>c</sup>	14.0	14.2	0.523 <sup>c</sup>	0.155	0.864
% of items correctly answered	89.1%	88.3%	0.647 <sup>c</sup>	89.2%	89.1%	0.923 <sup>c</sup>	87.3%	88.5%	0.523 <sup>c</sup>	0.155	0.864
<b>Self-perceived risk for HIV/AIDS</b> (low to high risk)	2.98	3.08	0.551 <sup>c</sup>	2.75	2.74	0.966 <sup>c</sup>	2.74	2.60	0.459 <sup>c</sup>	0.055	<b>0.001</b>
<b>Attitudes towards condom use</b> (negative to positive attitude)	3.87	4.01	0.398 <sup>c</sup>	4.11	3.97	0.362 <sup>c</sup>	3.90	4.07	0.286 <sup>c</sup>	<b>0.025</b>	0.707
<b>Condom use self-efficacy</b> (low to high efficacy)	4.11	4.19	0.448 <sup>c</sup>	4.26	4.24	0.828 <sup>c</sup>	4.14	4.20	0.671 <sup>c</sup>	0.103	0.852
<b>Behavioral intentions</b> (not safe to safe)	3.94	3.79	0.295 <sup>c</sup>	3.93	3.92	0.941 <sup>c</sup>	3.88	3.93	0.718 <sup>c</sup>	0.840	0.138
<b>Sexual Risk Scale Norms</b> (low to high strength)	3.73	3.87	0.379 <sup>c</sup>	3.92	3.85	0.583 <sup>c</sup>	3.76	3.87	0.526 <sup>c</sup>	0.105	0.975
<b>Sexual risk behaviors</b>											
Have ever seek sex online	61.5%	59.5%	0.853 <sup>d</sup>	58.3%	44.4%	0.238 <sup>d</sup>	61.3%	44.4%	0.169 <sup>d</sup>	0.875	<b>0.017</b>
Median number of partners in the past 3 months	2	2	0.548 <sup>d</sup>	2	1.5	0.161 <sup>d</sup>	2	1	0.124 <sup>d</sup>	<b>0.046</b>	<b>0.003</b>
<b>Condom use percent/episodes</b> (Receptive/Instructive/Both)											
<b>Total</b>	N=34	N=33		N=35	N=33		N=27	N=33			
<i>Median percent</i>	100%	88.9%	0.428 <sup>d</sup>	93.3%	100%	0.520 <sup>d</sup>	93.3%	100%	<b>0.023<sup>d</sup></b>	0.676	<b>0.006</b>
<b>With unknown status partner</b>	N=26	N=25		N=29	N=23		N=19	N=21			
<i>Median percent</i>	100%	100%	0.377 <sup>d</sup>	100%	100%	0.389 <sup>d</sup>	100%	100%	<b>0.039<sup>d</sup></b>	0.630	0.107
<b>With Positive partner</b>	N=2	N=4		N=3	N=2		N=1	N=2			
<i>Median percent</i>	100%	84.2%	N/A	100%	100%	N/A	100%	100%	N/A	0.472	0.255
<b>With Negative partner</b>	N=17	N=19		N=18	N=15		N=11	N=16			
<i>Median percent</i>	93.3%	94.4%	0.828 <sup>d</sup>	67.5%	66.7%	0.808 <sup>d</sup>	55.6%	100%	0.080 <sup>d</sup>	0.416	0.236

Variable	Baseline			6 month			12 month			p-value <sup>e</sup>	
	Control (N=39)	Intervention (N=37)	p-value	Control (N=36)	Intervention (N=36)	p-value	Control (N=31)	Intervention (N=36)	p-value	Control	Intervention
<b>Drug use</b>											
<i>Smoking</i>	15.4%	16.2%	0.921 <sup>a</sup>	11.1%	16.7%	0.496 <sup>a</sup>	6.5%	16.7%	0.270 <sup>b</sup>	0.475	0.969
<i>Alcohol</i>	56.4%	70.3%	0.211 <sup>a</sup>	50%	61.1%	0.343 <sup>a</sup>	54.8%	61.1%	0.604 <sup>a</sup>	0.739	0.525
<i>Any drug (not including smoking and alcohol)</i>	20.5%	35.1%	0.154 <sup>a</sup>	25%	33.3%	0.437 <sup>a</sup>	19.4%	25.0%	0.580 <sup>a</sup>	0.721	0.334
<i>Poppers</i>	15.4%	29.7%	0.134 <sup>a</sup>	19.4%	11.1%	0.326 <sup>a</sup>	12.9%	13.9%	>0.999 <sup>b</sup>	0.204	<b>0.002</b>
<i>ATS</i>	0%	13.5%	<b>0.024<sup>b</sup></b>	2.8%	11.1%	0.357 <sup>b</sup>	0%	13.9%	0.057 <sup>b</sup>	N/A	0.825

<sup>a</sup> Chi-square test was used to compare proportions between arms

<sup>b</sup> Fisher's exact test was used to compare proportions between arms

<sup>c</sup> Two-sample t-test was used to compare means between arms

<sup>d</sup> Wilcoxon rank-sum (Mann-Whitney) test was used to compare medians between arms

<sup>e</sup> Generalized estimation equation (GEE) was used to investigate the longitudinal trends

**Table 4.**

Logistic regression for association between selected predictors and No CLAI in the past 3 month (reported at month 12 visit)

Predictors	Bivariate analysis			Multivariate analysis		
	Odds Ratio	95% CI	p-value	Adjusted Odds Ratio	95% CI	p-value
<b>Socio-demographics (at baseline visit)</b>						
Age						
28 years old	Ref.					
> 28 years old	1.7	0.5-5.3	0.37			
Education						
Less than bachelor's degree	1.9	0.2-18.7	0.56			
Bachelor's degree or higher	Ref.					
Occupation						
Unemployed/Student	1.1	0.2-6.6	0.93			
Full-time worker	Ref.					
Freelancer / Own business / Part-time worker	0.8	0.2-2.6	0.72			
Monthly Income						
500 USD / No salary	1.5	0.3-9.3	0.64			
501-1,000 USD	Ref.					
> 1,000 USD	0.8	0.2-2.6	0.69			
Relationship status						
Not in relationship	1.8	0.6-5.3	0.32			
In relationship	Ref.					
<b>Risk Behaviors</b>						
Seek sex online						
No	Ref.					
Yes	1.2	0.4-3.4	0.80			
Number of partners						
Single partner	Ref.					
Multiple partners	0.8	0.3-2.3	0.63			
Number of episodes of sexual intercourse *						
1-4 episodes	4.4	1.3-14.5	0.016	4.0	1.1-13.8	<b>0.031</b>
>4 episodes	Ref.			Ref.		
Substance use (include alcohol)						
No	Ref.					
Yes	1.3	0.4-3.9	0.70			
<b>Attitudes</b>						
Self-perceived risk for HIV/AIDS						
Mean or below (low risk)	Ref.					

Predictors	Bivariate analysis			Multivariate analysis		
	Odds Ratio	95% CI	p-value	Adjusted Odds Ratio	95% CI	p-value
Above mean (high risk)	1.3	0.4-3.9	0.67			
Attitudes towards condom use						
Mean or below (negative attitude)	Ref.					
Above mean (positive attitude)	1.3	0.4-3.9	0.67			
Condom use self-efficacy						
Mean or below (low efficacy)	Ref.					
Above mean (high efficacy)	1.7	0.5-5.3	0.37			
Behavioral intentions						
Mean or below (not safe)	Ref.					
Above mean (safe)	1.3	0.4-3.9	0.63			
HIV/AIDS Knowledge						
Mean or below (poor knowledge)	Ref.					
Above mean (good knowledge)	1	0.3-2.9	0.94			
<b>Arm *</b>						
Control	Ref.			Ref.		
Intervention	4.2	1.3-13.4	0.016	3.8	1.1-12.7	<b>0.032</b>

\* For indicated predictors that were selected into multivariate analysis (p-value < 0.20)