SURVEY REPORT

Bio-Behavioral Survey Using Web Based Respondent Driven Sampling Among Men Who Have Sex With Men In Thailand

Kai Noi Survey 2022

EXECUTIVE SUMMARY

This report describes a web-based respondent driven sampling (RDS) survey among men who have sex with men in Thailand. The sampling area comprised the entire country; additionally, in Bangkok only, participants were consented to attend routine clinics for a blood draw for HIV and other testing. A dedicated website functioned as the “RDS survey office” with virtually all features automated, including eligibility screening, consent, interview, coupon issuance, and peer recruitment training. Online interviews were self-administered; coupons and compensation had electronic formats. The primary objectives included to examine the characteristics of such a survey design, in particular its feasibility, sampling speed, geographic coverage of sampling, coupon uptake, fraud attempts, as well as uptake of biomarker testing.

The survey was implemented from February to June 2022. We initiated sampling with 21 seeds (total 35 seeds), a total of 6,207 coupons were issued and 2,287 (36.8%) were redeemed. Sampling reached a maximum of 191 waves, for select indicators (HIV testing, serostatus knowledge, condom use at last sex) convergence was reached though homophily was present to various extent. Sampling covered all 6 regions and 75 out of 77 provinces. Multiple fraudulent enrollments (n=318) were detected and removed from analysis; a further 106 survey records had their main interview data blanked out as their participants did not pass an attention filter question. Our final sample size was 1643. None of the 271 participants residing in greater Bangkok presented for a blood draw at one of the 10 participating clinics.

Kai Noi Survey is an automated online RDS system that was successfully implemented across Thailand at relatively low cost ($22/participant) and was able to produce interview-based weighted estimates for MSM across Thailand. However, key challenges included fraud and a lack of biomarker uptake. We recommend (smaller scale) repeats of the pilot with modifications to the biomarker-related design and strengthened measures against survey fraud. We further conclude that the automated web RDS system is a feasible survey design that may be used for future nation-wide surveys among networked populations with ready access to the internet.

1 Acronyms

ADS	Associate Director of Science
BBS	Bio-Behavioral Survey
BoE	Bureau of Epidemiology
CBO	Community-Based Organization
CDC	Centers for Disease Control and Prevention
DoE	Division of Epidemiology
GoT	Government of Thailand
IEC	Independent Ethics Committee
KP	Key population(s)
MoPH	Ministry of Public Health
HIV	Human Immunodeficiency Virus
IRB	Institutional Review Board
MSM	Men who have Sex with Men
OTP	One Time Password
PEPFAR	US President's Emergency Plan for AIDS Relief
RDS	Respondent Driven Sampling
SOP	Standard Operating Procedures
STI	Sexually Transmitted Infections
VCT	Voluntary Counselling Testing

2 Contents

3 Background

HIV and surveillance in Thailand. HIV/AIDS remains a major public health threat in Thailand, and the epidemic is believed to be most severe among men who have sex with men (MSM).[1] The Division of Epidemiology (DOE) of the Thailand Ministry of Public Health (MoPH) routinely conducts bio-behavioral surveys (BBS) among MSM in Bangkok, Chiang Mai, and Phuket using venue day-time sampling (VDT). Drawbacks of VDT includes that only MSM attending venues can be sampled and that VDT requires major logistical efforts and resources. Respondent Driven Sampling (RDS) is ideal to sample socially networked populations without a sampling frame while facilitating population estimates by estimating respondents' sampling probabilities (Heckathorn, 1997). RDS is widely used for key populations (KP) surveys globally and is being employed for BBS among female sex workers in Thailand.

Rationale for a Web-based RDS design. The rapid growth and use of web-based social media applications geared towards MSM makes HIV service provision, health education, and surveillance related data collection among MSM in cyberspace more important. Web-based RDS (webRDS), i.e., RDS where sampling and – often – data collection takes place in cyberspace, has been used in various populations[2,3,4]. WebRDS offers several potential advantages over conventional, physical, RDS:

- Geographic distances are no longer a consideration (facilitating national-level surveys)
- Sampling may be faster (no need for recruiter and recruit to physically meet for coupon exchange)
- Survey costs may be lower (no need for a survey office, fewer staff needed).

Internet penetration in Thailand for 2019 was estimated at 82%.[5] In a survey among gay men in Thailand (n=277), approximately 80% of respondents reported using social network applications such as Facebook and Jack'd to find partners (Boonchutima, 2016). Internet use is considered ubiquitous among MSM in Bangkok and other urban areas. Line is the most population messenger app in Thailand.[6]

[1] https://www.unaids.org/en/regionscountries/countries/thailand

[2] Safarnejad, Ali, Nguyen Thien Nga, and Vo Hai Son. "Population size estimation of men who have sex with men in Ho Chi Minh City and Nghe An using social app multiplier method." *Journal of Urban Health* 94.3 (2017): 339-349.

[3] Strömdahl, Susanne, et al. "Implementation of web-based respondent driven sampling among men who have sex with men in Sweden." *PloS one* 10.10 (2015): e0138599.

[4] Bengtsson, Linus, et al. "Implementation of web-based respondent-driven sampling among men who have sex with men in Vietnam." *PloS one* 7.11 (2012): e49417.

[5] https://www.internetworldstats.com/stats3.htm

[6] https://www.similarweb.com/apps/top/google/store-rank/th/communication/top-free/

4 Goals and Objectives

Goal. The goal of this survey was to evaluate and demonstrate the feasibility of a web-based RDS survey linked with subsequent HIV-related biomarker collection at pre-determined sites.
Objectives

To **examine the survey characteristics** such as: coupon uptake, sampling speed, sample size, geographic patterns of sampling, bottlenecks[7] and convergence[8], proportion of enrolled respondents with biomarker data, operational feasibility (use of software, electronic payment, automated electronic coupon management), costs, and data quality.

5 Methods Overview

A detailed description of the methods can be found in the annex.

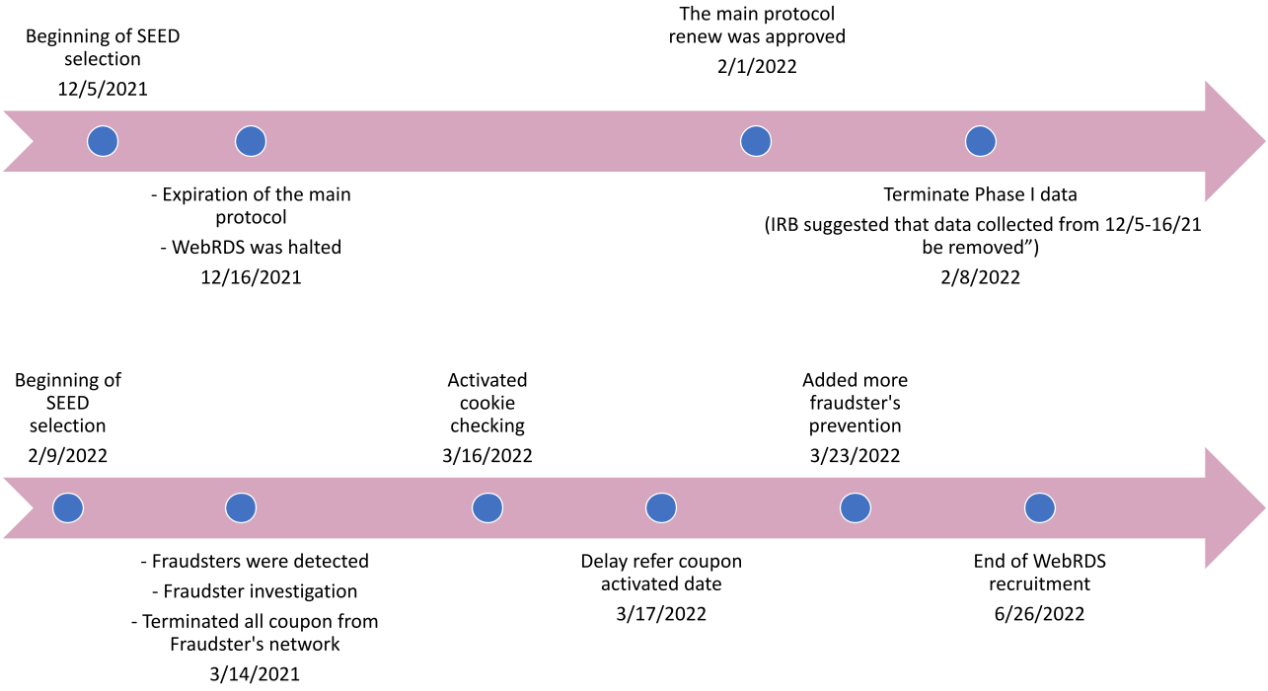
This survey design was also informed through meetings with MSM members from community-based organizations (CBO). CBO members also participated in multiple dry runs of the online systems. Briefly, we conducted a cross-sectional BBS among MSM using an online respondent driven sampling design (webRDS). Seeds were identified in cyberspace using banner ads or micro-messaging. Eligible participants were male and aged 15 years and older, had anal sex with another man in the last six months, resided in Thailand, could read Thai, and presented a valid eCoupon. The sampling area comprised all of Thailand; there was no physical survey office infrastructure. Eligibility screening, consent, interview, coupon issuance, peer recruitment, and compensation were all performed in cyberspace, mostly through coded automation and self-administered. After interview completion, recruits residing in Bangkok (only) were invited to visit one of several HTS clinics for a blood draw and HIV testing. Compensation was offered separately for survey enrollment, peer recruitment, and the biomarker component.

Survey timeline

Below figure (Figure 1) depicts the overall timeline of the survey. After an initial start on 5 December 2021, the survey protocol expired on 16 Dec 2021 all data collection was halted, and the local IRB advised to purge all data collected until that date. The protocol was renewed in February 2022, new seeds were identified, and sampling was re-started. All data and findings shown here are based on data collected from February onwards.

[7] Bottlenecks: A social network specific term indicating clustering within the entire social network whereby the frequency of characteristics of interest differs across clusters.
[8] Convergence: Convergence is reached at a point in sampling when the weighted proportion of an outcome of interest no longer changes, i.e., is independent from the seed characteristics (of the same outcome).

Figure 1. Survey timeline, Kai Noi Survey, 2021-2022.



6 Result - Sampling

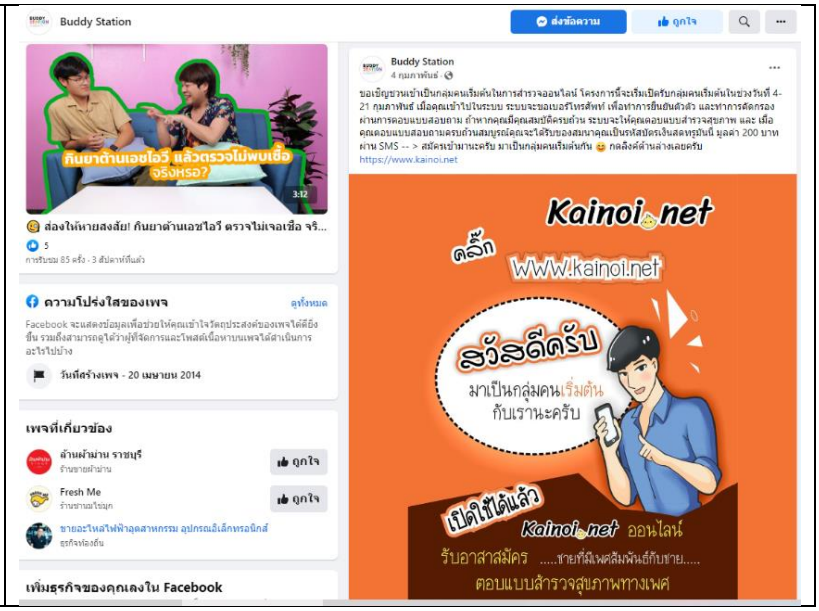
6.1 Seeds

Initial seeds were recruited through various social media to initiate and sustain recruitment. Seeds had to meet all eligibility criteria and a set number of seeds were sought from each region.

Identifying seeds. Seeds were identified in cyberspace using methods described below .

Micro messaging. Below screen shot shows a micro messaging example used in BlueD ("*Kainoi.net*"), a gay social media app,. This messaging approach was used five times from February through May. Users could click on such messages and would then get directed to our survey website and if they affirmed their interest to join the survey were then taken to the seed eligibility screen.

Banner ads. The survey also used banner ads such as those shown below in BlueD and Buddy Station ("*Kainoi.net*"), with the same function for seed identification as described above.



Chatroom. Survey staff or volunteers engaged candidate seeds at various day/night times through interaction in Pink Monkey chatrooms (image below) in February 2022. Candidates expressing interest in the survey were provided with a link to the survey to assess their eligibility.

Seed sampling characteristic. The table below (Table 1) shows key statistics that led to the final sample of 35 seeds. The survey was started with 21 seeds; 14 more seeds were added during sampling to increase sampling. Please see the annex for more details regarding seed eligibility.

Table 1. Seed screening and eligibility		
No. starting seed eligibility interview	673	100.0%
No. ineligible	390	57.9%
No. not completing eligibility interview	248	36.8%
No. eligible	35	5.2%
No. seeds consenting	35	100%
No. seeds at start of survey	21	60.0%
No. seeds added during survey	14	40.0%

Waves and seed-specific sample sizes. The table below (Table 2) shows the sample sizes and number of waves achieved by seed. Of the 35 seeds, 22 did not recruit any eligible peer, 5 seeds reached only wave 1, etc., whereas 1 seed led to 191 waves and accounted for 88.6% of the sample.

Table 2. Number of waves and sample size by seed			
No. seeds	**Max No. waves reached**	**Sample size by seed**	**Sum**
22	0	22*1	22
5	1	3,4,2,2,3	14
2	2	5,3	8
2	3	5,12	17
1	4	18	18
1	15	48	48
1	18	73	73
1	191	1,549	1,549
35 (total)	**N/A**	**1,749 (total)**	**1,749 (total)**

6.2 Coupons

Overall coupon uptake was 37% (as Table 3 below), a proportion typical for RDS surveys. Given the electronic format of the coupons, more than a thousand coupon IDs were re-submitted but rejected as such. In addition, 243 invalid (non-existing) coupon IDs were redeemed which also did not lead to any survey enrollment.

Table 3: Coupon distribution		
	N	%
Coupons distributed	6,207	100%
Coupons redeemed	2,287	36.8%
Coupons unredeemed	3,920	63.2%
Duplicate coupon ID redeemed	1,008	N/A
Invalid coupon ID	243	N/A

6.3 Recruitment

Sampling began on 9-Feb-2022 and ended on 30-Jun-2022

Eligibility. One of the first checks included whether the internet-enabled device used by the candidate participant had an IP address in Thailand. Shown below (Figure 2) are examples where candidates were deemed ineligible because they appeared to reside outside Thailand (in these examples, in Lao PDR and the US, respectively). The Kai Noi system recorded 464 invalid log-in attempts due to IP addresses located outside Thailand, using invalid coupon codes, or using previously registered phone numbers.

Figure 2. Examples of Kai Noi website messaging indicating hypothetical logins from outside Thailand.

There were 2,455 valid log-ins leading to screening for eligibility, of these, 2,151 passed the eligibility screening, 13 were not eligible, and 291 aborted the screening before it was completed.

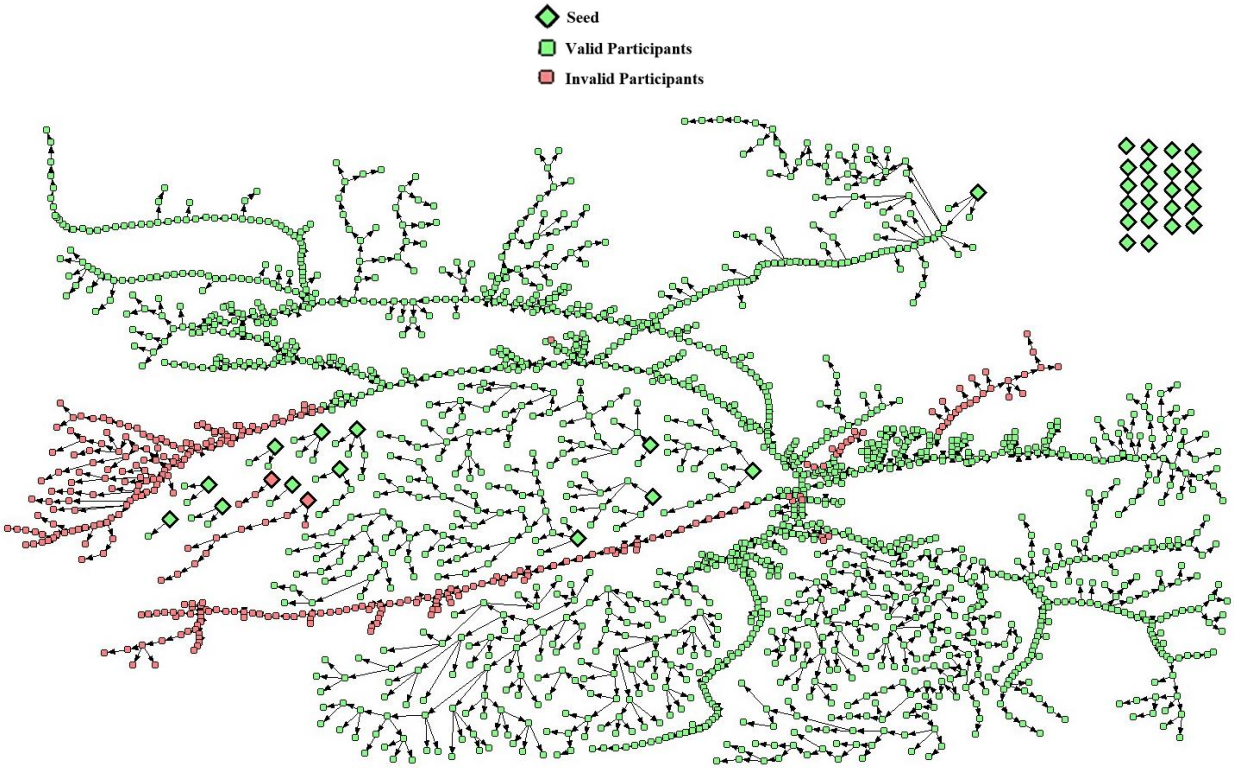
Survey fraud

Staff found that some participants had re-enrolled in the survey by using additional mobile phone numbers. These phone numbers belonged to non-participants. Anecdotally, it appears that fraudulent participants had borrowed or rented other people's phone numbers and so could re-enroll in the survey and repeatedly claim compensation. Survey staff compiled a list of all suspicious phone numbers and enrollments. These records were excluded from analysis.

Recruitment tree

The graph below (Figure 3) displays the recruitment tree, including "participants" who were later classified as fraudulent enrollments. Noteworthy are the very long recruitment chains as well as the lack of "branches" (multiple recruitments by a single recruiter).

Figure 3. Recruitment tree, including both fraudulent (invalid) and valid participants.



The embedded video files below (Figure 4) show the distribution of survey enrollment across space and time in Thailand. As shown, sampling was swift and covered all regions in Thailand. Sampling dried out on its own, especially after anti-fraud measures were added, such as delayed coupon activation.

Figure 4. Recruitment across space and time (video file)

Valid participants only (yellow color: seeds)

Spatiotemporal recruitment - Valid pa

Valid and **invalid** (fraudulent) participants

Spatiotemporal recruitment - Valid an

The distribution of recruits across Thailand's six regions is shown below (Table 4). Participants in all regions were sampled. Embedded in the Central Region is greater Bangkok, where, across 6 provinces, a total of 271 participants were sampled (as Table 5 below).

Table 4. Sampling by Region

Region	n	%
1.North	336	19.2%
2.Central	653	37.3%
3.North-East	378	21.6%
4.West	220	12.6%

Table 5. Sampling by Greater Bangkok province

Province	n	%
Bangkok	163	60.1%
Nonthaburi	25	9.2%
Nakhon Pathom	7	2.6%

5.East	74	4.2%
6.South	88	5.0%
Total	**1749**	**100%**

Pathum Thani	44	16.2%
Samut Prakan	29	10.7%
Samut Sakhon	3	1.1%
Total	**271**	**100%**

6.4 Homophily, convergence, bottlenecks

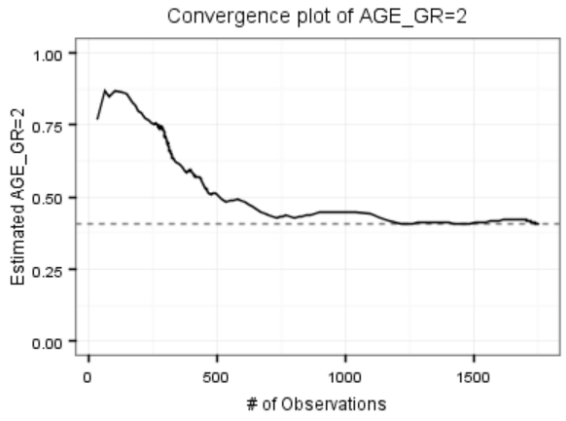
Below table (Table 6) shows **homophily** by select characteristics (homophily is a metric describing the degree of recruiting peers with similar (>1) or opposite/dissimilar (<1) traits). There was substantial homophily for age, residence, internet enabled device type, and timing of last HIV test, but little homophily for condom use at last sex and browser type.

Table 6. Homophily by select charcateristics

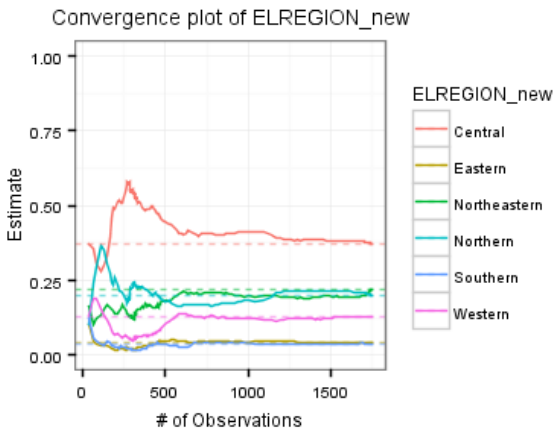
Trait	Categories	Homophily	P value
Age	15-19, 20+ years	1.72	<0.0001
Residence	Region 1 through 6	1.86	<0.0001
Device type	Mobile, desktop	1.66	<0.0001
Browser type	Safari, Chrome, Mozilla, Other	1.29	<0.0001
HIV tested	Last 12 mths, >12 mths ago, never	1.98	<0.0001
Condom use at last sex	Yes, No	1.08	<0.0001

Convergence. Convergence for select key characteristics is shown below (Figure 5) and was generally reached only after a sample size of several hundred participants was reached.

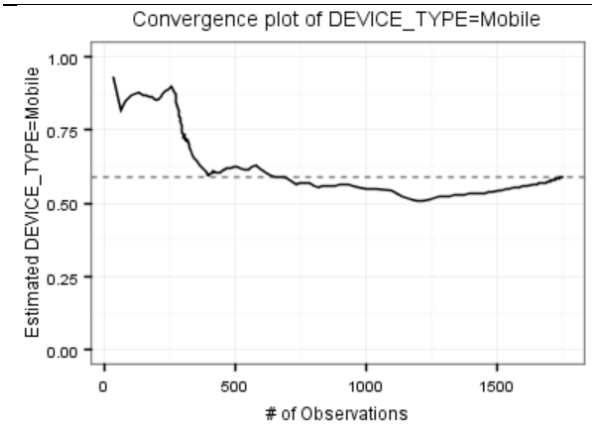
Figure 5. Convergence for select sample characteristics



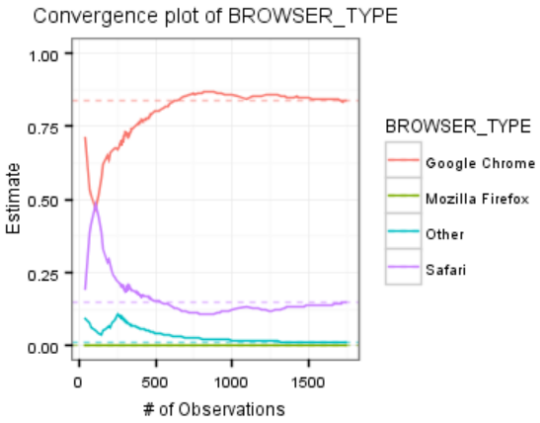
Graph above: Convergence for the age group 20+ years.



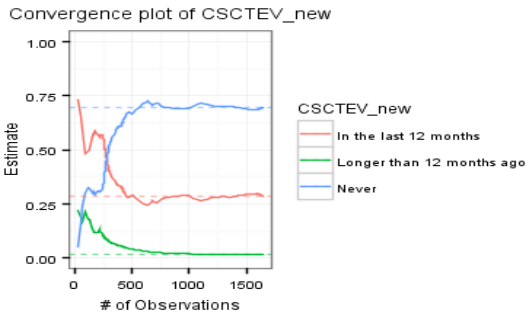
Graph above: Convergence for residence by Region.



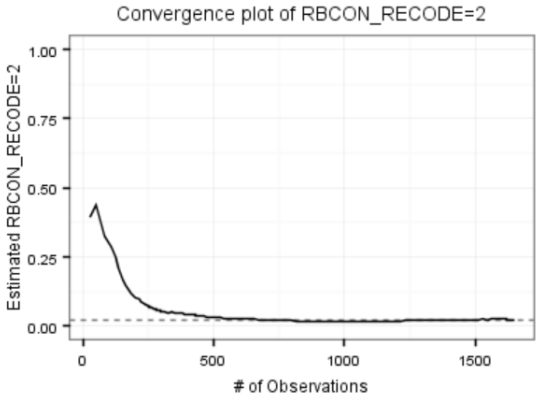
Graph above: Convergence for the proportion using a mobile device for survey enrollment.



Graph above: Convergence for the internet browser type used for survey enrollment

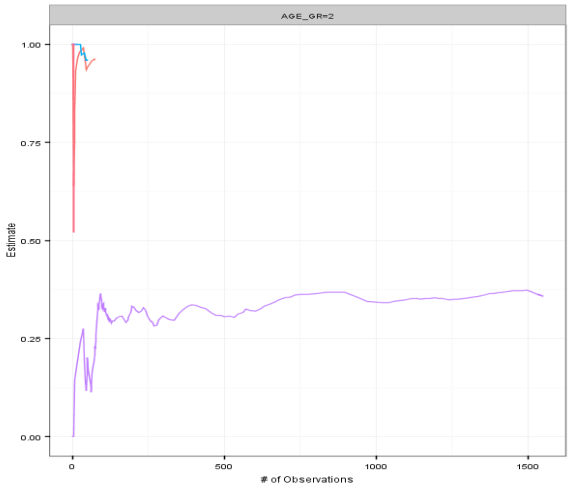


Graph above: Convergence for HIV testing history.

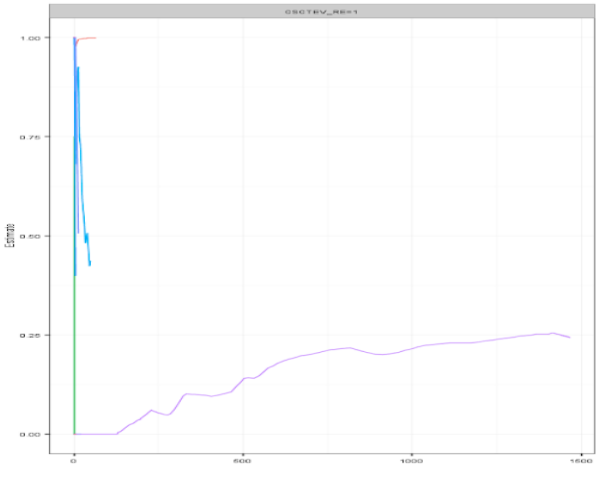


Graph above: Convergence for condom use at last sex.

Bottleneck graphs. The two graphs below depict bottleneck graphs for age and HIV testing history, respectively. Since a large proportion of the sample size infers from a single seed, these graphs have limited utility.



Graph above: Bottleneck graph for age group.



Graph above: Bottleneck graph for having tested for HIV in the last 12 months.

6.5 Recruitment pattern by device

The table below (Table 7) displays the **recruitment dyads by device used**, separate for valid and invalid recruits. Among valid recruits close to 90% of recruitment dyads used either both desktop machines or both mobile phones. Among invalid recruitment dyads, close to 95% used the same type of device and three quarters of recruitments took place between mobile phones only, a much larger proportion than among valid recruitment dyads.

Table 7. Peer-peer recruitment by device type and recruit status

	Recruit Status				
Device recruitment relationship	Valid		Invalid		Total
	n	%	n	%	
Desktop-Desktop	528	30.8%	64	20.1%	592
Desktop-Mobile	75	4.4%	8	2.5%	83
Mobile-Desktop	102	6.0%	9	2.8%	111
Mobile-Mobile	1009	58.9%	237	74.5%	1246
Grand Total	1714		318		2032

Valid: Genuine survey participant; Invalid: Fraudulent survey participant

The **average time to recruitment** was substantially smaller for invalid recruitment (201 min.) than for valid recruitments (592 min., as Table 8 below). Among valid recruitments, average time to recruitment was shortest for desktop-desktop relationships (325 min.) and longest for mixed device types (991 and 942 min.). Minimum and maximum recruitment times did not differ by validity status.

Table 8. Time to recruitment (minutes) by device relationship and validity

	Average	Max	Min	Std.Dev.
Valid	**592.2**	**19995.0**	**0.8**	**1899.9**
Desktop-Desktop	324.9	19884.7	0.8	1284.1
Desktop-Mobile	991.0	17785.3	1.0	3161.9
Mobile-Desktop	941.9	19995.0	2.0	2649.6
Mobile-Mobile	667.1	18715.8	1.3	1941.0
Invalid	**200.9**	**4245.9**	**1.5**	**469.5**
Desktop-Desktop	105.6	1004.8	2.6	210.5
Desktop-Mobile	886.1	2539.6	9.6	1091.0
Mobile-Desktop	273.8	1047.4	4.3	414.1
Mobile-Mobile	200.7	4245.9	1.5	473.9
Grand Total	**531.0**	**19,995.0**	**0.8**	**1,760.4**

Note: Time-to-recruitment is calculated in minutes from coupon issuance to coupon receipt. Valid recruitment: No sign of fraud; invalid: fraud detected, excluded from main data analysis. Std. Dev.: Standard deviation.

6.6 Degree

The mean degree values (i.e., participants' personal network sizes) for the cascading degree interview steps were remarkable "flat" (as Table 9 below), i.e., did not significantly decrease in size, suggesting that almost all the peers known by recruits were likely eligible for survey participation. It further suggests that almost all social network members of our survey participants also use the internet (Question #2)

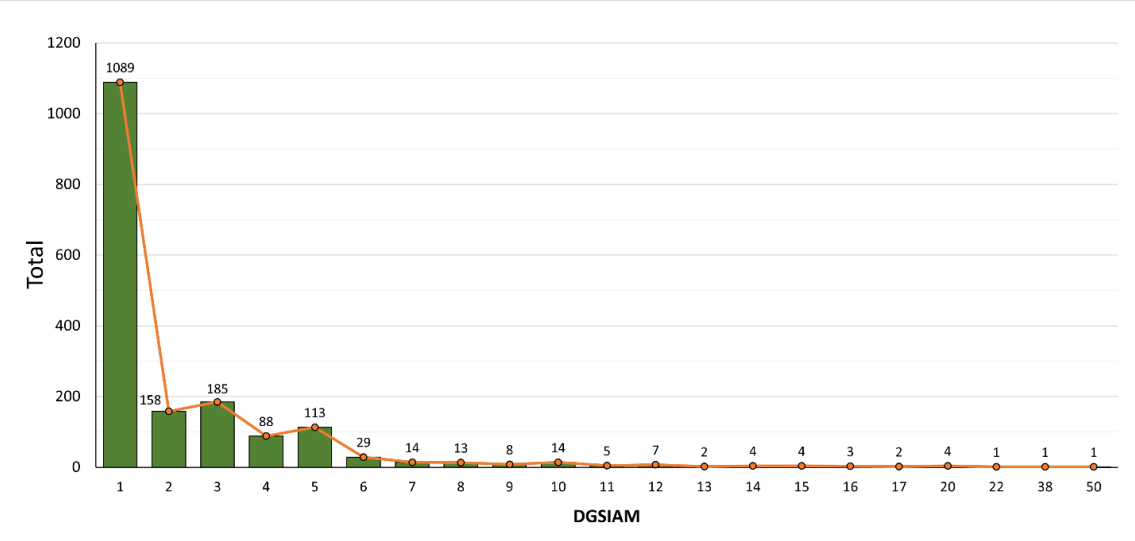
	Table 9. Mean values for individual degree questions	Mean value
1.	No. MSM you know and have been in contact with in the last 7 days (online or offline)?	2.35
2.	How many of these use the internet or social media?	2.33
3.	Of these, how many are aged 15 years or older?	2.31
4.	Of these, how many live in Thailand?	2.30

Final degree distribution was as shown below (Table 10):

Table 10. Distribution of degree values. N=1,749.	Mean	St. Deviation	25th Percentile	75th Percentile	Min	Max
Thailand	2.30	2.83	1	3	1	50
Bangkok only	3.69	3.91	1	5	1	20

The graph below (Figure 6) shows the distribution of the final degree in more detail. Quite surprisingly, it shows that most participants have a final degree value of 1, with little evidence of heaping. The low degree values may also be a reflection of the relatively short recall time ("7 days").

Figure 6. Distribution of the final degree values



7 Results – MSM Characteristics

7.1 Setting the final data set

The table below shows key quantities and characteristics leading to the final data set for analysis. We recorded 464 invalid log-in attempts using either invalid codes or previously used phone numbers. A total of 2,455 persons logged in successfully and initiated the eligibility screening interview. Of these 2,151 were deemed eligible and proceeded to the consent stage, of which 99.6% consented and in turn proceeded to the main interview. The main interview was completed by 2,067 participants. Of these, 318 records were retroactively recognized as fraudulent (invalid) participants and were removed from the data set (none of the 318 invalid "recruits" peer-referred a genuine recruit, i.e., their removal did not lead to breaks in the recruitment chains), leaving **1,749 valid participants**.

Of these, we set the main interview data to missing for 106 records: These 106 participants did not pass the **attention filter question** (see questionnaire in annex, CSATT) and so their other response values in the main interview were deemed unreliable. We also applied a **"straight-lining" analysis** whereby we examined nine consecutive questions that were not subject to skip-by-design patterns. One participant responded to all nine questions with the same value which was deemed highly unlikely to be a valid response pattern, leading to the decision to set his main interview data to missing. This same participant also did not pass the attention filter question, hence the set-to-missing for this record did not alter the total number of records set to missing (n=106). These 106 records remained in the data set for analysis however (along with their eligibility and degree response values) in order to avoid numerous breaks in the transmission chains. This resulted in a data set with **1,643 records with non-missing data in the main interview (Table 11)**.

Table 11 . Setting the final sample and data set

Details	**N**	**%**
Invalid log-in (invalid code or phone number)	464	N/A
Eligibility screening	2,455	100%
Not eligible	13	0.5%
Not completed	291	11.9%
Eligible	2,151	87.6%
Consented to join survey	2,142	99.6%
Did not consent	9	0.4%
Main interview, (among *consenters*)	2,142	100%
Not completed	75	3.1%
Completed	2,067	96.9%
Participant validity	2,067	100%
Invalid participants (fraudulent enrollment)	318	15.4%
Valid participants (genuine participants)	1,749	84.6%
Data validity	1,749	100%
Invalid records (failed attention filter, set to missing)	106	6.1%
Valid records (contributing data to analysis)	1,643	93.9%

Main interview metrics

The online main interview (see further below for the detailed instrument) was short in length[9], self-administered, and offered in Thai. Data domains included basic demographics, social network size, recruiter-recruit relationship, HIV testing history, HIV treatment, PrEP, HIV risk behaviors, cyberspace usage, and questions pertaining to population size estimation (multiplier method). Pre-programmed data checks and skip patterns were used as warranted.

7.2 Demographic characteristics

The table below (Table 12) shows key demographics among MSM in Thailand. As with other MSM surveys, age was skewed towards younger MSM, with a mean age of 21.5 years (median: 20, interquartile range: 19-24, range: 15-56). (Age was probed as part of the eligibility screening, separate from the main interview, hence the sample size of 1,749)

Table 12. Age distribution. N=1,749	Unweighted		Weighted		
	n	%	L95%CI	Point	U95%CI
15-19	807	46.1%	50.3%	59.3%	68.3%
20-24	552	31.6%	20.9%	25.9%	30.8%
25-29	315	18.0%	7.8%	11.5%	15.2%
30-34	33	1.9%	0.5%	1.3%	2.0%
35-39	31	1.8%	0.0%	1.8%	3.5%
40-44	6	0.3%	-0.1%	0.2%	0.5%
45-49	3	0.2%	0.0%	0.1%	0.1%
50+	2	0.1%	-0.3%	0.1%	0.5%

Most (83%) of Thailand's MSM have completed high school; with an 14% having attained more advanced educational degrees (as Table 13 below).

Table 13. Highest educational status attained. N=1,643	Unweighted		Weighted		
	n	%	L95%CI	Point	U95%CI
No schooling	14	0.9%	-0.8%	0.5%	1.8%
Secondary school	39	2.4%	0.9%	2.7%	4.5%
High school	1138	69.3%	75.8%	83.0%	90.3%
Diploma	98	6.0%	2.2%	3.8%	5.4%
Bachelor	233	14.2%	3.0%	6.1%	9.3%
Master's	119	7.2%	1.2%	3.9%	6.5%
Higher than Master's	2	0.1%	0.0%	0.0%	0.1%

[9] The recommended length of online interviews is often cited as 5 or 10 minutes.

Our question on what kind of work MSM pursue was not fully informative as 70% (weighted) stated "other", followed by being a student (17%).

	Unweighted		Weighted		
Work (N=1,643)	n	%	L95%CI	Point	U95%CI
Unemployed	60	3.7%	-0.9%	1.3%	3.5%
Farmer	9	0.5%	0.1%	0.7%	1.2%
Own business	1	0.1%	0.0%	0.0%	0.0%
Officer	2	0.1%	0.0%	0.0%	0.0%
Laborer	8	0.5%	0.0%	0.2%	0.4%
Employee	99	6.0%	1.3%	2.7%	4.2%
Merchant	67	4.1%	1.0%	2.1%	3.2%
Governor	97	5.9%	1.5%	3.7%	5.9%
Student	320	19.5%	9.6%	16.9%	24.2%
Domestic work	35	2.1%	0.4%	1.1%	1.7%
Sex work	18	1.1%	0.2%	0.7%	1.2%
Other	927	56.4%	58.8%	70.6%	82.4%

7.3 Online behavioral characteristics

More than 90% (weighted) of MSM use the internet to find sex, sell sex, and or buy sex. Very few MSM use the internet to "learn about HIV or use HIV services" (as Table 14 below).

Table 14. Reasons to use the internet	Unweighted		Weighted		
(Multiple choice format)	n	%	L95%CI	Point	U95%CI
To find sex	1,451	88.3%	85.9%	89.3%	92.6%
To sell sex	74	4.5%	1.0%	1.7%	2.4%
To buy sex	35	2.1%	0.3%	0.6%	0.9%
To learn about HIV or use HIV services	35	2.1%	0.3%	0.6%	0.9%
To pay or receive money	259	15.8%	12.0%	16.1%	20.1%
To play games	1,006	61.2%	61.3%	68.1%	74.9%

BlueD, a gay-friendly social media app is the dominant app used by MSM in Thailand (as Table 15 below), followed by Facebook.

Table 15. Social media apps MSM have profiles on or enrolled in (multiple choice question), N=1,643	Unweighted		Weighted		
	n	%	L95%CI	Point	U95%CI
Blued	1,103	67.1%	64.6%	77.6%	90.5%

Grindr	75	4.6%	1.2%	3.0%	4.8%
Hornet	92	5.6%	1.4%	2.6%	3.9%
Jack'd	71	4.3%	0.6%	2.1%	3.5%
Gay Romeo	286	17.4%	3.6%	9.0%	14.4%
Tinder	445	27.1%	11.6%	16.7%	21.8%
Facebook	779	47.4%	32.3%	39.5%	46.6%
Line	555	33.8%	14.6%	20.8%	27.0%
Instagram	417	25.4%	13.0%	17.0%	21.1%
Twitter	494	30.1%	14.7%	18.5%	22.2%

The table below (Table 16) shows the proportion of MSM who have either one or more than one profile on select social media apps. On BlueD, the most important app for gay men in Thailand almost all MSM only have a single profile. However, the picture is more varied for other apps, including Grindr, Jack'd and Hornet where the majority of users have more than one profile.

Table 16. No. of profiles MSM have on social media. N=1643.

	No. Profiles	Unweighted		Weighted		
		n	%	L95%CI	Point	U95%CI
Blued	1	977	88.6%	92.8%	96.5%	100.0%
	2+	126	11.4%	-0.3%	3.5%	7.2%
Grindr	1	30	40.0%	5.9%	57.9%	100.0%
	2+	45	60.0%	-9.8%	42.1%	94.1%
Hornet	1	42	45.7%	22.8%	45.8%	68.8%%
	2+	50	54.3%	31.2%	54.2%	77.2%
Jack'd	1	26	36.6%	-7.1%%	38.6%	84.3%
	2+	45	63.4%	15.7%	61.4%	100.0%
Gay Romeo	1	219	76.6%	71.5%	79.9%	88.2%
	2+	67	23.4%	11.8%	20.1%	28.5%
Tinder	1	304	68.8%	72.5%	78.5%	84.6%
	2+	138	31.2%	15.4%	21.5%	27.5%
Facebook	1	473	61.1%	69.2%	78.5%	84.6%
	2+	301	38.9%	12.6%	21.7%	30.8%
Line	1	371	66.8%	68.8%	75.3%	81.8%
	2+	184	33.2%	18.2%	24.7%	31.2%
Instagram	1	262	63.1%	65.3%	74.5%	83.6%
	2+	153	36.9%	16.4%	25.5%	34.7%
Twitter	1	269	54.7%	57.6%	65.4%	73.2%
	2+	223	45.3%	26.8%	34.6%	42.4%

7.4 Risk behavior

Age at first anal sex. The mean age Thai MSM had their first same sex experience was 16.9 years, with an inter-quartile range of 15-19 and a range of 8-27 years.

Below table (Table 17) illustrates that a large proportion of MSM attend gay-friendly venues, with more than 80% doing so several times a week or more and only 3% doing so rarely.

Table 17. Frequency of visits to gay or TG friendly venues such as saunas, clubs, bath houses, or bars. N=1,643	Unweighted		Weighted		
	N	%	L95%CI	Point	U95%CI
Not even once a month	74	4.5%	0.7%	2.6%	4.5%
About once a month	80	4.9%	1.2%	2.5%	3.9%
About once a week	203	12.4%	6.3%	8.7%	11.1%
Several times a week	1,095	66.6%	70.5%	76.9%	83.3%
Almost every day	143	8.7%	2.8%	6.4%	10.0%
No answer	48	2.9%	-1.3%	2.9%	7.0%

About 1 in 10 of Thai MSM bought sex from other men in the preceding 12 months (as Table 18 below).

Table 18. Buying sex from men. N=1,643	Unweighted		Weighted		
	n	%	L95%CI	Point	U95%CI
Yes, in the last 12 months	376	22.9%	7.2%	11.0%	14.8%
Yes, but more than 12 months ago	62	3.8%	1.8%	2.7%	3.5%
Never bought sex	1,205	73.3%	82.2%	86.3%	90.5%

Similar to above, fewer than an estimated 5% of MSM had been selling sex in the preceding 12 months, and more than 90% stated never having sold sex to other men (as Table 19 below).

Table 19. Selling sex to other men. N=1,643	Unweighted		Weighted		
	n	%	L95%CI	%	U95%CI
Yes, in the last 12 months	211	12.8%	2.7%	4.5%	6.2%
Yes, but more than 12 months ago	52	3.2%	1.1%	1.9%	2.6%
Never sold sex	1,380	84.0%	91.6%	93.7%	95.8%

About 95% of MSM reported multiple same sex partners in the preceding three months. Some three quarters had three to five same sex partners, and a small minority reported more than six same sex partners (as Table 20 below).

Table 20. No. same sex partners in the preceding 3 months. N=1,643	Unweighted			Weighted	
	n	%	L95%CI	%	U95%CI
One	88	5.4%	2.2%	4.7%	7.1%
Two	319	19.4%	12.2%	16.3%	20.4%
Three to five	1,170	71.2%	72.0%	77.5%	83.0%
Six to ten	46	2.8%	0.5%	1.2%	1.8%
More than ten	20	1.2%	0.1%	0.4%	0.7%

Self-reported condom use at last sex was very high at an estimated 98% (as Table 21 below).

Table 21. Condom use at last same sex act. N=1,643	Unweighted			Weighted	
	n	%	L95%CI	%	U95%CI
Yes	1,554	94.6%	95.8%	97.6%	99.4%
No	89	5.4%	0.6%	2.4%	4.2%

Almost half (46%) of MSM ever had sex with a woman, although few (4.0%) did so in the preceding 12 months (as Table 22 below).

Table 22. Sex with women. N=1,643	Unweighted			Weighted	
	n	%	L95%CI	%	U95%CI
Yes, in the last 12 months	108	6.6%	1.8%	4.0%	6.2%
Yes, but more than 12 months ago	571	34.8%	34.3%	42.0%	49.7%
Never	964	58.7%	46.4%	54.0%	61.7%

The proportion of MSM who report injecting drugs in the preceding year was low at 0.3% and 1.0% for ever having injected drugs (as Table 23 below).

Table 23. Injecting drug use. N=1,643	Unweighted			Weighted	
	n	%	L95%CI	%	U95%CI
Yes, in the last 12 months	8	0.5%	0.0%	0.3%	0.6%
Yes, but more than 12 months ago	17	1.0%	0.4%	1.0%	1.6%
Never	1,618	98.5%	98.0%	98.7%	99.3%

7.5 Service uptake

HIV testing

Two out of three MSM (69.8%) stated never having tested for HIV; among those who ever tested for HIV, most have done so within the last 12 months (as Table 24 below).

Table 24. Timing of last HIV test (N=1,643)	Unweighted		Weighted		
	n	%	L95%CI	Point	U95%CI
In the last 12 months	675	41.1%	11.7%	28.7%	45.7%
Longer than 12 months ago	54	3.3%	0.4%	1.5%	2.6%
Never tested for HIV	914	55.6%	52.1%	69.8%	87.5%

By far the most important reason for not having ever tested was the “fear of stigma” (as Table 25 below).

Table 25. Main reason for never having tested (N=1,643)	Unweighted		Weighted		
	n	%	L95%CI	Point	U95%CI
I feel i am not at risk for HIV	40	4.4%	-2.5%	1.6%	5.7%
Fear of positive result	14	1.5%	0.1%	0.7%	1.3%
No money to get tested	12	1.3%	0.0%	0.1%	0.3%
No time to get tested	16	1.8%	-0.5%	0.4%	1.4%
Fear of stigma	832	91.0%	91.9%	97.1%	100%

Only one participant stated his last HIV test result was HIV-positive; this small proportion is surprising and most likely reflects some degree of non-disclosure, despite the very young age distribution and the large proportion of never-testers (as Table 26 below).

Table 26. Last HIV test result. N=728	Unweighted		Weighted		
	n	%	L95%CI	Point	U95%CI
Negative	728	99.9%	99.8%	99.9%	99.9%
Positive	1	0.1%	0.1%	0.1%	0.2%
Don’t know	0	0.0%	0.0%	0.0%	0.0%

On average MSM last tested HIV-negative 8.5 months ago (IQR: 3-13, range: 0-26). The one participant who reported having tested HIV-positive also reported being on ART (Data not shown).

Pre-exposure prophylaxis

The estimated proportion of self-reported HIV-negative MSM who have heard about PrEP is very high at 96% (as Table 27 below).

Table 27. Has heard about PrEP. N=728.	Unweighted		Weighted		
	n	%	L95%CI	Point	U95%CI
Yes	676	92.9%	88.2%	95.6%	100%
No	52	7.1%	-2.9%	4.4%	11.8%

Similarly, close to 90% of MSM who have heard about PrEP are actually using PrEP (as Table 28 below).

Table 28. Currently using PrEP. N=676.	Unweighted		Weighted		
	n	%	L95%CI	Point	U95%CI
Yes	612	90.5%	80.1%	89.4%	98.8%
No	64	9.5%	1.2%	10.6%	19.9%

Of these not currently using PrEP, few have used it recently or ever (as Table 29 below).

Table 29. PrEP use among MSM not currently using PrEP. N=64.	Unweighted		Weighted		
	n	%	L95%CI	Point	U95%CI
Used in the last 6 months	4	6.3%	1.2%	2.6%	3.9%
Last used more than 6 months ago	7	10.9%	2.6%	7.5%	12.5%
Never used	53	82.8%	84.7%	89.9%	95.1%

Among those who never used it, most don't feel at risk (as Table 30 below).

Table 30. What is the main reason you never took PrEP?	Unweighted		Weighted		
	n	%	L95%CI	Point	U95%CI
Don't know about it	1	1.9%	0.0%	0.3%	0.7%
Don't know where to get prep	4	7.5%	1.7%	5.4%	9.1%
Embarrassed to ask for it	3	5.7%	-1.0%	1.6%	4.3%
Don't feel at risk	36	67.9%	64.9%	81.2%	97.6%
Afraid of side effects	4	7.5%	-1.7%	4.9%	11.5%
Don't want others to know	5	9.4%	-3.8%	6.5%	16.9%

8 Discussion

8.1 Survey results

Our final sample size of over 1,600 participants covered all regions and almost all provinces in Thailand. As seen with conventional RDS, sampling was dominated by younger, relatively well educated MSM. The occupational background remains largely unclear as most MSM reported "other", followed by being current student. A large proportion of MSM use the internet to "find" sex, a reminder for public health authorities to use cyberspace to engage MSM for safe sex and HIV prevention messages.

Of potential importance are the estimates for social media apps as these estimates can inform the reach of public health messaging across various apps. Among apps probed, the most frequently used app appears to be BlueD, followed by Facebook. This survey also confirms that (young) MSM continue to use offline venues such a saunas, bars and clubs several times a week. HIV risk behaviors were confirmed in several dimensions, including buying and selling sex, as well as having multiple sex partners (for most MSM, 3-5 partners in the preceding 3 months). A positive finding was the very high proportion of sex acts protected by condoms (98%).

Of concern is the large proportion of MSM who never tested for HIV (70%) even though this survey oversampled younger MSM, with "fear of stigma" being the most cited reason for not testing. Among those who did test and reported an HIV-negative test result, awareness and current use of PrEP is very high (>80%).

8.2 Successes

1. **Survey design**. The team created a fully functional virtual RDS system that replaced all essential elements of a brick-and-mortar RDS survey offices, including checking coupon validity, eligibility screening, consent, interview, coupon issuance, peer recruitment training, and compensation.
2. **Survey implementation**. Sampling was relatively fast and covered the entire country. Costs were substantially lower than typical "offline", physical RDS surveys (see appendix 14. Survey Expenditures).
3. **Data quality**: Despite the very rapid interview completion by most recruits, the data quality is satisfactory, suggesting minimal or few coding errors by programmers and little inattention by recruits.
4. **Re-use of coded webRDS**. The code is available and can be re-deployed with minimal preparatory effort within Thailand, i.e., can easily be adapted for other populations of interest, especially other key populations. The code can also be used outside Thailand assuming IT expertise is available to adapt the survey to a different geographic setting.

8.3 Challenges and possible solutions

Several key challenges are noted below. While these are substantial, the investigators believe these can be largely overcome or at least ameliorated.

Self-reported HIV status. Only one participant self-reported an HIV-pos result, which is not credible for a sample size of 1,643 and a country like Thailand where the estimated HIV prevalence among MSM is approximately 11%, suggesting that participants were reluctant to report a previous HIV-positive result. It is not clear whether this discrepancy is specific to our web-based design or should be expected in MSM surveys in Thailand. Measures need to be taken to improve self-reporting of HIV-positive status. Recommendations include: 1) Using multiple questions to inform this single indicator (self-reported HIV status, e.g., (not necessarily in adjacent order):

1. "*Has a health care provider ever told you that you have HIV?*"
2. "*Are you or have you ever taken treatment for HIV?*"
3. "*Have you ever tested HIV-positive?*"
4. "*What was the result of your last HIV test?*"

Any affirming/"positive" answer would then set the HIV status to positive. Only if all questions are responded in the negative would the HIV status be set to negative.

Interview data quality in general. Consider:

- Setting a **minimum amount of time** before a participant may select an answer, e.g., 3 or 5 sec, or set a minimum time proportional to the individual question and answer word count (e.g., 1 sec for each 5 words). However, as this report shows, there are no major concerns regarding interview data quality save for a few exceptions such as self-reported HIV status.
- **Re-assess the simplicity and clarity of question-and-answer** phrasing which is of paramount importance for self-administered interviews.

Fraud. Any survey offering compensation for participation faces the risk of fraud. Survey staff suspected and eventually confirmed large scale fraud when a participant contacted the survey staff with questions that appeared odd to our staff. Over 300 fraudulent enrollments were detected despite multiple security measures to prevent such fraud. From an analysis point-of-view the fraud cases in our survey represented mostly a loss of funds (paid-out compensation) and, assuming we identified all fraudulent "participants", did not compromise the quality of the data set as we simply removed fraudulent enrollments from the data set for analysis; also because (unsurprisingly) none of the fraudulent "recruits" peer-referred valid recruits, i.e., did not break recruitment chains.

We recommend additional measures to minimize and prevent such fraudulent enrollments in the future, such as:

- **Seeds**:
  - **Identify seeds offline** among trusted and known members of the community (e.g., CBO members) rather than online (banner ads or micro messaging)
  - If identifying seeds online (banner ads, micro messaging), **remove all text promising monetary compensation** (communicate compensation during the consent process only).
- **Eligibility**:

- Expand the eligibility interview to include 2-3 questions to further verify target population membership. E.g., for an MSM survey probe ask candidate participants' knowledge about their community, such as:
  - Which of the following is not a social app gay men use:
    1. Romeo
    2. BlueD
    3. Angel
    4. Grindr
    5. Jack'd

  Accept only candidates who e.g., correctly answered such questions. Rotate different question sets for increased utility. This approach may not help prevent the fraud cases but will ensure that only eligible participants enroll in the survey.

- **Use interview response values for additional authentication**. E.g., send during or shortly after the interview a link to the registered LineID, which directs the user to a Kai Noi website where one or two main interview questions are repeated and the user is prompted to answer these within a given short time (e.g., 2 min) and the response values (e.g., age, or a behavioral value) must be identical to those in the original main interview. This may help to identify fraudulent participants who use other people's phones temporarily (for OTP confirmation) as such a prompt will force them to access "their" phones within a very short time. This may also serve the purpose of attention filter questions as differing values may also indicate rushed, non-truthful responses.

Biomarker component. The complete lack of biomarker uptake marks the biggest challenge for this survey pilot and made clear that we did not achieve an important goal in this survey pilot. The reasons for this are unclear as most participants (82%) residing in Bangkok indicated online that they would be willing to present at a clinic. Investigators deemed the compensation offered as adequate and think it's unlikely that a higher compensation would help much. The investigators suggest to pilot (small-scale) modifications to explore potentially better options for collecting biomarker collection, ranked by preference as follows:

1. Mail participants a **self-collection kit** for a dried blood spot sample or a kit to self-collect capillary plasma in a microtube and have the participant mailed the blood specimen through a pre-addressed, pre-paid envelope or mailbox to a reference lab.
   a. Thailand has a well-established system for PCR testing of infants, using heel-prick and DBS collection; these DBS are sent by mail/courier to a central lab.
   b. DBS self-collection has already been tested and used in other (research) projects involving MSM in Thailand
   c. Such a system could be envisioned for the entire country (as opposed to our pilot which was restricted to BKK) and would allow for most critical testing (HIV serology, VL, recency) though not for CD4 T^+ cell counts.

2. Mail participants an **HIV self-testing** kit and have the participant document the result via video or photo.
    a. Self-testing is becoming increasingly common in the context of PrEP programming globally and is legal and available in pharmacies in Thailand and supported by the national AIDS committee.
    b. However, the biomarker data yielded that way would be restricted to HIV serostatus; all other biomarkers, in particular VL, would not be available or additional avenues would need to be sought, such as arranging for the HIV-positive participant to attend a clinic for an additional routine blood draw and testing which then would need to be added to the survey's data base.
3. **Combine the compensation** for interview and blood draw into one, i.e., only pay the compensation if both interview and blood draw were completed.
    a. However, investigators are skeptical if this would lead to more testing uptake.
    b. Further this approach (just like the original design) would be difficult to scale across Thailand unless the combined compensation is used for blood self-collection or self-testing.
4. **Call the participants** to establish personal rapport and encourage them to go for a blood draw.

Various combinations of the above options can be envisioned to further increase biomarker uptake.

8.4 Other recommendations

1. We recommend splitting the underlying survey protocol in two:
    a) *Routine surveillance protocol*: Routinizing webRDS to generate interview-based population estimates (sans biomarker) for other key populations. Ready this protocol for three key populations (transgender women, female sex workers, people who inject drugs).
    b) *Formative assessment protocol*: Spin off a formative assessment protocol to pilot new variations with regard to biomarker collection, such as self-collecting blood samples, self-testing at home, and or combined compensation for the interview and biomarker component.
2. We recommend sharing Kai Noi's experience and the developed code with other stakeholders and countries as a sampling method for networked populations with high internet usage.

Minor recommendations

- Do not make coupons case sensitive (to facilitate Coupon ID entry)
- Instead of accepting one of three modes of ID (phone numbers, Line ID, email address), only use the phone number (to impede duplicate enrollment)

8.5 Conclusions

Kai Noi failed to collect crucial biomarker data and endured numerous fraudulent survey enrollments. Still, Kai Noi adds to the small but growing body of web-based surveys using probability sampling. As internet usage will continue to grow and with is social activities in cyberspace, webRDS surveys will

remain or grow in attractiveness. Sampling speed, cost, and geographic spread remain attractive features of online RDS. Further operational research or piloting appear justified to identify a feasible survey design leading to both valid interview and biomarker data.

ANNEX

1 Target Population and Eligibility Criteria

The target population comprised MSM residing in Thailand with access to the internet.

Eligibility criteria

Inclusion criteria

- Born male
- 15 years or older
- Residing in Thailand in past 3 months; IP address in Thailand
- Had anal sex with one or more men in past 6 months
- Able to read and write in Thai
- Presents a valid eCoupon (except seeds)
- Provides Line ID (or other social media app username) and / or cell phone number
- Knows and is known by his recruiter (referring peer)
- Provides consent

Additional inclusion criteria for biomarker component

- Resides in Bangkok
- IP address in sampling area for biomarker collection

Exclusion criteria

- Previously enrolled in this survey:
    - Self-report
    - Records a personal identifier (such as Line ID, email address, or cell phone) of a previously enrolled recruit

2 Sampling Area and Sample Size Considerations

The sampling area for data collection included all of Thailand; that for additional biomarker collection was restricted to Bangkok due to logistical capacity. Our survey goal and primary objective did not call for a particular sample size.

3 Survey Website Design

A survey website ("Kai Noi") was designed to assume virtually all functions of a typical RDS survey office in an automated fashion, i.e., with minimal or no interaction between survey staff and participants. Division of Epidemiology staff administered the website. Depending on the device used, participants were able to use text-to-speech function. Both website and eCoupons displayed information how to contact survey staff if needed. Survey staff's activities were largely limited to monitoring events and data flow, and trouble-shoot as needed. The website was compatible with different:

- Devices: smart phones, tablets, and laptops

- Web browsers: Chrome, Safari, Internet Explorer, Firefox
- Operating systems: Android, Apple, and Windows

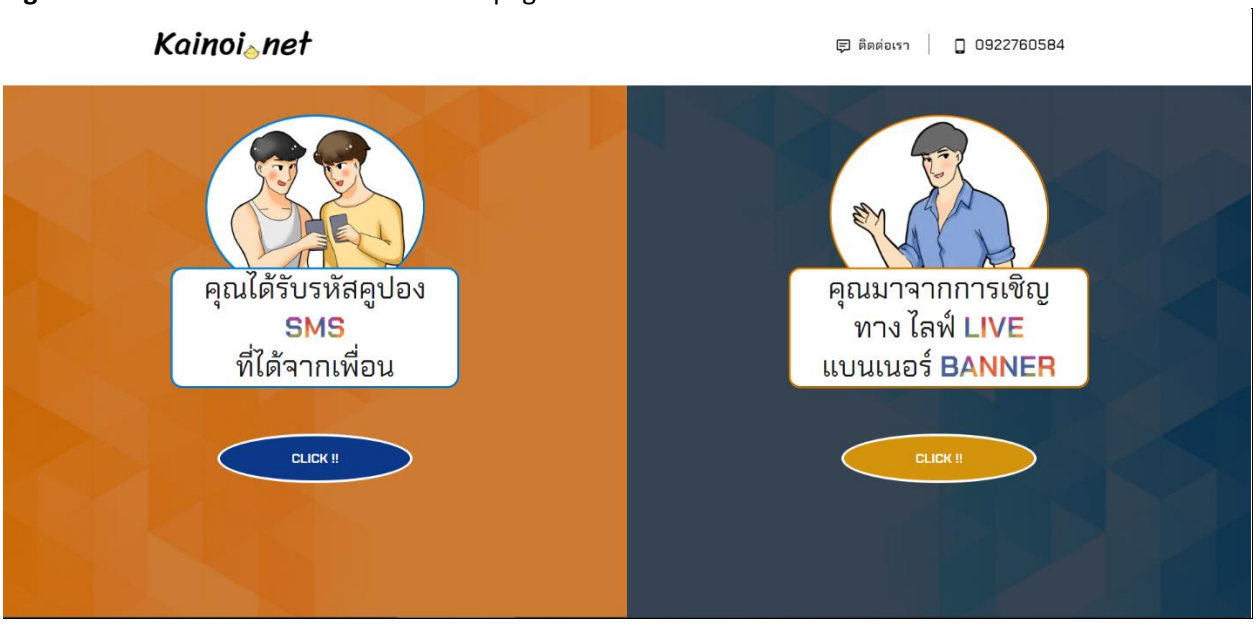
Critical functions of the website included:

- Checking coupon validity (whether coupon ID was issued, is still valid, not used previously)
- Participant validity (whether participant had enrolled in survey previously)
- Eligibility screening
- Consenting
- Interviewing
- Providing instructions and information for the offline biomarker collection
- Peer recruitment training
- Coupon issuance
- Compensation
- Tracking recruitment and survey related events

The specifications of Kainoi.net development are :

- Linux server
- Domain SSL Certificatation AlphaSSL by GlobalSign
- PHP version 7.3.33
- JAVA
- MySQL version 5.0.12

Figure 7: Screenshot of Kai Noi main webpage



Design

CDC informaticians wrote the web page with HTML, CSS (Cascading Style Sheet) and Bootstrap to facilitate the various steps of survey participation in an automated fashion, including web portal, screening, consent, and the questionnaire page. For data entry in the questionnaire Lime survey was employed using sequency answering (i.e., one page per question), the auto-generated questionnaire ID was linked to the eCoupon code.

API (application programming interface) and web services

Code was developed to facilitate the RDS and survey functionalities, specifically:

1. **Coupon ID** processing: Coupon IDs were created using a random concept (alphanumeric, case sensitive, five digits in length); coupon IDs could only be logged in by candidate participants along with their mobile phone number. Coupon IDs were checked to verify that they had been issued, were activated, were not yet expired, were not previously used, and were not suspended. Coupon IDs were used to link recruiters with recruits. All logged in coupon IDs were saved in the surveys data base
2. Multiple **fraud prevention measures** were implemented
3. A **web-based SMS service** provided by True (mobile network provider in Thailand) was used for several critical steps:
    a. Sending **one-time-passcodes** (OTP) to the registered phone numbers for authentication,
    b. Sending **mobile money** codes for compensation: code was written to generate time-bound random mobile money codes related to the True money data base
    c. Sending **reminders** to use the referral coupons

Data management: A dashboard was developed in PowerBI to monitor survey events

Fraud detection
Phone numbers were the principal means to minimize the risk of duplicate enrollment by candidate participants and to compensate participants for their survey participation and peer recruitment efforts.

III. Additional fraud prevention (added during survey)

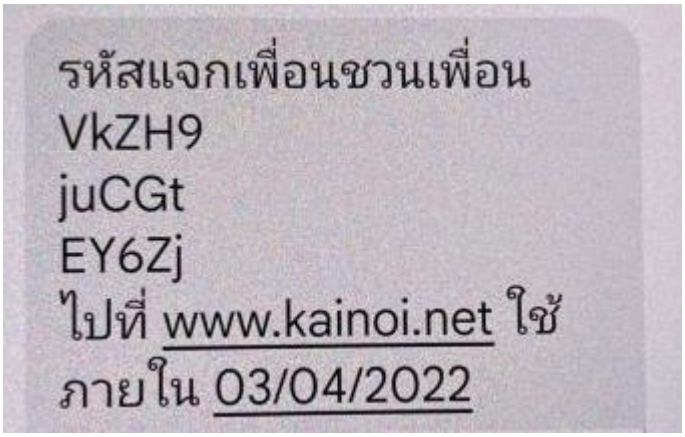
1. A Python script was created to list all recruitment coupons related to confirmed/likely fraudsters
2. We **deactivated all unused coupons** from the confirmed fraud coupons list
3. We activated **cookie checking t**o prevent the participant using the same device to re-enroll with a new phone number
    a. At first use of a coupon on a given electronic device a cookie is created and labeled ‘new user’
    b. Once screening for eligibility started, the cookie’s label changed to ‘old user’
    c. The same electronic device (‘old user’) could no longer be used with a new coupon and phone number; upon such an attempt to re-use an electronic device the new coupon was deactivated and the phone number ‘blacklisted’, i.e., no longer accepted for enrollment

4. These cookie-related measures only minimized fraud as some fraudulent participants may have known the survey staff's use of cookies and were free to delete the cookie on their device and/or use an incognito mode on a browser to prevent our cookie status checking
5. We introduced a delay for paying out compensation to 14 days at the beginning of event and then 7 days after enrollment
6. We delayed the activation date (i.e., the first date a coupon may be used) of all new referral coupons to 1 day after the coupon was generated for those who used the coupon within 15 minutes after the coupon was activated

4 eCoupon

Coupons had an electronic format (eCoupons) and function as invitations that participants can send to their peers online or by text message (see annex). The eCoupon ID linked the recruiter to their recruits. eCoupons included the following elements: Survey name, survey web address, coupon ID, expiration date (subject to coupon uptake, investigators could allow enrollment past the expiration date). The target group and exact purpose was not mentioned in the eCoupon. The language used on the eCoupons was Thai. Each recruit received three coupons.

Figure 8. eCoupon example



5 ID Numbers

The survey utilized the following ID numbers:

a) *IP address*: candidate recruits' IP addresses were automatically assessed and recorded to confirm its location within Thailand (and to assess whether the URL was located within the area designated for biomarker collection).
b) *Coupon ID:* Case-sensitive, five-digit alphanumeric, randomly generated.

Recruits were asked to provide at least one of the following ID:

c) *Phone number*

d) *Line ID* (a social media app)
e) *Email address*

6 Identifying Duplicate Recruits

Survey staff monitored parameters (see list below) possibly suggesting duplicate enrollment prompting further investigation and possibly blocking that coupon ID from being used.

#	Item	Characteristic
1.	Cookie	Detected in browser
2.	Phone number	Same as recruiter's
3.	Coupon issuance to coupon use time	<10 minutes
4.	Browser type	Same as recruiter's
5.	Coupon ID	Previously used coupon ID is offered again

7 Communication with Participants

As needed participants and survey staff could directly communicate through the use of participants' stated communications identifiers, such as their Line ID, email, or phone numbers that they listed upon enrollment. Survey staff also used a dedicated Line ID, email address, and phone number for such communication.

8 Compensation

Compensation was informed by past RDS surveys in Thailand and MoPH regulations about such payments. Compensation was paid separately for interview and biomarker collection (exchange rate: US$1~B36):

- Survey enrollment and interview: Baht 300
- Peer recruitment: Baht 150/successful recruitment
- Blood draw: Baht 700

The biomarker payment was larger than for the interview as it entailed travel costs and substantially more time than the online interview. Payment was dispensed electronically by SMS (electronic code) which could be used to top up one's e-wallet (e.g., TrueMoney). One line of code corresponded to B50, B150, or B500.

9 Survey Staff and Training

Survey staff roles and responsibilities differed from physical RDS as recruitment and data collection was largely automated. Three survey staff per site were trained for 2 days, and needed to monitor recruitment, data collection, biomarker collection, detect/prevent

fraudulent behavior, answer (online) questions from recruits, and monitor payment. Three staff were used: a survey coordinator, a survey assistant, and a data manager.

Training: Pre-survey, investigators conducted a one-week training with the survey staff, covering survey background, survey design, survey tools, enrollment procedures and informed consent, communication, electronic payment, data confidentiality, research ethics, and monitoring. Training included a pilot with mock procedures covering all survey aspects.

10 Sampling Procedures and Interviews

Overview

Candidate participants received from their recruiter an eCoupon containing an invitation message, a coupon ID, and a web address. They logged in using the eCoupon ID and phone number, were screened for eligibility, consented, self-administered the interview, were trained on peer recruitment, were issued eCoupons, and paid. Recruiters received peer-referral payment upon successful enrollment of peer recruits. After completion of these procedures, recruits residing in greater Bangkok were offered to present at a clinic of their choice for HIV-related biomarker testing. Select test results were to be returned and recruits were to be paid electronically.

10.1 Survey initiation - seeds

Sampling design for seeds[10]

Candidate seeds self-selected/identified (i.e., without being selected by investigators or survey staff) through the following online means:

1. **'Blast' (mass) messages or 'micro-messaging'** to pre-defined groups of people in social media apps. Sample text: "Join the Kai Noi survey for men's health! Earn money!" A link to the survey was enclosed or embedded.
2. **Banner ads** on select webpages/apps: Banner ad text: "Kai Noi Survey: Men's health in Thailand!". We used the following online venues to identify seeds:

Table 31. List of gay-friendly social media apps used in Thailand	
Social media app name	**Used for Kai Noi banner ads**
BlueD	**Yes**
Buddy Station	**Yes**
Facebook	No
Grindr	No

[10] Seeds are survey participants chosen by investigators to initiate peer recruitment.

Hornet	No
Jack'd	No
GayRomeo	No

Seed characteristics

All survey participant eligibility criteria applied (except coupon possession). Additionally, we sought to ensure diversity among and social distance between seeds:

- **Social distance to survey**: None of the seed's friends already joined the survey
- **Degree**: Personal network size greater than five
- **Residence**: As determined by investigators (all Regions/Provinces are eligible at first, later restricted as needed when adding seeds)

After clicking on the survey's banner ad, the seed candidate was directed to the Seed Eligibility Questionnaire. Eligible seed candidates were then directed to the consent page; ineligible candidates were thanked and virtually exited.

Desired group seed characteristics

We sought diversity among seeds with regard to the **online venue** (no single online venue should account for > 67% of all seeds identified; banner ads were taken down once that threshold was exceeded, **residence**: No province (except Bangkok) should have more than **1** seed, and **age** (in each region, seeds aged <30 years cannot account for > 67% of all seeds).

Number of seeds at sampling start

- Bangkok: 6 seeds
- Each other region (North, North-East, Central, East, South): 3. Sub-total: 15
- Grand total: **21 seeds**

Adding seeds during sampling

Investigators added more seeds depending on certain trigger values, such as **residence** (alert if any region does not record a new successful recruitment in the last 7 calendar days); **age** (alert if proportion of MSM recruits (across entire sample) 30+ years drops <25%); **or sampling speed** (alert if No. recruitments across all regions in last 7 calendar days drops <100)

10.2 Coupon validation

Candidate participants accessed the survey website by using the URL embedded in the eCoupon. They were prompted to enter their coupon ID. The coupon ID was validated by checking it against:

1) issued eCoupons (must be among issued eCoupons)
2) redeemed eCoupons (must not be among already redeemed eCoupons)
3) coupon expiration date (this criterion was used at the discretion of the survey staff)

Coupons also had to be already “activated” (start date) and not be classified “suspended” (coupon IDs issued to recruits later recognized as fraudulent). Any eCoupon ID entered by a candidate recruit was classified as redeemed and as valid or not valid (see above). Users with valid coupons were allowed to proceed to the screening stage; others received a message that their coupon was not valid and exited.

10.3 Screening

After reading a short welcoming on the screening webpage, they proceeded to the screening interview (see annex). Candidate participants had to answer all screening questions; candidates could not go back and change any of their answers. Ineligible candidates were shown a message that they could not participate (without telling them why); they are not able to navigate to the interview webpage. Eligible candidates automatically proceed to consent page.

10.4 Consent for main interview

Eligible participants landed at the page showing the consent script (see annex) written in Thai. Participants consented electronically to enroll and being interviewed. The participant could download a copy of the consent script and or could indicate that they had questions which staff were able to answer via chat or voice. Candidate participants who refused consent were asked about the reason for refusal (see annex) and were thanked and exited.

10.5 Interview, peer recruitment training, coupon issuance, compensation

Following consent, participants underwent the online self-administered interview (see Annex). Following the interview, recruits received standardized information on how to refer peers to the survey (see Annex). The exact eligibility criteria were not disclosed. Recruits were then issued eCoupons for peer recruitment and received electronic payment for their visit.

10.6 Peer recruitment

Participants could transfer their eCoupons to their peers by any means, including text, chats, or emails. If coupons remained unredeemed, reminders were sent to the recruiter up to two times (approximately three and seven days after coupon issuance).

11 Biomarker Component

Biomarker collection, at any one of 10 participating clinics in Bangkok comprised an HIV test, HIV recency testing, syphilis, HBV, and HCV. All clinics were easily reachable and known to be "gay-friendly". Participants were to be pre and post-test counseled and, as warranted, initiated on PrEP or HIV treatment. Clinic staff were to enter the test results into the online survey database and participants were to be compensated for time and travel costs. Because no recruit presented himself for a blood draw, no more details regarding the survey's biomarker components are offered here. The full details are available in the protocol.

12 Data Analysis

Weighted analysis. RDS Analyst[11] software was used to derive weighted estimates adjusting for the complex sampling design. The Gile's SS estimator was used to derive weighted estimates, along with a national MSM size estimate of 588,000 (source: AEM Thailand data sheet)

Successive Sampling PSE[12]*:* In this RDS-A integrated method, successive sampling approximation is applied to RDS to leverage information in the ordered sequence of observed personal network sizes. The inference uses a Bayesian framework, allowing for the incorporation of prior knowledge. Using RDSA, a previous PSE is refined using the RDS data set using RDS inherent data variables, including degree values and date of enrollment. We used the following parameters/specifications: *Prior*: Mean PSE, sample size as observed, maximum PSE ~10% of the adult gen pop males. Distribution type: Beta. *Posterior*: Mean, max, and standard deviation of observed degree values. Conway Maxwell Poisson distribution shape. MCMC sampling preferences: Burn-in 5,000, interval 10, number of samples: 10,000.

13 Human Subjects Considerations

13.1.1 Institutional review and considerations

The protocol had been deemed non-research by the Division of Epidemiology, Ministry of Public Health, Bangkok. This project was reviewed in accordance with CDC human research protection procedures and was determined to be research, but CDC investigators did not interact with human subjects or have access to identifiable data or specimens for research purposes.

13.2 Informed consent

Informed consent was obtained electronically, online. Consent was serial and separate for the interview and biomarker portion, i.e., individuals consented for the interview but could then refuse biomarker collection. Participants had the opportunity to chat or call (or be called) to discuss any questions they may have. A copy of the consent could be downloaded by (or sent to) the participant. Participants could decide to withdraw after providing consent; however, no participant indicated to do so. A waiver was received to enroll MSM aged 15-17 without parental consent.

[11] http://www.deducer.org/pmwiki/pmwiki.php?n=Main.RDSAnalyst

[12] Handcock, Mark S., Krista J. Gile, and Corinne M. Mar. Estimating hidden population size using respondent-driven sampling data. *Electron J Stat*. 2014 ; 8(1): 1491–1521. doi:10.1214/14-EJS923.

13.3 Data security

Access to the **survey website** was password protected, i.e., restricted to survey participants (until data collection is complete), survey staff, and investigators. All data entered into the survey website was encrypted. After survey completion access to the website was blocked.

Data base security: Survey data files were password protected. Access to personal identifying information was restricted to survey staff on a need-to-know basis. Survey staff signed confidentiality agreements (see annex). Data systems holding the original survey data were protected with anti-virus software.

Data back-up: All original survey data (such as screening, interview, coupon ID, lab results, payment data) were backed up at the end of each business day on a separate password protected computer system.

Data transfer across locations occurred via secure file transfer protocols, virtual private networks, secure media, or secure data networks. Data files were password protected.

Anonymizing data: Following completion of all survey procedures, all personal identifiers were removed from electronic files and any hard copy materials.

13.4 Potential risks and benefits

Potential risks were deemed minimal, mainly including disclosure of personal identifying information.

There were no direct benefits to survey participants; indirect benefits included that the survey would inform the public health response for the same target population.

14 Survey Expenditures

Table. Kai Noi Survey Expenditures			Exchange rate Thai Baht:USD		36.00
Pre-survey	**Cost/Time**	**Unit**	**# Units**	**Cost (B)**	**Cost (USD)**
No. staff hours for coding	260	Hour	-	In-house	In-house
No. staff hours for Kai Noi website development	212	Hour	-	In-house	In-house
Meeting with stakeholders to discuss scope of work	13,947	Baht	3	฿41,840	$1,162
Meeting with web and graphic designer	13,467	Baht	3	฿40,402	$1,122
Dry run (interviewing only)	5,825	Baht	2	฿11,650	$324
Dry run (interviewing and blood collection)	7,400	Baht	2	฿14,800	$411
Graphic designer for Kai Noi page	25,000	Baht	1	฿25,000	$694
IT hardware (Tablet)	4,400	Baht	20	฿88,000	$2,444
IRB-related activities (CREC, BMA, and DDC)					
Photocopying, printing	5,791	Baht	4	฿23,163	$643
IRB submission fee	25,000	Baht	1	฿25,000	$694
IRB renewal fee	10,000	Baht	2	฿20,000	$556
Stakeholder meeting	21,478	Baht	2	฿42,956	$1,193
Training of clinic staff	21,200	Baht	1	฿21,200	$589
NGO staff time	20	Hour	-	In-kind	In-kind
Subtotal				**฿354,011**	**$9,834**
Intra-survey	**Cost/Time**	**Unit**	**# Units**	**Cost (B)**	**Cost (USD)**
Server	22,898	Baht	3	฿68,694	$1,908
Participant compensation					
Primary incentive (per person)	300	Baht	2067	฿620,100	$17,225
Secondary incentive (per person)	50	Baht	2032	฿101,600	$2,822
Lab testing compensation	700	Baht	0	฿0	$0
Social media apps (banner ads, etc.)	40,000	Baht	1	฿40,000	$1,111
SMS messaging costs	16,050	Baht	1	฿16,050	$446
Internet for clinic staff (10 sites)	2,962	Baht	9	฿26,661	$741
Clinic staff cost per participant (not used)					
Counselor	150/Peer	Baht	0	-	-
Laboratory staff	150/Peer	Baht	0	-	-
Laboratory testing fees					
HIV, HBV, HCV, syphilis	850/Peer	Baht	0	-	-
Viral load	2000/Peer	Baht	0	-	-
Rapid recency	450/Peer	Baht	0	-	-
Transport device fee for data collection	928	Baht	1	฿928	$26
Documents and devices	69,611	Baht	1	฿69,611	$1,934
Subtotal				**฿943,644**	**$26,212**
Grand Total				**฿1,297,655**	**$36,046**
Grand Total per Survey Participant			1643	**฿790**	**$22**

15 Staff Confidentiality Agreement

Survey Staff Confidentiality Agreement

Name: _____Position:_____

I recognize that through this survey I may gain access to survey participants' personal information, such as facial images (video chat), phone numbers, names or social app user ID. I understand that I am required by law to keep this information confidential. I will strictly follow the principles below during and after survey implementation:

 I will keep confidential *all* patient information I gain access to

 I will access and abstract patient information only based on the needs of the survey

 I will only disclose participant information to participating health facilities or investigators as warranted by the protocol or SOP

 I will not discuss participants' information in public places or outside of work

I understand that it is my obligation and responsibility to ensure the confidentiality of all survey participants' information. Improper disclosure or misuse of participants' information, whether intentional or due to neglect on my part, will result in disciplinary action and could result in employment termination.

Signature:_____Date:_____

16 Data instruments – Seeds and Eligibility

16.1 Seed candidate interest

People identified as potential seeds (banner ads, blast messages, chatroom) were routed to the Kai Noi survey website and this short instrument was administered:

#	CAND	SEED CANDIDATE INTEREST	VALUE	PROGRAMMING, COMMENTS
na	CANDINT Seed candidate interest in survey	Welcome to the Kai Noi Survey. This is a health survey for men and transwomen. The survey is conducted by the Ministry of Health. If you are eligible we pay you for your time. Click here to learn if you can take part.	OK 1 NO, THANKS 2	1 (OK): proceed to next instrument (Seed Eligibility)
	CANDDEVICE Seed candidate device type	Device type	MOBILE DEVICE 1 COMPUTER 2 OTHER 3 UNKNOWN 4	Collected as recognizable by browser software, automatic, hidden
	CANDDATE Seed candidate date	Date of interview	<SYSTEM DATE>	Date of interview, recorded automatically, hidden
	CANDLOC1 Seed candidate IP address	IP address	< >	Must be captured
na	SEEDINTMSG	No problem. Thanks for your interest and good bye.		Skip if SEEDINT='1'. **Exit interview 1 minute after showing message.**

16.2 Seed eligibility screening

This instrument is administered to people who click on the banner ad and express an interest in the survey. The purpose of this instrument is to assess the candidate's eligibility as a seed. Seeds are eligible if they 1) meet the same criteria as for recruits (except coupon receipt), and 2) if their degree (personal network size) is large enough.

#	EL	SEED ELIGIBILITY	VALUE	SKIP/PROGRAMMING, COMMENT
na	QPTTL Questionnaire name	Questionnaire title	SEED ELIGIBILITY	Automatic, hidden
na	QPVER Questionnaire version	Questionnaire version	1.0	Automatic, hidden
na	QPDE Participant device type	Device type	MOBILE DEVICE 1 COMPUTER 2 OTHER 3 UNKNOWN 4	Collected as recognizable by browser software, automatic, hidden
na	QPIDATE Date	Date of interview	<SYSTEM DATE>	Date of interview, recorded automatically, hidden
na	QPITIME Start time	Start time of interview	<SYSTEM TIME>	Automatic, hidden
na	QPITIME Seed cyber location	Banner ad location	<NAME OF SOCIAL APP OR WEBSITE>	Seed specific variable
na	ELLOC1 IP address	IP address	< >	Must be captured Automatic, hidden
na	ELLOC2 In/outside Thailand	Location translated from IP address	THAILAND 1 OUTSIDE THAILAND 2	2=Not eligible for survey participation Automatic, hidden

na	ELNOMSG1	Thank you. Unfortunately, you cannot take part in this survey. We appreciate your interest though! If you have any question, you can contact us at *Phone number / Line ID* here. Thank you and goodbye.		Skip if ELLOC2=1. **Exit interview 1 minute after showing message.**
na	ELLOC3 Region name	Region name in Thailand	<REGION NAME>	Automatic, hidden (Additional eligibility may be invoked during sampling)
na	ELLOC4 Province name	Province name in Thailand	<PROVINCE NAME>	Automatic, hidden (Additional eligibility may be invoked during sampling)
		ELIGIBILITY		
1.	ELSXBORN Recruit's sex	Welcome. Let's see if you are the right person to take part. Were you born male or female?	MALE 1 FEMALE 2	Must respond 2 = Ineligible
2.	ELTGNOW Recruit's gender identity	Do you consider yourself being male, female, or transgender/?	MALE 1 FEMALE 2 TRANSGENDER 3	Must respond. No impact on eligibility. MSM survey: '2' or '3' = ineligible
3.	ELAGE Recruit's age	How old were you at your last birthday?	AGE IN COMPLETED YEARS: ## RANGE: 10-88	Must respond. <15, 98=Ineligible. Additional age limits may be implemented by investigators.
4.	ELREGION Region of residence	In which region of Thailand do you live now?	DROP DOWN MENU LISTING ALL REGIONS	Include Bangkok as a separate value. Ineligible region: TBD *(Defined by investigators)*
5.	ELPROVINCE Province of residence	In which province do you live now?	DROP DOWN MENU LISTING ALL PROVINCES	Skip if ELREGION=Bangkok. Ineligible province: TBD *(Defined by investigators)*
6.	ELDISTRICT District	In which district do you live?	DROP DOWN MENU LISTING ALL DISTRICS	Not used for eligibility screening. Used for survey evaluation.
7.	ELMSMEV Ever anal sex with a man	Have you ever had anal sex with a man? With anal sex we mean a penis enters a man's anus.	YES 1 NO, NEVER 2 DON'T KNOW 97	Must respond 2,97,98=Ineligible

			REFUSE TO ANSWER 98	
8.	ELMSMREC Anal sex in last 6 mths	When did you last have anal sex with a man?	IN THE LAST 6 MONTHS 1 LONGER THAN 6 MONTHS AGO 2 DON'T KNOW 97 REFUSE TO ANSWER 98	Skip if ELMSMEV=2 Must respond 2,97,98=Ineligible
9.	ELDG Degree total	How many MSM do you know and have been in contact with in the **last 7 days (online or offline)**.	1-5 1 6-10 2 MORE THAN 10 3	Must answer 1=Ineligible (not large enough degree)
10.	ELFRREC Social distance	Did any of your friends join this survey?	YES 1 NO 2	1=Ineligible (Rationale: Looking for seeds with separate networks)
11.	ELIGBILITY Eligibility	Eligibility	ELIGIBLE 1 NOT ELIGIBLE 2	Automated, hidden. Eligible if reply values are recorded for all questions above and none of these indicate ineligibility. Eligible seed are to be automatically forwarded to the Consent Page.
na	ELNOMSG2	Thank you. Unfortunately, you cannot take part in this survey. We appreciate your interest though! If you have any question, you can contact us at *Phone number / Line ID* here. Thank you and goodbye.		Skip if ELNEHAVIOR=1 (ELIGIBLE). **Exit interview 1 minute after showing message.**
na	ELEND	End of data instrument		Automatic trigger for next section.

16.3 Recruit eligibility

#	EL	COUPON ELIGIBILITY	VALUE	PROGRAMMING, COMMENT
1.	ELCIDN	Welcome to our survey. Please enter the ID number of your coupon.	ALPHANUMERIC	Must enter
2.	ELLOC1	IP address	< >	Must be captured Automatic, hidden. Used to determine approximate location.
3.	ELLOC2	Location translated from IP address	BANGKOK 1 ELSEWHERE IN THAILAND 3 OUTSIDE THAILAND 4	4=Not eligible for survey participation
4.	ELCIDN	Coupon ID	ALPHANUMERIC	Must be captured Hidden Captured automatically
5.	ELCIDN2	Coupon ID expired?	NOT EXPIRED 1 EXPIRED 2	(2=Not eligible) Hidden. Expired: Investigators decide if expired coupons will be accepted
6.	ELCIDN3	Coupon ID	VALID 1 NOT VALID 2	2=Not eligible Hidden. Not valid if: - Coupon ID never issued - Redeemed previously
7.	ELNOMSG1	Sorry but the coupon you have is not valid. If you have another coupon please try again. Thank you.		After 30 sec, exit screen. Message for candidate recruits with **invalid coupon** but eligible otherwise.

NA	QP	QUESTIONAIRE PARAMETERS	RESPONSE VALUES	PROGRAMMING, COMMENTS
NA	QPTTL	Questionnaire title	WEBRDS	Automatic, hidden
NA	QPVER	Questionnaire version	1.0	Automatic, hidden

NA	QP	QUESTIONAIRE PARAMETERS	RESPONSE VALUES	PROGRAMMING, COMMENTS
NA	QPDE	Device type	MOBILE DEVICE 1 COMPUTER 2 OTHER 3 UNKNOWN 4	Collected as recognizable by browser software, hidden
NA	QPIDATE	Date of interview	<SYSTEM DATE>	Date of interview, recorded automatically, hidden
NA	QP6M	Calculated variable—Interview date minus 6 months (date)	<DATE>	Computed automatically, hidden
NA	QP12M	Calculated variable—Interview date minus 12 months (date)	<DATE>	Computed automatically, hidden
NA	QPITIME	Interview start time	<SYSTEM TIME>	Start time of interview, recorded automatically, hidden
NA	QPPID	Participant ID	NUMERIC	Automatically assigned, hidden

NA	EL	PARTICIPANT ELIGIBILITY	RESPONSE VALUES	PROGRAMMING, COMMENTS
NA	ELMSG1	Welcome to this short interview, lasting 10 minutes. Please choose the answer that fits best. If you are not sure, please give your best guess.		Move to next question after 5 sec. (Note: Eligibility interview continues to end even if some replies indicate ineligibility)
8.	ELKNOW Know recruiter	About the person who gave you this coupon: Do you know him?	YES, I KNOW HIM 1 NO, I DON'T KNOW HIM 2	Must respond. 2=Ineligible. Investigators may decide to use candidate as a seed
9.	ELRECPART Recruiter enrolled in survey	Did this person join this survey too?	YES 1 NO 2 I DON'T KNOW 3	Not used for eligibility screening. Used for survey evaluation.
10.	ELRECPH	Please tell us the last two digits of that person's phone number?	## DON'T KNOW 1 REFUSE TO ANSWER 2	Not used for eligibility screening. Used for survey evaluation.

NA	EL	PARTICIPANT ELIGIBILITY	RESPONSE VALUES	PROGRAMMING, COMMENTS
	Recruiter's last 2 phone digits			
11.	ELRECMSM Recruiter is MSM	Is this person an MSM or a TG?	YES-MSM 1 YES-TG 2 NO 3 I DON'T KNOW 4	Not used for eligibility screening. Used for survey evaluation.
12.	ELDUP Previously enrolled	Now some questions about yourself: Did you enroll in this survey before?	YES, I TOOK PART BEFORE 1 NO, THIS IS THE FIRST TIME FOR ME 2	Must respond. 1=Not eligible.
13.	ELCOUP No. days since coupon receipt	How many days ago did you receive the invitation to this survey? Type '0' if you got it today.	No. DAYS AGO INVITATION WAS RECEIVED ## RANGE: 0-90	Not used for eligibility screening. Used for survey evaluation.
14.	ELSXBORN Recruit's sex	What was your sex at birth?	MALE 1 FEMALE 2 REFUSE TO ANSWER 3	Must respond 2=Ineligible
15.	ELTGNOW Recruit's gender identity	Do you consider yourself being male, female, or transgender/?	MALE 1 FEMALE 2 TRANSGENDER 3 OTHER 4	Must respond MSM survey: '2', '3', or '4' = ineligible
16.	ELAGE Recruit's age	How old were you at your last birthday?	AGE IN COMPLETED YEARS: ## RANGE: 10-88	Must respond <15, 98=Ineligible
17.	ELREGION Region of residence	In which region of Thailand do you live now?	DROP DOWN MENU LISTING ALL REGIONS	Include Bangkok as a separate value. Ineligible region: TBD *(Defined by investigators)*
18.	ELPROVINCE	In which province do you live now?	DROP DOWN MENU LISTING ALL PROVINCES	Skip if ELREGION=Bangkok. Ineligible province: TBD *(Defined by investigators)*

NA	EL	PARTICIPANT ELIGIBILITY	RESPONSE VALUES	PROGRAMMING, COMMENTS
	Province of residence			
19.	ELLOCBM Residence eligible for biomarker	Respondent's residence is within a defined biomarker sampling area.	METRO BANGKOK 1 NOT BIOMARKER ELIGIBLE 2	Hidden, automatic. Use ELREGION and ELPROVINCE to assign value. Used to determine if recruit will be offered blood draw.
20.	ELLOC2 Urban or rural residence	Do you live in a town or in a village?	IN A TOWN 1 IN A VILLAGE 2	Skip if ELLOCBM= 1 or 2 (BKK or CM) Not used for eligibility screening. Used for survey evaluation.
21.	ELMSMEV Ever anal sex with a man	Have you ever had anal sex with a man? With anal sex we mean a penis enters a man's anus.	YES 1 NO, NEVER 2 DON'T KNOW 97 REFUSE TO ANSWER 98	Must respond 2,97,98=Ineligible
22.	ELMSMREC Anal sex in last 6 months	When did you last have anal sex with a man?	IN THE LAST 6 MONTHS 1 LONGER THAN 6 MONTHS AGO 2 DON'T KNOW 97 REFUSE TO ANSWER 98	Skip if ELMSMEV=2 Must respond 2,97,98=Ineligible
23.	ELIGIB Eligible	ELIGIBILITY	ELIGIBLE 1 NOT ELIGIBLE 2	Automated, hidden. Eligible if reply values are recorded for all questions above and none of these indicate ineligibility
NA	ELNOMSG2	Thank you. Unfortunately, you cannot take part in this survey. We appreciate your interest though! If you have any question, you can contact us at *Phone number / Line ID* here. Thank you and goodbye.		Skip if ELIGIB=1 (ELIGIBLE) Exit interview 30 sec after playing message.

17 Informed Consent Script - Interview

Text in [] brackets is optional, as described in the protocol.
Flesch-Kincaid Grade: 5.6

Biobehavioral Survey (BBS) using web-based respondent driven sampling (RDS) in Thailand
"Kai Noi Survey"

Introduction and survey purpose
The Thai Ministry of Public Health and the U.S. Centers for Disease Control and Prevention (CDC) launch the ***Kai Noi Survey***. The survey examines the sexual health of men who have sex with men (MSM) and transwomen. This survey is supported by <*Cite here the CBO names which support it*>.
Here we tell you what you can expect if you decide to join the survey.
What you can expect
If you join, you will do an online interview about 10 minutes long. We also want your friends to join. We will pay you some money for the interview and some more money if your friends join as well.
Telling your friends to join the survey
After the interview, we will send you some digital invitations, called *coupons*. You can send these coupons to your friends. They should be MSM or transwomen.
What about risks and confidentiality?
There are no expected risks. We will not sell or share identifying information with people outside this survey. We keep your survey results in a password-protected database on a password-protected computer.
What are your benefits?
There are no cost to you. We will send you Baht YY to do the interview and Baht YY for each of your friends who join as well. You can join only one time. After you finish the interview, you can see the answers of all interviews combined.
[Raffle
Everyone who successfully completes this survey we will enter in a raffle. In the raffle, you can win a smart phone. Also, we will enter you in the raffle again for each of your friends who complete the survey. If you win, we will let you know you immediately.]
Your decision
You are free to join this survey. At any time, you can decide to leave this survey. Whether you join or not, there is no penalty.
Questions or concerns?

If you have any questions or comments, please call us at <*to be inserted*>. If you have questions about your rights as a survey participant, you can contact <*XX: Name, title, affiliation, and phone number*>.

This survey was approved by <*XX: Name of institution in Thailand*> as well as the CDC in the USA. You can have a copy of this form **here**. <*hyperlink will be added*>.

Please check one box:

☐ I **agree** to join the survey. (Message: "Thank you. You will now be directed to the interview.")

☐ I **refuse** to join the survey. (Recruits will be directed to refusal question)

NA	RF	QUESTION	RESPONSE VALUES
1.	RFINT Reason for refusal	We understand you rather not be part of this survey, that's fine. If you don't mind, please tell us the main reason you don't want to join the survey.	NO INTEREST 1 NO TIME 2 THOUGHT THIS WAS SOMETHING ELSE 3 NOT ENOUGH MONEY OFFERED 4 OTHER 96
		Thank you for your time. Good-bye.	

18 Data Instrument - Main Interview

Default values: Other: 96; Don't Know: 97; Refuse to answer: 98; Not applicable (skipped by design): 99.

Grey text=hidden, not visible to participant. All questions must be answered unless skipped by design.

NA	DG	DEGREE	RESPONSE VALUES	PROGRAMMING, COMMENTS
NA	DG1MSG	Thank you. This survey is about men who have sex with men or transwomen. Now a few questions about your MSM or transwomen friends. Click NEXT.		
1.	DGBEHAV Degree total	How many MSM do you know and have been in contact with in the **last 7 days (online or offline)**.	### RANGE 0-195	Must answer. MSM survey only. Global personal network size (degree).
2.	DGWEB Degree web	How many of these [DGBEHAV] use the internet or social media? Pls give your best guess.	ALL OF THEM [X] ### MAX: DGBEHAV value	Must answer. Degree limited to internet using peers.
3.	DGAGE Degree age	Of these [DGWEB] people how many are aged 15 years or older?	ALL OF THEM [X] ### MAX: DGWEB	Must answer. Degree limited to adult internet using peers.
4.	DGSIAM Degree place	Of these [DGAGE] people, how many live in Thailand?	ALL OF THEM [X] ### MAX: DGAGE	Must answer. Degree limited to adult internet using peers in Thailand. **Degree value for Thailand**
5.	DGBKK Degree Bangkok	Of these [DGSIAM] people, how many live in Bangkok?	ALL OF THEM [X] ### MAX: DGSIAM value	Skip unless ELLOC=1 (lives in Bangkok) GO TO DGCOUP. Degree limited to adult internet using peers in Bangkok. **Degree value for Bangkok.** May be used for sub-analysis.

6.	DGCOUP Degree vs coupon receipt	Think about the [DGSIAM, DGBKK] people you know. Did you get the invitation to this survey from one of these?	YES 1 NO 2	Establishing whether the coupon likely came from one of the eligible peers. May or may not be used for post survey eligibility re-evaluation.

NA	**DE**	**DEMOGRAPHICS**	**RESPONSE VALUES**	**PROGRAMMING, COMMENTS**
NA	DEMSG	Thank you. Now a few more questions about yourself.		Move to next question after 3 sec.
7.	DEEDU Highest education reached	What is your highest degree in education?	PRIMARY SCHOOL 1 SECONDARY SCHOOL 2 COLLEGE OR HIGHER 3	Describes participant's basic characteristics
8.	DEOCC Occupation	What do you do for work?	MANUAL WORK 1 WHITE COLLAR WORK 2 SEX WORK 3 I'M A STUDENT 4 HAVE NO WORK 5	Describes participant's basic characteristics

NA	**CY**	**CYBERSPACE**	**RESPONSE VALUES**	**PROGRAMMING, COMMENTS**
NA	CYMSG	Thank you. Now a few questions about being online.		Move to next question after 3 sec.
9.	CYUSE Internet use	Which of the following do you do online? Check all that apply.	TO FIND SEX A TO SELL SEX B TO BUY SEX C TO LEARN ABOUT HIV OR USE HIV SERVICES D TO PAY OR RECEIVE MONEY E TO PLAY GAMES F NONE OF THE ABOVE G	Multiple choice question – allow more than one answer. Cannot select "NONE OF THE ABOVE" and another option at the same time. Informs HIV prevention services.
10.	CYAPP/X	What sites or apps do you have profiles on? Check all that apply.	BLUED A GRINDR B HORNET C	Multiple choice question – allow more than one answer.

NA	CY	CYBERSPACE	RESPONSE VALUES	PROGRAMMING, COMMENTS
	Which soc apps do you use		JACK'D D GAY ROMEO E OTHER F NONE OF THE ABOVE G	Cannot select "OTHER", "NONE OF THE ABOVE", or "REFUSE TO ANSWER" and another option at the same time. Multiplier question for population size estimation
11.	CYAPPA How many profiles A	How many user profiles do you have with [SOCIAL APP A]?	# RANGE 1-5	Skip unless CYAPPA=1 To gauge online venue multiplicity. Multiple profiles may lead to duplicate enrollment.
12.	CYAPPB How many profiles B	How many user profiles do you have with [SOCIAL APP B]?	# RANGE 1-5	Skip unless CYAPPB=1 To gauge online venue multiplicity
13.	CYAPPC How many profiles C	How many user profiles do you have with [SOCIAL APP C]?	# RANGE 1-5	Skip unless CYAPPC=1 To gauge online venue multiplicity
14.	CYAPPD How many profiles D	How many user profiles do you have with [SOCIAL APP D]?	# RANGE 1-5	Skip unless CYAPPD=1 To gauge online venue multiplicity
15.	CYAPPE How many profiles E	How many user profiles do you have with [SOCIAL APP E]?	# RANGE 1-5	Skip unless CYAPPE=1 To gauge online venue multiplicity
16.	CYOFF Frequency of visiting physical venues	Thank you. In addition to be online, how often would you say you visit gay or transgender friendly venues, such as saunas, clubs, bath houses, or bars?	NOT EVEN ONCE A MONTH 1 ABOUT ONCE A MONTH 2 ABOUT ONCE A WEEK 3 SEVERAL TIMES A WEEK 4 ALMOST EVERY DAY 5	To examine overlap with time location sampling

NA	CS	CONTINUUM OF SERVICES	RESPONSE VALUES	PROGRAMMING, COMMENTS
17.	CSMSG1	Thank you. Now a few questions about HIV.		Move to next question after 5 sec.
18.	CSCTEV Last HIV test	When have you last tested for HIV?	IN THE LAST 12 MONTHS 1 LONGER THAN 12 MONTHS AGO 2 NEVER TESTED FOR HIV 3	If '1' or '2' go to CSCTRS Informs testing uptake in last 12 months
19.	CSCTNV Reason why never tested	What is the main reason you have never tested for HIV? Check one.	I FEEL I AM NOT AT RISK FOR HIV 1 FEAR OF POSITIVE RESULT 2 NO MONEY TO GET TESTED 3 NO TIME TO GET TESTED 4 FEAR OF STIGMA 5	After response, go to CSATT. Reason why (potentially) outside 1st 90
20.	CSCTRS Last test result	What was the result of your last HIV test?	NEGATIVE 1 POSITIVE 2 DON'T KNOW 3	If '2' go to CSCFPY If '3' go to CSATT 1st 90
21.	CSCFNY Year of last neg test	Which year did you last test HIV negative?	#### RANGE 1990 - SYSTEMYEAR NEVER TESTED HIV NEGATIVE 1	Skip if CSCTRS≠1 Use for incidence estimation (Osmond's algorithm).
22.	CSCFNM Month of last neg test	Which month did you last test negative?	## RANGE 1-12	Skip if CSCTRS≠1 Skip if CSCFNY<Systemyear-3 Use for incidence estimation.
23.	CSPREP1 Heard of PrEP	Some HIV-negative people take PrEP before having sex. PrEP is a medicine to prevent getting HIV. Have you heard of PrEP?	YES 1 NO 2	
24.	CSPREP2 Currently using PrEP	Do you currently use PrEP?	YES 1 NO 2	Informs PrEP programming
25.	CSPREP3 Ever took PrEP	Have you ever taken PrEP?	YES, IN THE LAST 6 MONTHS 1 YES BUT LONGER THAN 6 MONTHS AGO 2 NEVER HAVE TAKEN PREP 3	Skip if CSPREP2='1' If CSPREP2='2' and CSPREP3='1' or '2', go to CSPREP5 If '3' to CSPREP4 Informs PrEP programming

NA	CS	CONTINUUM OF SERVICES	RESPONSE VALUES	PROGRAMMING, COMMENTS
26.	CSPREP4 Reason for never taking PrEP	What is the main reason you never took PrEP?	DON'T KNOW ABOUT IT 1 DON'T KNOW WHERE TO GET PREP 2 EMBARRASSED TO ASK FOR IT 3 DON'T FEEL AT RISK 4 (AFRAID OF) SIDE EFFECTS 5 DON'T WANT OTHERS TO KNOW 6	Skip if CSPREP2='1' Go to CSATT Informs PrEP programming
27.	CSPREP5 Reason for stopping PrEP	What is the main reason you stopped PrEP?	DON'T FEEL AT RISK FOR HIV 1 NOT CONVENIENT TO GET 2 (AFRAID OF) SIDE EFFECTS 3 DON'T WANT OTHERS TO KNOW 4	Skip if CSPREP2='1' Go to CSATT Informs PrEP programming
28.	CSBIOM Willing to go for blood draw	Would you be willing to go to a nearby clinic for an HIV test, as part of this survey, for extra money?	YES 1 NO 2	Skip if ELLOCBM='3' (lives outside biomarker eligible area) Gauging survey HIV testing uptake outside biomarker sampling area
29.	CSCFPY Year 1st pos test	Which year did you first test HIV-positive?	#### RANGE: 1990-CURRENT YEAR	Gauge duration since HIV diagnosis. Use for incidence estimation. Informs incidence estimation.
30.	CSCFPM Month 1st pos test	Which month did you first test positive?	## RANGE 1-12	Skip if CSCFPY<Systemyear-2 I.e., skip this question when respondent tested > 2 years ago (recall bias)
31.	CSTRCURR On ART?	Do you take ARV to treat your HIV infection?	YES, ON TREATMENT NOW 1 I WAS ON TREATMENT, BUT STOPPED 2 NO, NEVER STARTED TREATMENT 3	If '1' go to CSATT If '3' go to CSTRNV 2nd 90
32.	CSTRST Why stopped ART?	What is the main reason you stopped treatment with ARV?	I FEEL HEALTHY 1 SIDE EFFECTS 2 I DON'T WANT OTHERS TO KNOW 3 INCONVENIENT TO GET TREATMENT 4 ALTERNATIVE TREATMENT 5	Skip if CSCTRS<>2 Skip unless CSTRCURR=2 or 3 Go to CSATT Reason why outside 2ND 90

NA	CS	CONTINUUM OF SERVICES	RESPONSE VALUES	PROGRAMMING, COMMENTS
33.	CSTRNV Why never on ART?	What is the main reason you never started treatment with ARV?	DON'T KNOW ABOUT TREATMENT 1 DON'T KNOW HOW TO GET TREATMENT 2 I DON'T WANT OTHERS TO KNOW 3 AFRAID OF SIDE EFFECTS 4 I FEEL HEALTHY 5	Skip if CSCTRS<>2 Skip unless CSTRCURR=2 or 3 Reason why outside 2ND 90
34.	CSCTSELF Interested in self-testing	If we send you the Oraquick test are you interested to self-test for HIV?	YES 1 NO 2 NOT SURE 3	
35.	CSATT Test Q	This question tests whether you actually read the question. Please select the answer "HIV and Hepatitis".	HIV ONLY 1 HIV AND SYPHILIS 2 HIV AND HEPATITIS 3 HEPATITIS AND SYPHILIS 4	Tests respondent's attention. May be used in data analysis to filter (drop) respondent interview data.

NA	RB	RISK BEHAVIOR	RESPONSE VALUES	PROGRAMMING, COMMENTS
NA	RBMSG1	Thank you. Now a few questions about behaviors and risk.		Move to next question after 5 sec.
36.	RBANDEB Age of MSM sex debut	How old were you when you first had anal sex with a man? With anal sex we mean a penis enters someone's anus.	AGE IN YEARS: ## RANGE: 12 TO ELAGE	Used to crudely gauge total duration of defining risk behavior; used for incidence calculation (Osmond's algorithm)
37.	RBBYSX Ever bought sex	Did you ever buy sex from other men?	YES, IN THE LAST 12 MONTHS 1 YES, BUT LONGER THAN 12 MONTHS AGO 2 NEVER BOUGHT SEX 3	Examining risk behaviors
38.	RBSLSX Ever sold sex	Have you ever sold sex to other men?	YES, IN THE LAST 12 MONTHS 1 YES, BUT LONGER THAN 12 MONTHS AGO 2 NEVER SOLD SEX 3	Examining risk behaviors

NA	RB	RISK BEHAVIOR	RESPONSE VALUES	PROGRAMMING, COMMENTS
39.	RBPANR No. male partners in last 3 mths	In the last 3 months, with how many men did you have anal sex with?	ONE 1 TWO 2 THREE TO FIVE 3 SIX TO TEN 4 MORE THAN TEN 5	Informs partner change rate
40.	RBCON Condom last sex	The last time you had anal sex with another man, did you or your partner use a condom?	YES 1 NO 2	Examining potential risk behaviors (depending on PrEP status)
41.	RBFEMSX Ever had sex with a female	Have you ever had sex with a woman?	YES, IN THE LAST 12 MONTHS 1 YES, BUT LONGER THAN 12 MONTHS AGO 2 NO, NEVER 3	Examining sexual exposure to bridging population.
42.	RBINJ Ever inject drugs	Did you ever inject drugs to get 'high' or feel better?	YES, IN THE LAST 12 MONTHS 1 YES, BUT LONGER THAN 12 MONTHS AGO 2 NEVER INJECTED DRUGS 3	Examining risk behaviors
NA	RBMSG2	Thank you. This completes the interview.		

19 Script for Peer Recruitment, Compensation

Peer recruitment. Thank you for taking the interview. As mentioned earlier we also want your friends to join this survey. Below you will find an electronic invitation you can forward to your friends. Only people you know can use this invitation. Remember that our survey is for men who have sex with other men or transwomen. We will pay you Baht <YY> for each of up to <*Y*> of your friends who successfully join the survey, meaning up to Baht <YY> in total. Of course, we will pay your friends the same money we paid you for joining. [If your friend joins and wins the raffle you will win as well, meaning we will give a prize to both you and your friend]. We cannot pay you if the wrong people use the coupon. Once the invite has been used <*Y*> times, it is no longer valid. The invitation is not transferable – only the friends you invite can use it. The invitation has an expiration date so please use it quickly!

Compensation. We will pay Baht <YY> to your Line account. You should get this payment within the next business day. If you have any questions, please contact us via <*add contact details here*>. Thanks again!

NA	BM	QUESTION	RESPONSE VALUES	SKIPS/PROGRAMMING	COMMENTS
	BMDEC Decision on blood draw	Please let us know your choice:	(1) **OK – I am willing** to go for HIV testing. Show me which clinics I can go to. (*Recruit will be directed to Clinic Info Page*) (2) **I want to learn more first** – show me the full informed consent (*Recruit will be directed to informed consent script*) (3) **I am not interested**. (*Recruit will be directed to refusal question*)		
	BMREF Reason for biomarker refusal	No problem. If you don't mind, please tell us the main reason you don't want to go for a blood test.	ALREADY KNOW MY HIV STATUS 1 ALREADY ON TREATMENT 2 NO TIME 3 THE MONEY IS NOT ENOUGH 4 OTHER 96	Skip if BMDEC=1 or 2	
		Thank you for your time. Good-bye.		Skip if BMDEC=1 or 2	

20 Institutions, Investigators, Funding, and Disclaimer

Institutions involved

- Thailand Ministry of Public Health, Division of Epidemiology (MoPH, DOE)
- Bangkok Metropolitan Administration (BMA)
- Centers for Disease Control and Prevention (CDC)
- Thai Red Cross AIDS Research Center

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Funding and disclaimer

This project has been supported by the President's Emergency Plan for AIDS Relief (PEPFAR) through the Centers for Disease Control and Prevention (CDC) under the terms of CDC-RFA-GH16-1676. The findings and conclusions in this report are those of the author(s) and do not necessarily represent the official position of the Centers for Disease Control and Prevention

Report - Kai Noi Survey - 2022