Ministry of Health

National Center for HIV/AIDS, Dermatology and STD


# NATIONAL POPULATION SIZE ESTIMATION, HIV RELATED RISK BEHAVIORS, AND HIV PREVALENCE AMONG MEN WHO HAVE SEX WITH MEN IN CAMBODIA IN 2014

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# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| AD | Administrative Districts |
| AIDS | Acquired Immunodeficiency Syndrome |
| CoPCT | Continuum of Prevention to Care and Treatment |
| EW | Entertainment Worker |
| FP | Focused Prevention |
| GIS | Geographic Information System |
| HIV | Human Immunodeficiency Virus |
| IP | Implementing Partner |
| IRB | Institutional Review Board |
| KII | Key Informant Interview |
| KP | Key Populations |
| MOH | Ministry of Health |
| MSM | Men Who Have Sex with Men |
| NCHADS | National Center for HIV, Dermatology and STD |
| NECHR | National Ethics Committee for Health Research |
| OD | Operational District |
| OW | Outreach Worker |
| PEPFAR | President's Emergency Plan for AIDS Relief |
| PHD | Provincial Health Department |
| PSI | Population Services International |
| PSK | Population Services Khmer |
| PHSC | Protection of Human Subjects Committee |
| STI | Sexually Transmitted Infection |
| SOP | Standard Operating Procedure |
| STATA | Statistical Package for the Social Sciences |
| TG | Transgender |
| USAID | United States Agency for International Development |
| UNAIDS | Joint United Nations Programs on HIV |
| WHO | World Health Organization |

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# EXECUTIVE SUMMARY

## Background

In line with the new global initiative "Three Zeros" (3.0) strategy of the United Nations, the National Center for HIV, Dermatology and STD (NCHADS) of the Ministry of Health (MOH) has committed to eliminating new HIV infections in Cambodia by 2025 using a set of strategies. The Standard Operating Procedure (SOP) for Continuum of Prevention to Care and Treatment (CoPCT) for key populations was established in 2010 and revised in 2012 in order to reach the goals set for 2025. The Boosted CoPCT for key populations focuses on expanding standard prevention interventions among all key populations that are considered at high risk of acquiring HIV, which include female entertainment workers (FEW), men who have sex with men (MSM), transgender women (TG), people who use drugs (PWUD), and people who inject drugs (PWID).

To help achieve the 3.0 initiative, studies have been conducted on size estimation, HIV-related risk behaviors, and HIV prevalence among MSM, a population considered highly susceptible to HIV infection. In order to respond to the needs and accurately measure the impact of HIV programs on this population, data on the size and geographical distribution of MSM must be collected. Findings from this study are important for resource allocation to the most efficient and effective interventions targeting the most prevalent risk behaviors to reduce new HIV infections among MSM.

## Study objectives

- To estimate the population size of MSM in Cambodia.
- To measure HIV-related risk behaviors among MSM in Cambodia.
- To measure HIV prevalence among MSM in Cambodia.

## Methods

The MSM size estimation was performed using the capture-recapture (CRC) method. Data collection occurred in two time points with an 18-day interval between capture and recapture rounds. Each round of data collection had a span of one week (Monday-Sunday). The estimation was calculated in three steps: (1) MSM size estimation was calculated using the Lincoln-Peterson formula to estimate visible-reachable MSM in 12 provinces; (2) the calculation was compensated by the estimated hidden MSM of 35.0% and sexually inactive MSM of 11.0% in the same settings of the first step; and (3) the ratio of MSM to the general male population was calculated in order to extrapolate all MSM-- urban and rural, sexually inactive and active, visible-reachable and hidden— in Cambodia.

A total of 838 MSM were randomly selected for interviews during the capture round to assess HIV risk behaviors. A two-stage cluster sampling method was used to recruit the participants. Venues/hotspots were considered primary units and individuals were considered secondary units. From the existing comprehensive geographic

information system (GIS) mapping for key populations in five provinces, there were about nine MSM per venue/hotpot. Therefore, 133 venues/hotspots were randomly selected from the entire list of 575 venues to get a representative sample.

A time location sampling approach was used to estimate the HIV prevalence among MSM in Cambodia. A map was developed prior to data collection to identify venues/hotspots (where and when MSM congregate). Afterwards, venues and dates/times were randomly selected to draw a representative sample of MSM. The sample size consisted of 1,646 MSM participants from eight cities/provinces with approximately 200 MSM per city/province, with the exception of Phnom Penh, where 400 MSM were included in the sample. The data collection team acquired a blood sample and demographic information for each participant. A serial two-test algorithm was used to determine the HIV status (Determine HIV ½ and Stat-Pak). All positive samples were tested at NCHADS's central laboratory for quality control.

Each question of the surveys was coded continuously or categorically according to the nature of the variables and entered into a computerized database using Epi Data version 3.1 (Odense, Denmark). STATA version 12.0 (College Station, TX) was used to analyze demographic characteristics, risk behaviors, and the HIV prevalence. Excel spreadsheet was used to calculate summary data of CRC for the size estimation.

## Results

The estimated size of MSM in Cambodia in 2014 was approximately 31,000. About 16,000 (52.0%) MSM were in urban areas; 27,500 (89.0%) MSM were sexually active; and 20,000 (65.0%) were reachable MSM. The capital city of Phnom Penh had the largest MSM population, approximately 6,800, while five provinces (Banteay Meanchey, Battambang, Kampong Cham, Kandal, and Siem Reap) had an MSM population between 2,000 and 3,000.

Subsequent indicators were measured to assess HIV-related risk behaviors and access to HIV education and health services among MSM. The majority of the respondents reported having anal sex in the last 12 months (88.6%), and nearly two-thirds of the respondents said they had anal sex in the last month (64.0%). Of those who reported having sex in the past six months, 69.4% reported always using condoms when having sexual intercourse with their partners. The majority of the respondents reported receiving information on HIV from outreach workers (71.6%). However, only two-thirds reported having been tested for HIV (66.6%), and even fewer (49.3%) reported having been screened for sexual transmitted infections (STI) in the past six months. Eight percent reported having at least one STI symptom in the past 12 months, the vast majority of those received treatment (93.6%).

HIV prevalence among MSM was 2.3%. Descriptive analysis showed that HIV prevalence was higher among MSM aged 24 years old or older (4.6%) and those with low formal education level (4.5%) compared to their comparison group. The cities/provinces with the highest HIV prevalence among MSM were Siem Reap (5.9%) and Phnom Penh (3.0%), while MSM in Battambang and Kandal had the lowest HIV prevalence at 0.5%. MSM who reported sex work being their main job had the highest HIV prevalence (17.2%) compared to those in other occupations who had an HIV prevalence ranging from 1.0% to 4.7%.

# Conclusions and Recommendations

With approximately 31,000 MSM in Cambodia, a population considered at high risk for contracting HIV due to engagement in risky sexual behaviors, efforts to prevent, manage, and treat HIV in this population are essential for achieving the 3.0 initiative aimed at eliminating new HIV infections in the country by 2025. Accurate strategic information, such as population size estimation, measures of risk behaviors, and HIV prevalence among MSM, is imperative to better understanding the impact of this population on the nationwide HIV prevalence, designing effective interventions, and informing further studies.

Additional information is needed to effectively respond to the immediate needs of this population. For example, there is a need for a more comprehensive study on HIV-associated risk factors among this population, evaluation of the existing programs and interventions (e.g. M-Style), and a nationwide estimation of HIV prevalence of this population.

# 1- INTRODUCTION

Globally, men who have sex with men (MSM) are recognized as a population with high risk of HIV. According to a 2012 systematic review, pooled HIV prevalence among MSM ranged from as low as 3.0% in the Middle East to as high as 25.4% in the Caribbean countries [1]. In all the countries included in the review, the HIV prevalence among MSM is substantially higher than the estimated HIV prevalence among the general population reported in a 2009 projection by UNAIDS [1]. The review suggested that the incidence of HIV infection among this population is substantial [1]. Another prospective study in China also found a high incident rate of about 7 per 100 person-years [2].

Similar to other settings, MSM share a significant role in driving the HIV epidemic in Cambodia. The Bros Khmer Study in 2010 reported that the prevalence of HIV and sexually transmitted infections (STI) is 2.2% and 51.5%, respectively [3]. HIV prevalence among MSM was almost three times higher than that among the general population aged 15-49 years old in the same year [3, 4]. Risky sexual behaviors among this population also remain challenging. According to our recent study, only 38.1% of MSM reported always using condoms in the past month when having sex with male sex workers [5].

With success in bringing down HIV prevalence in the general adult population from the peak of about 2.0% in 1998 to 0.7% in 2014, Cambodia is hoping to achieve its new goals through the Cambodia 3.0 strategy, which aims to eliminate new HIV infections in Cambodia by 2025 through advancement in HIV prevention and treatment [5, 6]. To support this strategy, a new standard operating procedure (SOP) known as the Boosted Continuum of Prevention to Care and Treatment (Boosted CoPCT) was introduced in 2013 [6]. The Boosted CoPCT sheds light for the need for data on national population size estimation as well as behavioral and biological surveillance among MSM. These data are important for HIV program planning, implementation, monitoring, and evaluation. To fill in the data gap, the National Center for HIV/AIDS, Dermatology, and STD (NCHADS) conducted this study in collaboration with the HIV/AIDS Flagship consortium partners, which include KHANA, FHI 360, and PSI/PSK.

# 2- STUDY OBJECTIVES

The objectives of the study are:

1) To estimate the national MSM population size in Cambodia.

2) To measure HIV-related risk behaviors among MSM in Cambodia.

3) To measure the HIV prevalence among MSM in Cambodia.

**Data collection training at KHANA office**
**photo credit Chhoun P.**

# 3- METHODS

This study comprised three surveys. The first survey was about MSM size estimation. The second survey dealt with HIV-related risk behaviors. The third survey captured the HIV prevalence among the target group. The following sub-sections delineate the population, sites, and sampling of the studies. Data collection, management, and analyses are also described.

## 3.1 Study population

In this study, MSM was defined as "Males who have sex with males, regardless of whether or not they have sex with women or have a personal or social gay or bisexual identity [7]." The study recruited participants who met the following inclusion criteria:

**a)** Biological male;

**b)** Aged 15 and over;

**c)** Having sex with at least one male partner in the past 12 months;

**d)** Khmer speaking; and

**e)** Able and willing to provide oral informed consent.

## 3.2 Study sites

The study was conducted in 12 provinces of Cambodia: Banteay Meanchey, Battambang, Kampong Cham, Kampong Chhnang, Kampong Speu, Kandal, Koh Kong, Phnom Penh, Preah Sihanouk, Prey Veng, Siem Reap, and Svay Rieng. These provinces were selected because they have been in the list of municipality/provinces with high HIV burden (see Annex 1 for the list of high burden ODs).

The participants were recruited from various venues/hotspots. Types of venues/hotspots were defined as follows:

- **Nightclub/discotheque:** An entertainment venue that usually operates at nighttime. A nightclub or discotheque generally has a dance floor and a disk jockey (DJ). This locale is known as an entertainment place where MSM can find sexual partners.
- **Sauna/spa:** Facilities where people go for massages or steaming to improve physical fitness. These locales are places where MSM work or go to find sexual partners.
- **Barber/beauty salon:** An establishment that provides women and men with services to improve their beauty. MSM may work or use such services.
- **Street:** An open space along a street in a town or city where MSM "hang out" or socialize. This is a common area for MSM to find sexual partners.
- **Park/river:** An open space for public use where MSM socialize and find sexual partners or clients.
- **Specific community:** A private house, pagoda or building where MSM gather and can find sexual partners.

## 3.3 Development of a venue map prior to data collection

Before the data collection began, the data collection team members paired up and spent five days in the field per province to update the lists of MSM venues in the 12 provinces. The venues were updated using the following methods:

**First phase:** Technical working groups collected lists of existing venues/hotspots used in HIV programs. Then, the data collection teams visited local NGOs and Provincial Health Departments (PHD) to update the lists of venues/hotspots. A meeting with these stakeholders in each province was held to review the existing lists and to determine if there were new venues/hotspots identified that had not been added to the existing ones. These stakeholders were asked about the specific time and day that MSM preferred to congregate in these spots. During the first phase, 108 new venues/hotspots were identified and added to the 505 existing venues on the lists.

**Second phase:** The data collectors also identified members of the MSM community who had broader networks within this population and were potentially not in the current HIV program coverage areas. These persons included MSM who knew other MSM living outside of their area. The team worked with them to investigate additional new venues/hotspots. To identify MSM who had a larger network size, the survey team visited public spots such as parks, riverbanks, and streets and asked 15 MSM two questions: 1) How many MSM do you know? And 2) How many places where MSM meet do you know? Out of the 15, two MSM who knew more than the others were selected for interviews. The purpose of this process was to identify venues/hotspots that were not included in the existing lists. Eight key informants (MSM with broader networks) were interviewed in each province, with a total of 96 interviews in the 12 provinces. Some key informants were asked to accompany the interviewers to locations they had indicated or marked. The names of additional locales were added to the existing lists, which were updated in phase one (see Annex 2 for KII tools). In phase two, there were 28 more venues/hotspots identified.

**Table 1: Estimated numbers of MSM and venues/hotspots by province from Phase 1 to Phase 2**

| Number of venues/hotspots | | | | | |
|---|---|---|---|---|---|
| **Provinces** | **# of venues** | **Phase1** | **Phase2** | **Total** | **Est. # of MSM** |
| Banteay Meanchey | 82 | 70 | 0 | 152 | 1,326 |
| Battambang | 83 | 2 | 0 | 85 | 2,244 |
| Kampong Cham | 27 | 0 | 0 | 27 | 300 |
| Kampong Chhnang | 28 | 2 | 0 | 30 | 282 |
| Kampong Speu | 2 | 16 | 3 | 21 | 529 |
| Kandal | 19 | 0 | 0 | 19 | 344 |
| Koh Kong | 27 | 14 | 2 | 43 | 272 |
| Phnom Penh | 108 | 0 | 13 | 121 | 4,356 |
| Prey Veng | 69 | 4 | 0 | 73 | 571 |
| Siem Reap | 43 | 0 | 0 | 43 | 801 |
| Preah Sihanouk | 17 | 0 | 0 | 17 | 120 |
| Svay Rieng | 0 | 0 | 10 | 10 | 56 |
| **Total** | **505** | **108** | **28** | **641** | **10,698** |

## 3.4 Sample size and sampling

For the size estimation, all venues/hotspots were visited during the capture round and re-visited during the recapture round.

For the behavioral assessment, Epi Info's STACAL software (Odense, Denmark) was used to calculate the required sample size. Inconsistent condom use was considered the main outcome variable for this calculation. Based on the BROS Khmer study, the percentage of MSM who did not use condoms during their last sexual encounter was approximately 35.0%, and the number of MSM was estimated to be around 21,300 in 2008 [8]. By selecting the confidence limit at 4%, and choosing the design effect equal to two, the sample size calculation determined that approximately 1,200 individuals were required to draw a representative sample, taking into account a 95.0% confidence interval (CI) and 10.0% refusal rate. A two-stage cluster sampling was used to recruit participants. Venues/hotspots were considered as primary sampling units, and individuals were considered as secondary sampling units. From the existing comprehensive GIS mapping for key populations in five provinces, there were about nine MSM per venue/hotpot. Therefore, 133 venues/hotspots were randomly selected from the entire list of 641 venues/hotspots to get the representative sample.

To estimate the HIV prevalence among MSM in Cambodia, a cross-sectional survey was conducted using a time-location sampling approach. The same map developed for the size estimation earlier discussed was used as a sampling frame that helped identify venues/hotspots--where and when MSM congregate. Afterwards, venues and dates/times were selected randomly to draw a representative sample of MSM. The sample size consisted of 1,646 MSM participants from eight provinces/municipality including Banteay Meanchey, Battambang, Kampong Cham, Kandal, Phnom Penh, Poipet, Preah Sihanouk, and Siem Reap. Approximately 200 MSM per city/province were included, with an exception of Phnom Penh, where 400 MSM were included in the sample.

## 3.5 Capture-recapture (CRC) method

The CRC method was used to estimate the size of MSM in this study. This method is based on two independent sampling rounds: the capture round and the recapture round. To use this method, the researchers mapped all sites where the population could be found, tagged all members of the population at the sites (the capture round), and returned to the same sites after an appropriate interval of time to retag all members of the population (the recapture round). Recapture round was conducted by counting both new members who were and were not counted in the first round.

This method relies on five main assumptions: (1) the population is closed; (2) every member has an equal chance of being recruited in the survey; (3) individuals captured in both rounds need to be matched; (4) the two sample sizes from first round and second round are independent; and (5) the sample size of each round is large enough to be meaningful [7,9,10]. If the two rounds are independent, the estimated probability of being tagged in both rounds is the product of the probabilities of being tagged in each round [7, 9, 10].

For this survey, the data collection occurred in two time points-- seven days (Monday-Sunday) for the capture round, and an additional seven days (Monday-Sunday) for the recapture round, with an 18-day interval between the two rounds.

**Capture round:** Trained data collectors visited every single venue/hotspot identified in the mapping lists and "tagged" all MSM at each venue/hotspot. Data collectors contacted MSM present at each survey site, introduced the survey

and its objectives, and asked whether the potential participant agreed to be screened for eligibility. If the potential participants were eligible, those who chose to participate were asked to provide a verbal consent using a written standard consent form. For every contact, the data collector collected brief information on socio-demographic characteristics and risky sexual behaviors using a short questionnaire that took about three minutes to complete. After completing the interview, data collectors provided a can of Bacchus (soft drink) to the interviewees to help with recalling during the recapture round. This memorable token was used to prevent double counting during the capture round and also to help identify individuals counted in both rounds. A question, "Have you ever received a can of Bacchus after completing an interview from any interviewer?", was included in the questionnaire for tagging.

**Recapture round:** Eighteen days after the capture round, data collectors revisited every site to recapture all MSM present at each venue/hotspot. The same screening criteria were applied. Also, the same questionnaire was used, except three additional questions that were included in the recapture round. At this round, data collectors provided a handkerchief as a memorable token and asked if they were captured in the first round. To identify MSM who had been interviewed in the first round, all interviewees were asked, "Have you ever received a can of Bacchus after completing an interview from any interviewer in the past two/three weeks?" Asking the participants if they had already received the second memorable token, a handkerchief, was used to assess duplicates at the recapture round.

During both rounds, each venue/hotspot was visited at least two times based on the proposed time of MSM gathering in the venue/hotspot lists. The proposed time of recruitment was based on the experiences of NGO staff working in those areas or through key informant interviews during the MSM venue/hotspot updating.

## 3.6 Data collection

### a. Size estimation

Prior to the data collection, a two-day training workshop was conducted and with a one-day practice for questionnaire pretesting for 18 data collectors, six team leaders, and two study coordinators. The training covered several topics such as the study objectives, the use of the tools, interview techniques, ethical considerations, communication skills, and how to administer the questionnaires.

The HIV/AIDS Flagship research team was responsible for overall monitoring of the data collection process and quality. The team was also responsible for identifying, documenting, and reporting protocol violation and social harms to the principal investigators. Team leaders were responsible for checking the questionnaires upon receipt from team members and ensuring that proper informed consents were obtained; data collection processes were follow; and compliance with the protocol was maintained.

The HIV/AIDS Flagship research team and the study coordinators traveled with data collection teams to monitor their fieldwork and to answer any questions during the data collection. For teams traveling far, study coordinators communicated with the team leaders daily by phone and/or email. The study coordinators also regularly checked with the team leaders to ensure that they were monitoring the quality of data collection, following appropriate protocol implementation, and that they were providing feedback to their teams as needed.

### b. HIV-related risk behavior survey

The survey was conducted simultaneously with the size estimation survey. Additional behavioral

questions were added to the questionnaire administered during the capture round to randomly select MSM who participated in the size estimation survey and volunteered to participate in this survey. A total of 838 MSM were interviewed to assess their HIV risk behaviors. Although the 838 participants were less than the approximated 1,200 representative sample size, this was considered enough when the design effect was reduced from two to one and a half.

The questionnaire included questions on socio-demographics (i.e. age, occupation, and marital status), condom and lubricant accessibility (i.e. where they preferred to get condoms and/or lubricant), sexual behaviors (i.e. how often they used condoms with their partners when having anal sex in the past 6 months), utilization of HIV programs (i.e. how many times they received information on HIV from outreach workers), and access to health services (i.e. if they ever had STI screening in the past 6 months).

### c. HIV prevalence survey

After obtaining an informed consent, the participants were interviewed with a short questionnaire consisting of demographic and gender identity questions, and a 5-10 ml whole blood sample was acquired from them for HIV testing.

To perform the HIV testing, a serial two-test algorithm-- Determine HIV ½ and Stat-Pak-- was used. A dried blood spot card was prepared for samples selected for quality control, which were brought to NCHADS's central laboratory. All positive samples and 10.0% of all non-reactive specimens were tested for the quality control. Two enzyme immunoassays (EIA) were used for this quality control: Vironostika HIV Uniform and Murex HIV-1.2.0 (11).

## 3.7 Data management and analyses

MSM size estimation analysis was done in three main steps:

- **First step:** The Lincoln-Peterson formula was used to calculate the estimated number of MSM in the 12 provinces. Lincoln-Peterson formula is N= C1*C2/R where N is the estimated population size, C1 is the number of unique contacts in round 1, C2 is the number of unique contacts in round 2, and R (retagged) is the number of MSM contacts in both rounds.

- **Second step:** In this step, we assumed that MSM who were recruited during CRC were identified in venues/hotspots so they were more likely to be visible-reachable MSM. To take into account the number of hidden MSM, the information from key informant interviews (KIIs) was used. Ninety-six KIIs were conducted among MSM who had a larger network. As mentioned in Section 3.3, key informants were identified during mapping prior to the data collection. To identify key informants who had a larger network size, the survey teams visited public spots such as parks, riverbanks, and streets and asked 15 MSM two questions: 1) How many MSM do you know? And 2) How many places where MSM meet do you know? Out of the 15, the study team selected two MSM who had the largest reported network out of the 15 MSM screened. The study team repeated this procedure until they got eight MSM in each city. Every key informant was asked, "Of the MSM that you know, how many of them does not disclose MSM status to others and local NGOs?" Some of them reported in percentage and some of them reported an exact number (e.g. 5 out

of 15, 7 out of 13). From this, we calculated the mean of percentages, which was about 35.0%. The number of hidden MSM was based on this percentage.

At the end of this step, we calculated an estimated total number of MSM in the 12 provinces, of which 35.0% were hidden MSM, 54.0% were visible-reachable and sexually active MSM, and 11.0% were visible-reachable and sexually inactive (those who had sex with at least one man in his lifetime, but not in the past 12 months). This 11.0% was calculated from the screening for eligible criteria.

- **Third (Final) step:** In this step, we again relied on assumptions that (1) Being MSM is biological; thus, MSM can be anywhere within the general male population and (2) MSM are more likely to relocate to urban cities where they can meet their peers and sexual partners. In our case, we calculated a ratio of MSM to the general male population in the same age range and sites. Overall, the ratio of MSM to the general male population was about 18 MSM per 1,000 males in urban areas and 5 MSM per 1,000 males in rural areas. The ratio was used to extrapolate an estimated number of MSM for each site, which was not covered by our study. In doing so, we were able to estimate the total number of MSM nationwide.

A sample of 5,557 individuals who were met during the capture and/or recapture rounds were analyzed to characterize the MSM population in this study, such as their age, marital status, occupation, education, living settings, etc.

A sample of 838 individuals who had been selected for the behavioral survey during the capture round were analyzed to assess their HIV-related risk behaviors, such as experience of having anal sex in the past 12 months, the number of sexual partners, condom use, access to condoms, receiving HIV prevention services, etc.

A sample of blood from 1,646 individuals was analyzed to determine the HIV prevalence, which was computed by simply dividing all HIV positive cases with the total number of participants. Data were disaggregated by gender self-identity, age group, level of education, and provinces.

For all the three surveys, the completed questionnaires were checked and verified for errors by the fieldwork supervisors during the field data collection process. Data entry began after the field data collection was completed. Data processing personnel consisted of a supervisor and five entry operators. Each question was coded continuously or categorically according to the nature of the variable and entered into a computerized database using Epi Data version 3.1 (Odense, Denmark). Double data entry was performed to crosscheck data entry errors. Consistency and verification were performed to eliminate occurring errors. STATA version 12.0 (College Station, TX) was used to analyze the participants' demographic characteristics, risk behaviors, and HIV prevalence. Excel spreadsheet was used to calculate summary data of CRC for the size estimation.

## 3.8 Ethical considerations

The study protocol and tools was reviewed and approved by the National Ethics Committee for Health Research (NECHR) of the Ministry of Health and the FHI 360 Ethical Committee called the Protection of Human Subjects Committee (PHSC).

Participation in the study was completely voluntary, and anticipated risk for the participants was minimal. Upon recruitment, eligible individuals were oriented about the study protocol and asked for an informed consent- a verbal consent

for the size estimation and risk behavior surveys and a written consent form for the HIV prevalence survey. The study participants were informed that they could refuse or discontinue their participation at any time for any reason and without any consequences.

Sensitive and confidential information was collected, including labeled blood samples, health status, utilization of HIV programs and services, etc. Thus, to protect the identity of the participants, a numeric code was used as the participant identifier for data collection purposes. All other personal identifiers from the survey questionnaires were removed. To ensure safety and confidentiality, forms that contained sensitive information (i.e. informed consent forms) were locked in bags during transportation and stored in locked cabinets. Electronic data were stored with a pass code.

# 4- RESULTS

## 4.1 Socio-demographic characteristics

The socio-demographic characteristics of MSM in the size estimation study are shown in Table 2. In total, 5,557 MSM were interviewed in both rounds. Mean age of MSM surveyed was 24.8 years (SD=6.6) with a wide range of 15 to 49 years. The mean years of formal education completed were 9.6 years (SD=3.6). Of the total, 92.7% of MSM in this study were never married; 5.0% were married; and 1.9% of them were divorced or separated. The top three occupations for this population were self employer (18.8 %), students (16.8%), and laborers (15.0%). A high proportion of the respondents (85.8%) reported living in the current city for more than two years. The mean duration of living in the current city was 7.4 years with a standard deviation of 4.3 years.

**Table 2: Socio-demographic characteristics of visible-reachable MSM interviewed at capture and recapture rounds (n= 5,557)**

| Variables | n (%) |
|---|---|
| Age | |
| Mean ± (years, SD) | 24.8 (6.6) |
| 15-19 | 1,044 (18.7) |
| 20-24 | 2,176 (39.0) |
| 25-29 | 1,370 (24.6) |
| 30-34 | 573 (10.3) |
| 35-39 | 181 (3.2) |
| 40-44 | 88 (1.6) |
| 45-49 | 128 (2.3) |
| Education (years) | |
| Mean number of years in school (in years ± SD) | 9.6 (3.6) |
| Never attended school | 84 (1.5) |
| 1-6 | 899 (16.2) |
| 7-9 | 1,700 (30.6) |
| 10-12 | 1,952 (35.2) |
| Higher | 915 (16.5) |
| Occupation | |
| Unemployed | 513 (9.2) |
| Students | 933 (16.8) |
| Office workers | 781 (14.0) |
| Entertainment workers | 586 (10.5) |
| Self-employed | 1,042 (18.8) |
| Salon & hairdressers | 779 (14.0) |
| Labor workers | 835 (15.0) |

| | |
|---|---|
| Sex workers | 40 (0.7) |
| Other | 260 (4.7) |
| Marital Status | |
| Never married | 5,163 (92.7) |
| Married | 281 (5.0) |
| Divorced, separated, or widowed | 105 (1.9) |
| Length of residence in the current city | |
| Mean (in months, ± SD) | 89.3 (51.9) |
| < 1 year | 416 (7.5) |
| 1-2 years | 374 (6.7) |
| > 2 years | 4,777 (85.8) |

Abbreviation: SD, standard deviation

## 4.2 Size estimation

### a. The estimation of visible-reachable MSM population in the 12 provinces

The estimation of visible-reachable MSM population in the 12 provinces of Cambodia is shown in Table 3. The first column is the number of MSM counted during the capture round (Round 1). The second column is the number of MSM who were counted during the recapture round (Round 2). The third column is the number of individuals who were retagged -- captured in both rounds. The fourth column shows the estimated number of MSM using the Lincoln-Peterson formula.

All MSM who were captured in both rounds were identified in hotspots/venues; therefore, these MSM were considered visible-reachable MSM only. The estimated size of MSM population in the 12 provinces was approximately 7,800 with a 95.0% CI ranged from 7,300 to 8,400 MSM. Of the selected sites, the majority of MSM were in urban administrative districts categorized by the 2008 census. The rural administrative districts were only in Kampong Chhnang and Prey Veng provinces (Table 3).

**Table 3: Number of men who have sex with men in capture and recapture rounds by province**

| Variables | Capture (C1) | Recapture (C2) | R | Total | 95% CI | |
|---|---|---|---|---|---|---|
| **Number by province** | **n** | **n** | | **n (%)** | **Lower** | **Upper** |
| Banteay Meanchey | 307 | 514 | 238 | 663 | 634 | 692 |
| Battambang | 440 | 573 | 250 | 1,008 | 947 | 1,070 |
| Kampong Cham | 113 | 123 | 69 | 201 | 182 | 221 |
| Kampong Chhnang (Urban) | 59 | 115 | 32 | 212 | 170 | 254 |
| Kampong Chhnang (Rural) | 50 | 96 | 26 | 185 | 143 | 227 |
| Kampong Speu | 87 | 146 | 40 | 318 | 256 | 379 |
| Kandal | 115 | 183 | 74 | 284 | 255 | 314 |
| Koh Kong | 39 | 59 | 31 | 74 | 66 | 82 |
| Phnom Penh | 1,291 | 1,624 | 569 | 3,685 | 3,502 | 3,867 |
| Prey Veng (Rural) | 41 | 173 | 32 | 222 | 189 | 254 |
| Siem Reap | 366 | 430 | 212 | 742 | 696 | 789 |
| Preah Sihanouk | 65 | 118 | 52 | 148 | 134 | 161 |
| Svay Rieng | 53 | 44 | 32 | 73 | 65 | 81 |
| **Total** | **3,026** | **4,198** | **1,657** | **7,815** | **7,238** | **8,391** |

Abbreviation: CI, confidence interval

## b. Estimation of visible-reachable and hidden MSM in the 12 provinces

The number of MSM estimated by the CRC method is called visible-reachable MSM. MSM recruited in the study did not represent the whole MSM population. In this section, we attempted to include hidden and sexually inactive MSM.

As seen in Table 4, the total number of MSM was calculated by the sum of (1) MSM who reported having sex with at least one man in the past 12 months (54.0%), (2) MSM who reported having sex in their lifetime but not in the past 12 months (11.0%)—referred to as sexually inactive MSM, and (3) hidden MSM (35.0%) (See Section 3.7 for calculation of hidden MSM). By including all three aforementioned groups, the total number of MSM aged 15-49 years in the 12 selected provinces was estimated to be 13,719.

**Table 4: Calculation of MSM proportion in the general male population according to sexual activity**

| Provinces and administrative districts (a) | MSM age 15-45 years old | | | |
|---|---|---|---|---|
| | Sex, 12 months (54%) | Sex, lifetime (11%) | Hidden MSM (35%) | Total MSM |
| Phnom Penh[1] | 3,685 | 751 | 2,388 | 6,823 |
| Battambang[3-4] | 1,008 | 205 | 654 | 1,868 |
| Siem Reap[5-6] | 742 | 151 | 481 | 1,375 |
| Banteay Meanchey[7-8] | 663 | 135 | 430 | 1,228 |
| Kampong Chhnang (urban)[9-11] | 212 | 43 | 137 | 393 |
| Kampong Chhnang (rural)[10-11] | 185 | 38 | 120 | 343 |
| Kampong Speu[12-13] | 318 | 65 | 206 | 588 |
| Kandal[14-15] | 284 | 58 | 184 | 527 |
| Prey Veng(rural)[16-19] | 222 | 45 | 144 | 410 |
| Kampong Cham[21-22] | 201 | 41 | 131 | 373 |
| Preah Sihanouk[23] | 148 | 30 | 96 | 273 |
| Koh Kong[24] | 74 | 15 | 48 | 137 |
| Svay Rieng[25] | 73 | 15 | 47 | 135 |
| **Total** | **7,815** | **1,509** | **4,802** | **13,719** |

Abbreviation: MSM, men who have sex with men

(a) Administrative districts (AD): [1]all districts (Khan), [2]Banan, [3]Battambang, [4]Sangke, [5]Siem Reap, [6]Brasat Bakong, [7]Serei Sophorn, [8]Poipet, [9]Kampong Chhnang, [10]Terk Phos, [11]Rorlea Pha-ea, [12]Kampng Leng, [13]Chhbar Morn, [14]Takhmao, [15]Kien Svay, [16]Peam Ror, [17]Peam Chor, [18]Preah Sdach, [19]Baphnom, [21]Kampong Cham, [22]Kampong Siem, [23]Preah Sihanouk, [24]Khemarak Phoumin, [25]Svay Rieng, [26]Stung Sen, [27]Kampot, [28]Kep, [29]Kratie, [30]Rattanak Mondul, [31]Anlong Veng, [32]Samrong, [33]Pailin, [34]Preah Vihear, [35]Pursat, [36]Banlung, [37]Stung Treng, [38]Doun Keo

## c. Ratio of MSM aged 15-49 years to the general male population in the same age group

After the total number of MSM in selected provinces was calculated, ratio of MSM to the general male population in each province was calculated as shown in Table 5. The total number of MSM was divided by the number of males in the same age range (15-49 years old) from selected administrative districts where venues/hotpots of MSM existed. From this calculation, we obtained an overall ratio of MSM to the general male population of 18 MSM per 1,000 males for urban areas and 5 MSM per 1,000 males in rural areas.

**Table 5: Calculation of MSM proportion in the general male population according to age groups**

| Provinces and administrative districts (a) | Male pop. age 15-49 (b) | Total MSM age 15-49 | Ratio MSM per 1000 male pop. |
|---|---|---|---|
| | **Urban** | | |
| Phnom Penh | 329,073 | 6,823 | 21 |
| Battambang | 101,083 | 1,868 | 18 |
| Siem Reap | 75,947 | 1,375 | 18 |
| Banteay Meanchey | 51,301 | 1,228 | 24 |
| Kampong Chhnang | 11,166 | 393 | 35 |
| Kampong Speu | 57,084 | 588 | 10 |
| Kandal | 69,469 | 527 | 8 |
| Kampong Cham | 42,654 | 373 | 9 |
| Preah Sihanouk | 22,226 | 273 | 12 |
| Koh Kong | 7,906 | 137 | 17 |
| Svay Rieng | 13,304 | 135 | 10 |
| **Total** | **781,214** | **13,719** | **18** |
| | **Rural** | | |
| Prey Veng | 104,537 | 410 | 4 |
| Kampong Chhnang | 55,864 | 343 | 6 |
| **Total** | **160,401** | **753** | **5** |

(a) Administrative districts (AD): [1]all districts (Khan), [2]Banan, [3]Battambang, [4]Sangke, [5]Siem Reap, [6]Brasat Bakong, [7]Serei Sophorn, [8]Poipet, [9]Kampong Chhnang, [10]Terk Phos, [11]Rorlea Pha-ea, [12]Kampng Leng, [13]Chhbar Morn, [14]Takhmao, [15]Kien Svay, [16]Ream Ror, [17]Ream Chor, [18]Preah Sdach, [19]Baphnom, [21]Kampong Cham, [22]Kampong Siem, [23]Preah Sihanuk, [24]Khemarak Phumin, [25]Svay Rieng, [26]Stung Sen, [27]Kampot, [28]Kep, [29]Kratie, [30]Ratanak Mondul, [31]Anlong Veng, [32]Samrong, [33]Pailin, [34]Preah Vihear, [35]Pursat, [36]Banlung, [37]Stung Treng, [38]Doun Keo

(b) Male population in 2014 was estimated based on the 2009 National Committee for Sub-National Democratic Development (NCDD), applying an annual growth rate of 1.6%, 1.7%, 1.8%, 1.8%, 1.8% in 2010, 2011, 2012, 2013, and 2014, respectively (12).

## d. Estimation of both visible-reachable and hidden MSM in all 24 municipality and provinces

Table 6 shows the final national size estimation of MSM population in Cambodia. This number included urban, rural, visible-reachable, hidden, sexually active, and sexually inactive MSM across the country. There were approximately 31,000 MSM in Cambodia. Of these, about 16,000 MSM were estimated to be in urban areas and 15,000 in rural areas. The largest number of MSM, about 6,800, was estimated to be in Phnom Penh. Five provinces had a population size of MSM between 2,000 and 3,000 – Banteay Meanchey, Battambang, Kampong Cham, Kandal, and Siem Reap. In addition, six other provinces had a population size of MSM between 1,000 and less than 1,500 – Kampong Chhnang, Kampong Speu, Kampong Thom, Kampot, Prey Veng, and Takeo.

**Table 6: Extrapolation of the numbers of MSM from the general male population aged 15-49 years**

| Provinces | Urban | | | Rural | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|
| | Males | Ratio/ 1000 males | MSM | Males | Ratio/ 1000 males | MSM | Males | Ratio/ 1000 males | MSM |
| Phnom Penh | 329,073 | 21 | 6,823 | N/A | N/A | N/A | 329,073 | 21 | 6,823 |
| Battambang | 80,784 | 23 | 1,868 | 192,696 | 5 | 963 | 273,480 | 10 | 2,831 |
| Banteay Meanchey | 75,947 | 18 | 1,375 | 150,086 | 5 | 750 | 226,033 | 9 | 2,125 |
| Siem Reap | 51,301 | 24 | 1,228 | 185,992 | 5 | 930 | 237,293 | 9 | 2,158 |
| Kampong Chhnang | 11,166 | 35 | 393 | 123,013 | 5 | 615 | 134,179 | 8 | 1,010 |
| Kampong Speu | 57,084 | 10 | 588 | 156,563 | 5 | 783 | 213,647 | 6 | 1,371 |
| Kandal | 69,469 | 8 | 527 | 300,133 | 5 | 1,501 | 369,602 | 5 | 2,028 |
| Prey Veng | 7,199 | 18 | 130 | 217,091 | 5 | 1,085 | 224,290 | 5 | 1,215 |
| Kampong Cham | 42,654 | 9 | 373 | 471,508 | 5 | 2,358 | 514,162 | 5 | 2,731 |
| Preah Sihanouk | 22,226 | 12 | 273 | 34,332 | 5 | 172 | 56,558 | 8 | 445 |
| Svay Rieng | 13,304 | 10 | 135 | 152,362 | 5 | 762 | 165,666 | 5 | 897 |
| Koh Kong | 7,906 | 17 | 137 | 28,285 | 5 | 141 | 36,191 | 8 | 278 |
| Uddar Meanchey | 35,308 | 18 | 636 | 22,950 | 5 | 115 | 58,258 | 13 | 750 |
| Pursat | 17,302 | 18 | 311 | 99,045 | 5 | 495 | 116,347 | 7 | 807 |
| Kampong Thom | 15,323 | 18 | 276 | 172,227 | 5 | 861 | 187,550 | 6 | 1,137 |
| Takeo | 13,125 | 18 | 236 | 253,926 | 5 | 1,270 | 267,051 | 6 | 1,506 |
| Mondulkiri | 2,758 | 18 | 50 | 12,653 | 5 | 63 | 15,411 | 7 | 113 |
| Kampot | 10,148 | 18 | 183 | 165,484 | 5 | 827 | 175,632 | 6 | 1,010 |
| Pailin | 8,939 | 18 | 161 | 9,357 | 5 | 47 | 18,296 | 11 | 208 |
| Kratie | 8,698 | 18 | 157 | 78,030 | 5 | 390 | 86,728 | 6 | 547 |
| Stung Treng | 8,157 | 18 | 147 | 20,870 | 5 | 104 | 29,027 | 9 | 251 |
| Ratanakiri | 6,503 | 18 | 117 | 31,373 | 5 | 157 | 37,876 | 7 | 274 |
| Preah Vihear | 4,879 | 18 | 88 | 40,245 | 5 | 201 | 45,124 | 6 | 289 |
| Kep | 2,852 | 18 | 51 | 7,248 | 5 | 36 | 10,100 | 9 | 88 |
| **Total** | **902,105** | **18** | **16,263** | **2,925,470** | **5** | 14,627 | **3,827,575** | **8** | **30,891** |

## 4.3 HIV risk behaviors and access to HIV services

### a. Risky sexual behaviors

Risky sexual behaviors of the MSM surveyed are shown in Table 7. The majority of the respondents reported having anal sex in the last 12 months (88.6%), and nearly two-thirds reported having anal sex in the last months (64.0%). The mean number of sexual partners in the past month was 1.7 with a wide range from 0 to 99. Approximately 60.0% had two or more sexual partners in the past month. Among those who reported having sexual intercourse in the past six months, 70.5% had biological male partners; 2.3% had biological female partners; and 27.2% had both. Of those who reported having sex, 69.4% reported always using condoms when having sexual intercourse with their partners in the past 6 months. The three most common places for MSM to meet their partners were the streets, parks or riversides (57.0%), clubs or discotheques (40.4%), and private houses (39.3%). The two most common sources from which they received condoms were friends or outreach workers (69.3%) and pharmacies, drug stores, or private clinics (61.9%).

**Table 7: Sexual behaviors and condom use among MSM (N=838)**

| Variable | Number (%) |
|---|---|
| Had anal sex in last 12 months | 742 (88.6) |
| Had anal sex last month | 536 (64.0) |
| Role at last anal sex in past 12 months | |
| Never had sex | 75 (8.9) |
| Insertive | 346 (41.0) |
| Receptive | 343 (41.0) |
| Both | 74 (8.8) |
| **Number of sexual partners in the past months** | |
| Mean (±SD) | 1.7 (4.8) |
| 0 | 139 (16.6) |
| 1 | 197(23.5) |
| 2-3 | 254 (30.4) |
| >=more | 247(29.5) |
| **Type of sexual partners in the past 6 months** | |
| Biological male only | 538 (70.5) |
| Biological female only | 17 (2.3) |
| Both | 208 (27.2) |
| **Places to meet partners in the past 12 months** | |
| Clubs or discotheques | 308 (40.4) |
| Saunas, spas, or massage parlors | 131 (17.2) |
| Barbers or beauty salons | 27 (3.5) |
| Streets, parks or river sides | 435 (57.0) |
| Private houses | 300 (39.3) |
| Specific communities | 101 (13.2) |
| M-Style or MSM clubs | 19 (2.5) |

| | |
|---|---|
| **Always use condoms when having anal sex in the last 6 months** | 530 (69.4) |
| **Sources of condoms and lubricant in the past 6 months?** | |
| Friend(s) | 581 (69.3) |
| Condom peer sale rep | 100 (11.9) |
| Pharmacy/drug store/clinic | 519 (61.9) |
| Condom outlets | 29 (3.5) |
| Marts | 115 (13.7) |
| Groceries | 187 (22.3) |

Abbreviation: SD, standard deviation; MSM, men who have sex with men

### b. Access to HIV education and health services

Table 8 presents the access to HIV education and health services among MSM in the study. The majority of the respondents (71.6%) reported receiving information on HIV from outreach workers in the past six months. Approximately two-thirds (66.6%) reported getting tested for HIV, and 49.3% reported having been tested for STI (49.3%) in the past six months. A small proportion of the respondents (7.8%) reported having STI symptoms in the past 12 months; of them, 93.6% received treatment for the most recent symptoms. The proportion of the respondents who had visited the M-Style website and Facebook page was very low (13.9% and 11.1%, respectively).

**Table 8: Exposure to HIV programs and access to health services among MSM**

| Variable | Number (%) N = 838 |
|---|---|
| Received information on HIV in the past 6 months | 600 (71.6) |
| Visited M-Style website in the past 6 months | 116 (13.9) |
| Used M-Style Facebook in the past 6 months | 93 (11.1) |
| Had HIV test in the past 6 months | 558 (66.6) |
| Had STI screening in the past 6 months | 413 (49.3) |
| Had STI symptoms in the past 12 months | 65 (7.8) |
| Received STI treatment for the most recent symptoms | 784 (93.6) |

Abbreviations: MSM, men who have sex with men; STI, sexually transmitted infection.

## 4.4 HIV prevalence

The overall HIV prevalence among MSM in this study was 2.3%. HIV rates differed greatly in age groups and education levels. Those in the age group of 25 years and older had a much higher HIV prevalence rate (4.6%) than those in the age group of 15-24 years (0.6%) (See figure 2). Similarly, HIV prevalence was 4.5% among those who had completed 0-6 years of education, compared to 2.0% and 1.2% among those who had completed 7-9 years and > 10 years of education, respectively (See figure 3). HIV prevalence was particularly high in some provinces such as Siem Ream (5.9%), Phnom Penh (3.0%), and Banteay Meanchey (2.5%) (See figure 4). In addition, although only 1.8% of the sample reported selling sex as their main

occupation, HIV prevalence among this group was much higher (17.2%) in comparison to MSM in other occupations in which the prevalence rates were less than 5.0% (See figure 5).

**Figure 1: HIV prevalence among MSM stratified by age groups**

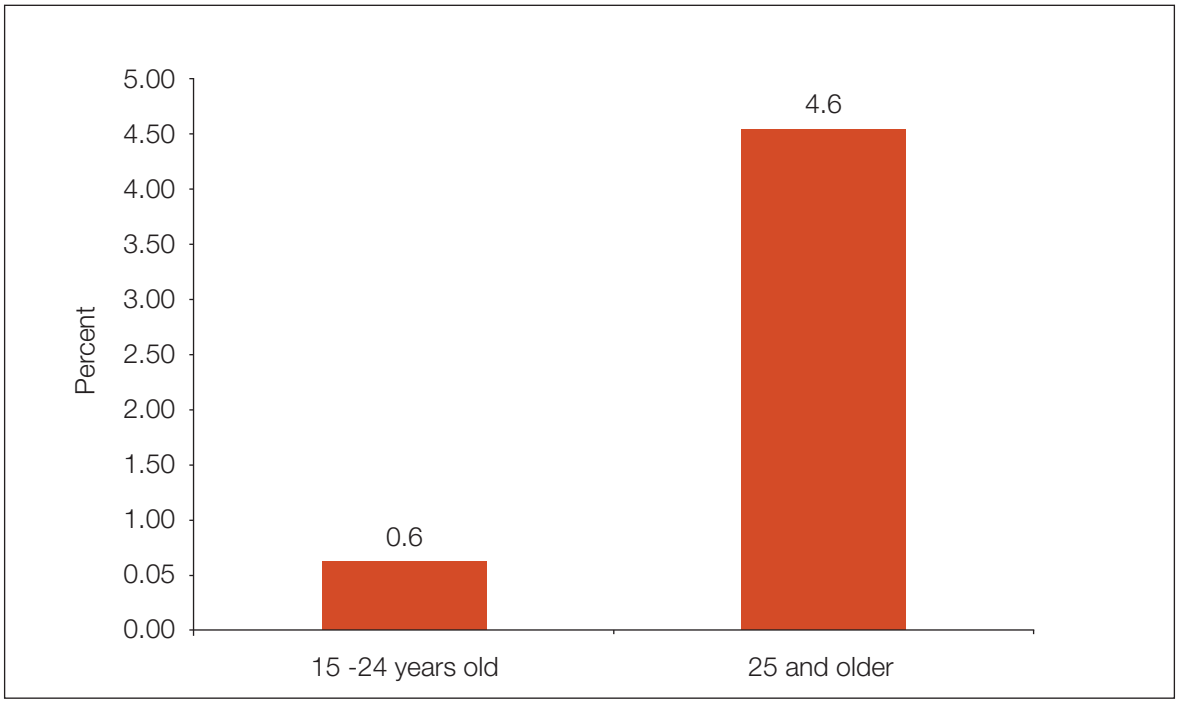



**Figure 2: HIV prevalence among MSM stratified by formal educational levels**

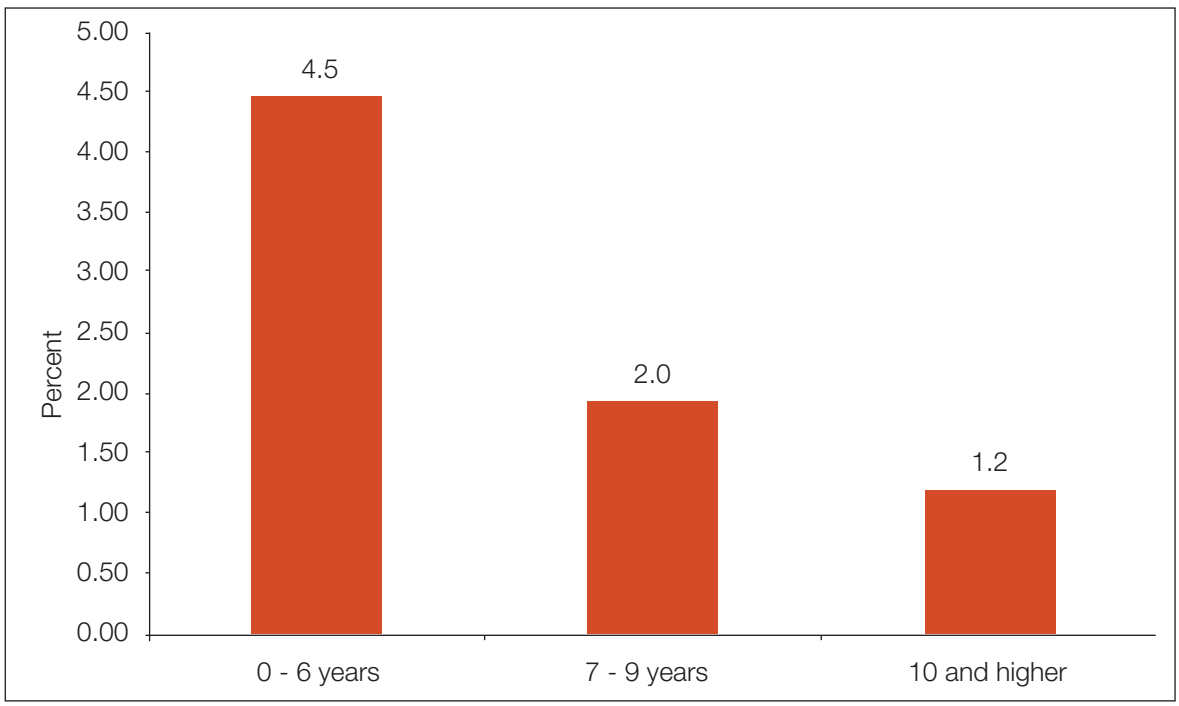


**Figure 3: HIV prevalence among MSM stratified by city/province of residence**

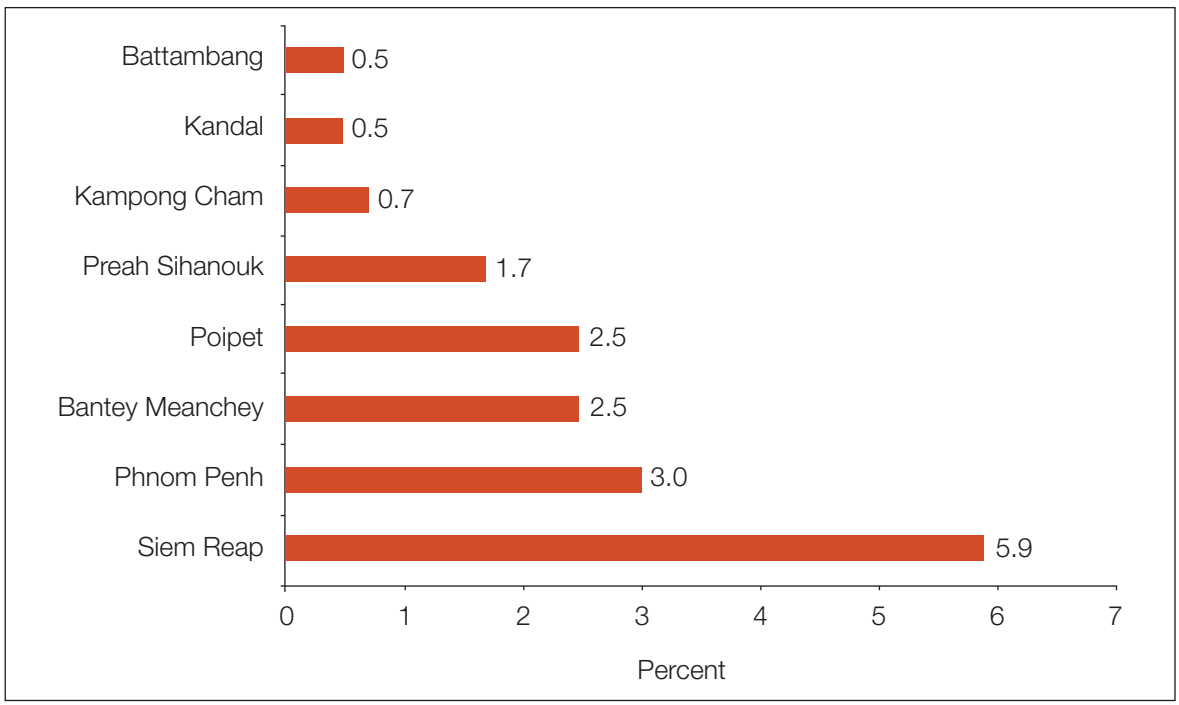
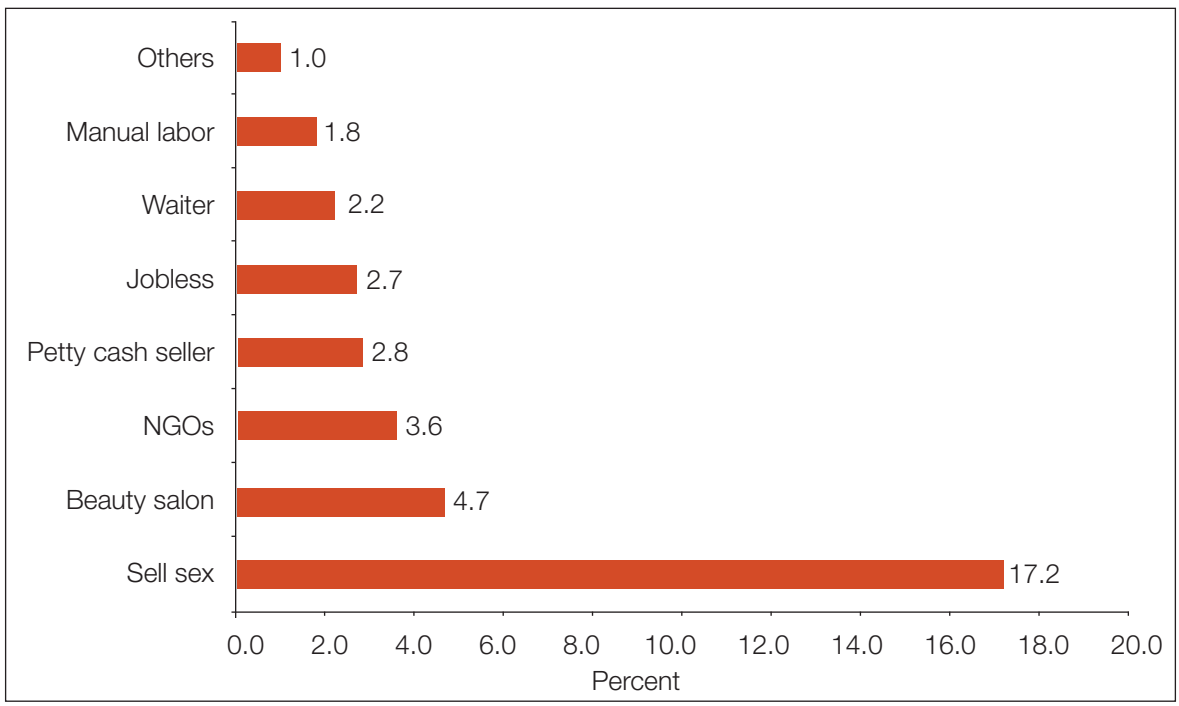



**Figure 3: HIV prevalence among MSM stratified by occupations**



# 5- DISCUSSION

This study is the first nationwide MSM population size estimation after two previous smaller studies were conducted in 2004 and 2008. We estimated that there were approximately 31,000 MSM aged 15-49 years in Cambodia in 2014. The prevalence of HIV was particularly high among older MSM, MSM with lower level of formal education, MSM living in Banteay Meanchey, Phnom Penh, and Siem Reap, and MSM working as sex workers and in beauty salons. These findings provide concrete data for Cambodia to estimate the sub-national HIV prevalence using AIDS Epidemic Model (AEM). Furthermore, the findings will better inform resource allocation and targeted HIV prevention and intervention programs.

Our nationwide size estimation started with using the results of the CRC method in the 12 provinces to estimate the numbers of hidden MSM and of MSM in the remaining 12 provinces, which were not included in the study. As described in the methods section, this size estimation relied on several assumptions: (1) the 7, 800 estimate only reflected visible-reachable MSM and that this was close to the correct number; (2) the proportion of hidden MSM was estimated to be about 35.0%, which was informed by the 96 key informant interviews, and that this was close to the correct number; and (3) being MSM is biological and MSM usually move to live in urban areas for socializing and seeking sexual partners.

Regarding the first assumption, the Lincoln-Peterson formula of the CRC method relied on five main assumptions as articulated in the methods section. We believe that we met four of the five assumptions. First, the population is closed. As only less than 10.0% had moved during the data collection period, we assume that this was an acceptable rate. Second, it requires that participants matching in both rounds should be reliable. This assumption was fulfilled as MSM who participated in the recapture round were provided with a memorable token, and the period of 18 days was short enough to recall. Third, it requires that the two sample sizes from the first and second rounds are independent. Distributing a can of Bacchus (soft drink) to a participant during the capture round did not affect the probability of re-sampling in the recapture round of distribution. Also, there were no specific reasons for the participants to keep themselves out of their communities during this study. Thus, the third assumption was successfully held in this case. Fourth, it requires that the sample size for each capture is large enough to be meaningful. As we visited all venues/hotspots, our sample was considered sufficiently large.

The fifth assumption was the only one that was believed to be violated. This assumes that every MSM has an equal chance of being recruited in the survey. This assumption was violated as a few hotspots were not reachable, and there were some hotspots that required an escort for security reasons. In such circumstances, the data collectors interviewed some of them outside the nightclubs/bars. On the other hand, in some communities where MSM hid their status due to social pressure, it was difficult to find and interview the target groups. Uncontrollable situations, such as rain during the data collection, especially during the capture round, or MSM with long working hours, might also have reduced their chance to participate in this study. The violation of this assumption influences the population size estimation. However, the violation does not tell the direction of estimation.

This study also found that MSM remain a high-risk group for HIV infection because of their risky sexual behaviors, such as having multiple sexual partners and inconsistent condom use. As already shown, 60.0% of them had two or more partners, and only about 70.0% of MSM in the study used condoms all the times when having anal sex in the past six months. However, compared to findings in the 2010 survey in which 65.0% of MSM reported using condoms in the last sex, our study might reflect an improvement in condom use among this high-risk population (3). Furthermore, the rates for HIV testing (66.6%) and STI testing (49.3%) were also higher. There was also low utilization of HIV programs in place in Cambodia, such as M-Style website (13.9%) and Facebook page (11.1%). This finding is in alignment with a 2012 systematic review, which claims that HIV prevention among MSM might potentially face challenges because of structural factors that contribute to low health-seeking behaviors of MSM populations in many parts of the world [1].

We found that the overall HIV prevalence among MSM in Cambodia was 2.3%. This prevalence is similar to that in the Bros Khmer Study in 2010, which found that HIV prevalence among homosexual MSM and bisexual MSM was 2.1% and 2.2%, respectively [3]. The prevalence in 2010 was subject to being underestimated because the majority of cases were new and those who already learned about their HIV status were very unlikely to participate in the study. It is worth noting that our study did not collect information whether the HIV cases were new or old. But, it is possible that only a small proportion of HIV positive patients have died and only a small proportion of MSM were newly diagnosed. In contrast, however, it is also possible that the majority of HIV cases in our study were newly diagnosed as was found in 2010, and those who learned about their HIV status did not participate in the study.

# 6- LIMITATIONS

There are several limitations in the three surveys. Each survey has its own unique limitations based on the specific study design. But some limitations are shared between the surveys, especially where the surveys overlapped, such as during the concurrent data collection in the capture round for the size estimation survey and the risk behavior survey. The individual and collective drawbacks of each survey are presented below.

## Size Estimation Survey:

- The 18-day time gap between the two rounds was not validated as a sufficient lag time to be able to capture MSM who might have been out of town for a short period of time during the survey. This is based on the criteria that the population must be closed when using the CRC method.
- It was very difficult to justify that everyone had an equal chance to participate because of the intrinsic nature of human variations.
- Recall bias was inevitable as the study participants were asked to report certain events that had occurred over the past several months. However, due to the design of the questions and the limited options, this recall bias was unlikely to have a severe effect on the findings.
- Besides the assumption that being MSM is biological, the numbers of MSM in rural areas were estimated based on the assumption that they usually move to urban areas for socializing and seeking sexual partners.

## HIV-Related Risk Behavior Survey:

- The behavioral questionnaire included self-reported measures that have inherent bias potential for both under- and over-reporting.

## HIV Prevalence Survey:

- The HIV prevalence only reflected that of the study sample. An estimate of the HIV prevalence nationwide still needs to be conducted.

## Size Estimation and HIV-Related Risk Behavior Surveys:

- The national size estimation derived from only 12 provinces and was assumed to reflect the nationwide number of MSM who usually congregated at the venues or hotspots listed during the mapping period. However, this estimation did not include:1) those who were in hidden places unknown to the field staff, outreach workers, and data collectors; 2) those who lived in rural areas; and 3) those who did not have sex with their male partners in the past 12 months. This might also affect the study sample for the HIV-related risk behavior survey since the data were collected at the same time of the capture round for the national size estimation survey.

## Size Estimation, HIV-Related Risk Behavior, and HIV Prevalence Surveys:

- Although the study tools were developed in close consultation with the program teams and experts working in the relevant areas and were pretested before the data collection, the findings from this study might be limited by the unknown reliability and validity of the tools.
- The participant inclusion criteria for the study were based on biological gender (i.e. MSM). However, there might have been differences in characteristics and sexual behaviors based on how the participants sexually identified themselves (i.e. male, female, or third gender).

# 7- CONCLUSIONS AND RECOMMENDATIONS

With approximately 31,000 MSM in Cambodia, continued efforts to prevent, manage, and treat HIV in this key population at higher risk are essential for achieving the 3.0 initiative aimed at eliminating new HIV infections in the country by 2025. Accurate strategic information, such as population size estimation, is imperative to conducting well-designed studies to better understand the impact of this population on the nationwide HIV prevalence and incidence, as well as continuous evaluation of the susceptibility and risks of this population for HIV.

Our study found a prevalence rate of 2.3% in our sample. This rate, is much higher within certain sub-groups, such as those with an older age (>24 years old), with less formal education, residing in Siem Reap and Phnom Penh, being sex workers, and engaging in bisexual practices (insertive and receptive sexual intercourse). This finding can help inform resource allocation to programs and interventions targeting these sub-groups that show higher prevalence of HIV. More or revised interventions on condom use and HIV-related health services are also worth exploring given the patterns of inconsistent use of condoms, low HIV and STI testing, and low utilization of the existing programs, such as M-Style website and Facebook.

Additional information is needed to effectively respond to the immediate needs of this population and achieve the goal of the 3.0 initiative. For example, there is a need for a more comprehensive study on HIV-associated risk factors among this population, evaluation of the existing programs and interventions (e.g., M-Style) to gauge effective interventions and reasons for underutilization, and a nationwide estimation of the HIV prevalence of this population.

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# ANNEXES

## 1- List of HIV high burden ODs in Cambodia

| No. | Province/ Municipality | Operational District (OD) | Number of OD | HIV Rate ANC in 2011* |
|---|---|---|---|---|
| 1 | Phnom Penh | OD Tbaung (Mean Chey) | 4 | 0.38% |
| | | OD Leach (Po Sen Chey and Dangkor) | | 0.25% |
| | | OD Kandal (Chamkar Mon and Prampi Makara) | | 0.43% |
| | | OD Choeung (Torl Kok, Reussey Keo, Sen Sok) | | 0.75% |
| 2 | Battambang | OD Battambang | 2 | 0.14% |
| | | OD Sampov Loun | | 0.55% |
| 3 | Banteay Meanchey | OD Serei Sophorn | 2 | 0.27% |
| | | OD O Chrov including Poipet | | NA |
| 4 | Pailin | OD Pailin | 1 | 0.46% |
| | | | | NA |
| 5 | Siem Reap | OD Siem Reap | 1 | 0.24% |
| | | | | NA |
| 6 | Odor Mean Chey | OD Samrong | 2 | NA |
| | | OD Anlung Veng | | |
| 7 | Preah Vihear | OD Preah Vihear including Sa Em | 1 | NA |
| | | | | NA |
| 8 | Kandal | OD Takhmao | 2 | 0.27% |
| | | OD Kean Svay | | 0.05% |
| 9 | Kampong Speu | OD Chbar Monn | 1 | 0.14% |
| | | | | NA |
| 10 | Takeo | OD Daun Keo | 1 | 0.16% |
| | | | | NA |
| 11 | Kampot | OD Kampot | 1 | 0.27% |
| | | | | NA |
| 12 | Preah Sihanouk | OD Preah Sihanouk | 1 | 0.69% |
| | | | | NA |
| 13 | Koh Kong | OD Smach Mean Chey | 1 | 0.33% |
| | | | | NA |
| 14 | Pursat | OD Sampov Meas | 1 | 0.10% |
| | | | | NA |
| 15 | Kampong Chhnang | OD Kampong Chhnang | 1 | 0.15% |
| | | | | NA |

| | | | | |
|---|---|---|---|---|
| **16** | **Svay Rieng** | OD Svay Chrum | 2 | 0.04% |
| | | OD Chi Phou Bavet City | | NA |
| **17** | **Prey Veng** | OD Kg Leav | 2 | 0.10% |
| | | OD Neak Loeung | | 0.10% |
| **18** | **Kampong Cham** | OD Kampong Seam-Kampong Cham | 2 | 0.15% |
| | | OD Memot | | 0.10% |
| **19** | **Kampong Thom** | OD Kampong Thom | 1 | 0.10% |
| **20** | **Kratie** | OD Kratie | 1 | 0.39% |
| **21** | **Stung Treng** | OD Stung Treng | 1 | NA |
| **22** | **Ratanakiri** | OD Ratanakiri | 1 | NA |
| **23** | **Mondolkiri** | OD Mondolkiri | 1 | NA |
| | **Total** | | 32 | |

**Source:** National Technical Working Group on HIV/AIDS meeting

## 2- Key informant interview selection process guideline for size estimation

### Motodub Driver

**1.** Go out at night to find motodub drivers

**2.** Ask the following questions to them:

- Number of MSM/third gender
- Locations
- Contact numbers that they know

**3.** Write this information in the table below

**4.** Interviewer will have to select two persons from this list who know many MSM/third gender OR select locations to identify new locations besides those already recorded on the list.

| Motodub Driver | Number of MSM/ third gender Known | Locations known | Contact number |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| 6 | | | |

### Artist

**1.** Ask outreach worker or villagers for local artists

**2.** Ask these questions to them:

- Number of MSM/third gender
- Locations
- Contact numbers that they know

**3.** Write this information in the table below

**4.** Interviewer will have to select two persons from this list who know many MSM/third gender OR select locations to identify new locations besides those already recorded on the list.

| Artist | Number of MSM/ third gender Known | Locations known | Contact number |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| 6 | | | |

## MSM age less than 24 or 40

**1.** Use existing list

**2.** Select from garden/street/ riverside

**3.** Ask these questions to them:

- Number of MSM/third gender
- Locations
- Contact numbers that they know

**4.** Write this information in the table below

**5.** Interviewer will have to select two persons from this list who know many MSM/third gender OR select locations to identify new locations besides those already recorded on the list.

| MSM<24 | Number of MSM/ third gender Known | Locations known | Contact number |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| 6 | | | |

| MSM<40 | Number of MSM/ third gender Known | Locations known | Contact number |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| 6 | | | |

# 3- Key informant interview (KII) guideline to identify additional venues

**Note:** Interviewer has to interview the following persons:

1. Two students who are MSM/third gender (age less than 24)
2. Two nighttime motodub drivers
3. Two MSM/third gender (age less than 40)
4. Two movie artists if possible

## Section A: General Information

**A1. Province:**

**A2. Age:**

**A3. Number of year studied:**

**A4. How do you define yourself?**

*(For participants who are MSM/3RD Gender)*

**1.** A man
**2.** Women
**3.** TG (3rd gender/Srey Sros)

**A5. How many MSM/third gender friends do you have? (Number:_____)**

*(For participants who are MSM/3RD Gender)*

**A6. Type of participant:**

**1.** High school students who are MSM/third gender
**2.** Night time motodub drivers
**3.** MSM/third gender who are older than 40
**4.** Others……

## Section B: Information about Location

**B1. Do you know places where MSM often congregate or go to seek sexual partners?**

*e.g. clubs or discotheques, sauna/spa/massage, barbers/beauty salons, streets/parks/river side, private houses (brothel), specific communities*

**B2. Reasons to go to those places?**

*e.g. many MSM or TG or quiet*

**B3. Can you tell me the location and time they meet?**

| No | Name of Location | Day | Time |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| 6 | | | |

*Note: Interviewer has to write down all of the locations reported and mark those locations on the map provided; interviewer has to verify these locations with the list of venues given by study coordinator to know whether the given locations are new or already recoded to avoid double counting.*

## Section C: Information about Hard-To-Reach Individuals

**C1. Do you know MSM/third gender who do not come to congregate at the places mentioned above? Can you describe these groups** *(e.g. age, occupation…)?*

**C2. How many are they?**

**C3. How can we make an appointment with them?**

**C4. Do you know why they do not come out to these places?**

**C5. Any comments:**

## 4- Screening script and eligibility criteria

**Province Code:**

**Survey Round:** **Capture___** **Recapture___**

HIV Flagship project, which consists of KHANA, FHI 360, and PSK, in collaboration with National Centre for HIV, Dermatology, and STD (NCHADS) is conducting MSM size estimation in 11 provinces--Phnom Penh, Kampong Cham, Battambang, Siem Reap, Banteay Meanchey, Preah Sihanuk, Prey Veng, Svay Rieng, Kampong Speu, Kampong Chhnang, and Koh Kong. 20,000 MSM are expected to participate in this survey. This interview will last about 5 to 10 minutes. During the interview, we would like to ask you some personal questions related to socio-demographic information and sexual behavior. You do not have to answer all questions or participate if you don't want. You can refuse to answer or leave the study at any time. All information gathered in this study will be kept strictly confidential. Your participation is completely voluntarily. Before we start talking more, I would like to know whether you are eligible for this study.

Do you allow me to ask these questions? [Yes] [No]

| Questions | Yes | No |
|---|---|---|
| A1. How old are you?<br>(Yes, if he/she is 15 years old or above) | ☐ | ☐ |
| A.2 Are you a biological male? | ☐ | |
| A3. Have you ever had sex with at least one biological male in the past 12 months?<br>*(Any form of sexual behavior: anal, oral, or masturbation)* | ☐ | ☐ |
| A4. Is he/she able to understand the previous Khmer questions above?<br>*(All the above questions are also tested whether the person is under alcohol or drug mental effects)* | ☐ | ☐ |
| A5. Do you agree to sign on a consent form to participate in this study? | ☐ | ☐<br>If not, why? |

Note: The potential participants will be enrolled if all the ABOVE ANSWERS are "YES"

**Name of person filling out this form:**

**Initials:**

# 5- Round one capture questionnaire

**Participant ID ☐☐☐☐☐☐**

**Date (dd/mm/yyyy):**

**Interviewer Code:**

**Province code:**

| | | |
|---|---|---|
| 01. BanteayMeanchey | 05. Kampong Speu | 09. Prey Veng |
| 02. Battambang | 06. Kandal | 10. Siem Reap |
| 03. Kampong Cham | 07. Koh Kong | 11. PreahSihanuk, |
| 04. Kampong Chhnang | 08. Phnom Penh | 12. SvayRieng, |

**Type of venues/hotspots (please circle 1)**

1. Clubs/discotheques
2. Saunas/spas/massage
3. Barbers/beauty salons
4. Streets/parks/river side
5. Private houses (brothels)
6. Specific communities
7. Other:

**Have you received Bacchus from any interviewer in the past 7 days?**

1. Yes
0. No (Skip)

**Have you received in this city?**

1. Yes
0. No

**Have you completed the interview when receiving Bacchus in the past 7 days?**

1. Yes
0. No

***If YES, END interview***

**Supervisor's name:** **Date:**

## Section1: Socio-demographic information

| Question Number | Question | Possible Answer | Remark |
|---|---|---|---|
| Q101 | How old are you? | _____years | |
| Q102 | How long have you been in school | _____years | (put 0 for no schooling) |
| Q103 | How long have you lived in this city? | _____months | (98=Since I was born code; 99= Not living in this city; 0=less than a month) |
| Q104 | Occupation | 1. Unemployed<br>2. Secondary/ higher school student<br>3. College student<br>4. Private company employee<br>5. Government employee<br>6. NGO employee<br>7. Entertainment worker<br>8. Self-employed/business perso<br>9. Barber/salon employee<br>10. Others……<br>99. Do not answer | |
| Q105 | Marital Status | 1. Unmarried and living with family<br>2. Unmarried and living alone<br>3. Unmarried but living with male partner<br>4. Unmarried but living with female partner<br>5. Married with (female) and living together<br>6. Married with (female) but not living together<br>7. Divorced/separated/widow<br>8. Other……..<br>99. Do not answer | |
| Q106 | Do you identify yourself as | 1. A man<br>2. Women<br>3. TG (3rd gender/Srey Sros)<br>4. Others…….<br>99. Do not answer | |

| | | | |
|---|---|---|---|
| Q107 | Have you ever performed/ expressed yourself as a female? | 1. Yes, always<br>2. Yes, sometimes<br>3. No, never<br>99. Do not answer | |
| Q108 | Did you stay in this city in the past 30 days? | 0. No<br>1. Yes<br>2. Do not know<br>99. Do not answer | |

# 6- Round two recapture questionnaire

**Participant ID ☐☐☐☐☐☐**

**Date (dd/mm/yyyy):**

**Interviewer Code:**

**Province code:**

| | | |
|---|---|---|
| 01. BanteayMeanchey | 05. Kampong Speu | 09. Prey Veng |
| 02. Battambang | 06. Kandal | 10. Siem Reap |
| 03. Kampong Cham | 07. Koh Kong | 11. PreahSihanuk, |
| 04. Kampong Chhnang | 08. Phnom Penh | 12. SvayRieng, |

**Type of venues/hotspots**

1. Clubs/discotheques
2. Saunas/spas/massage
3. Barbers/beauty salons
4. Streets/parks/river side
5. Private houses (brothels)
6. specific communities
7. Other:

**Have you received Bacchus from any interviewer in the past two or three weeks?**

1. Yes
0. No

**Have you completed the interview when receiving Bacchus in the past two or three weeks?**

1. Yes
0. No

**Have you received towel from any interviewer in the past 7 days?**

1. Yes
0. No

**Have you received in this city?**

1. Yes
0. No

**Have you completed the interview when receiving towel in the past 7 days?**

1. Yes
0. No

***If YES, END interview***

**Supervisor's name:** **Date:**

## Section1: Socio-demographic information

| Question Number | Question | Possible Answer | Remark |
|---|---|---|---|
| Q101 | How old are you? | _____years | |
| Q102 | How long have you been in school | _____years | (put 0 for no schooling) |
| Q103 | How long have you lived in this city? | _____months | (98=Since I was born code; 99= Not living in this city; 0=less than a month) |
| Q104 | Occupation | 11. Unemployed<br>12. Secondary/ higher school student<br>13. College student<br>14. Private company employee<br>15. Government employee<br>16. NGO employee<br>17. Entertainment worker<br>18. Self-employed/business perso<br>19. Barber/salon employee<br>20. Others……<br>99. Do not answer | |
| Q105 | Marital Status | 9. Unmarried and living with family<br>10. Unmarried and living alone<br>11. Unmarried but living with male partner<br>12. Unmarried but living with female partner<br>13. Married with (female) and living together<br>14. Married with (female) but not living together<br>15. Divorced/separated/widow<br>16. Other……..<br>99. Do not answer | |
| Q106 | Do you identify yourself as | 5. A man<br>6. Women<br>7. TG (3rd gender/Srey Sros)<br>8. Others……<br>99. Do not answer | |
| Q107 | Have you ever performed/ expressed yourself as a female? | 1. Yes, always<br>2. Yes, sometimes<br>3. No, never<br>99. Do not answer | |
| Q108 | Did you stay in this city in the past 30 days? | 0. No<br>1. Yes<br>2. Do not know<br>99. Do not answer | |

# 7- Behavioral questionnaire

**Participant ID ☐☐☐☐☐☐**

**Date (dd/mm/yyyy):**

**Interviewer Code:**

**Province code:**

| | | |
|---|---|---|
| 01. BanteayMeanchey | 05. Kampong Speu | 09. Prey Veng |
| 02. Battambang | 06. Kandal | 10. Siem Reap |
| 03. Kampong Cham | 07. Koh Kong | 11. PreahSihanuk, |
| 04. Kampong Chhnang, | 08. Phnom Penh | 12. SvayRieng, |

**Type of venues/hotspots**

1. Clubs/discotheques
2. Saunas/spas/massage
3. Barbers/beauty salons
4. Streets/parks/river side
5. Private houses (brothels)
6. specific communities
7. Other:

**Have you received Bacchus from any interviewer in the past 7 days?**

1. Yes
0. No (Skip)

**Have you received in this city?**

1. Yes
0. No

**Have you completed the interview when receiving Bacchus in the past 7 days?**

1. Yes
0. No

***If YES, END interview***

**Supervisor's name:** **Date:**

## Section1: Socio-demographic information

| Question Number | Question | Possible Answer | Remark |
|---|---|---|---|
| Q101 | How old are you? | _____years | |
| Q102 | How long have you been in school | _____years | (put 0 for no schooling) |
| Q103 | How long have you lived in this city? | _____months | (98=Since I was born code; 99= Not living in this city; 0=less than a month) |
| Q104 | Occupation | 1. Unemployed<br>2. Secondary/ higher school student<br>3. College student<br>4. Private company employee<br>5. Government employee<br>6. NGO employee<br>7. Entertainment worker<br>8. Self-employed/business perso<br>9. Barber/salon employee<br>10. Others……<br>99. Do not answer | |
| Q105 | Marital Status | 1. Unmarried and living with family<br>2. Unmarried and living alone<br>3. Unmarried but living with male partner<br>4. Unmarried but living with female partner<br>5. Married with (female) and living together<br>6. Married with (female) but not living together<br>7. Divorced/separated/widow<br>8. Other……..<br>99. Do not answer | |
| Q106 | Do you identify yourself as | 1. A man<br>2. Women<br>3. TG (3rd gender/Srey Sros)<br>4. Others…….<br>99. Do not answer | |

| | | | |
|---|---|---|---|
| Q107 | Have you ever performed/ expressed yourself as a female? | 1. Yes, always<br>2. Yes, sometimes<br>3. No, never<br>99. Do not answer | |
| Q108 | Did you stay in this city in the past 30 days? | 0. No<br>1. Yes<br>2. Do not know<br>99. Do not answer | |

## Section 2: Condom and lubricant accessibility

| Question Number | Question | Possible Answer | Remark |
|---|---|---|---|
| Q201 | Where do you prefer to get condom and lubricant *(could be more than one answer)* | 1. Friends/outreach workers<br>2. Peer Educator<br>3. Pharmacy/drug store/clinic<br>4. Condom outlets<br>5. Gas stations<br>6. Grocery stores<br>7. Others……..<br>8. Don't know<br>99. Do not answer | |

## Section 3: Sexual behavior

| | | | |
|---|---|---|---|
| Q301 | In the past 12 months, where have you often met your sexual partners? *(could be more than one answer)* | 1. Clubs or discotheques<br>2.Sauna/spa/massage<br>3.Barbers/beauty salons<br>4. Streets/parks/river side<br>5. Private houses (brothel)<br>6. Specific communities<br>7. MStyle/SMS club<br>8. Others……..<br>9. Don't know<br>99. Do not answer | |
| Q302 | In the past 6 months, what type of sexual partners has you had sex with? | 0. Never had sex<br>1. Biological men only<br>2. Biological women only<br>3. Third gender/TG<br>4. Others……<br>99. Do not answer | |
| Q303 | In the past 12 months, have you had anal sex? | 0. No<br>1. Yes<br>99. Do not answer | |

| | | | |
|---|---|---|---|
| Q304 | In the past month, did you have anal sex? | 0. No<br>1. Yes<br>99. Do not answer | |
| Q305 | During your last anal sex, what role were you? | 0. Have never had sex<br>1. Insertive<br>2. Receptive<br>3. Both<br>99. Do not answer | |
| Q306 | In the past 6 months, how often have you used condom with your partners when having anal sex? | 1. Always<br>2. Often<br>3. Sometimes<br>4. Rarely<br>5. Never<br>99. Do not answer | |
| Q307 | In the past month, how many persons have you had sex with? | _____ persons | |

## Section 4: HIV program

| | | | |
|---|---|---|---|
| Q401 | In the past 6 months, how many times have you received information on HIV from outreach workers?<br>*(Show education tools)* | _____times | Code 0 if never received any |
| Q402 | In the past 6 months, how many times have you visited Mstyle facebook?<br>(Show picture of Mstyle webpage ) | _____times | Code 0 if never received any |
| Q403 | In the past 6 months, how many times have you visited Mstyle website?<br>(Show picture of Mstyle website ) | _____times | Code 0 if never received any |

## Section 5: Access to health services

| | | | |
|---|---|---|---|
| Q501 | In the past 6 months, have you ever had HIV test? | 0.No<br>1. Yes<br>3. Do not know<br>99. Do not answer | skip to 503 |
| Q502 | Have you received test result? | 0. No<br>1. Yes, sometimes<br>2. Yes, all the time<br>3. Do not remember<br>99. Do not answer | |
| Q503 | In the past 6 months, have you ever had STI screening? | 0.No<br>1. Yes<br>3. Do not know<br>99. Do not answer | skip to 505 |
| Q504 | Have you received test result? | 0. No<br>1. Yes, sometimes<br>2. Yes, all the time<br>3. Do not remember<br>99. Do not answer | |
| Q505 | In the past 12 months, have you ever had STI? | 0. No<br>1. Yes<br>3. Do not know<br>99. Do not answer | End the interview |
| Q506 | In the past 12 months, have you sought treatment? | 0. No<br>1. Yes<br>3. Do not know<br>99. Do not answer | |

End of Interview!

# 8- HIV prevalence specimen information sheet

Province :

Name of location:

Target group: (MSM)

| eluster# | Signature of staff recieved consent | Reject Blood test | Code of blood tabe | Date of blood withdrawal | Age | Married or single | age of first sex | Year of study | occupation | number of friend as MSM | result Determ | result Stat-P | result final |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
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**Code for occupation (Please refer bellow code)**

- Unemployed
- Student at high school
- Student of University
- Motor taxi driver
- Police
- Government staff
- Farmer
- Worker
- Seller
- Private company staff
- NGO staff
- Salon staff
- Work at restaurant, club, hotel
- Sex worker
- Other

## 9- Sampling Frame/ Listing

Province.....

| No | Cluster Name | Number of people in each cluster | Mark the Cluster Selected |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| 6 | | | |
| 7 | | | |
| 8 | | | |
| 9 | | | |
| 10 | | | |
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| 12 | | | |
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| 16 | | | |
| 17 | | | |
| 18 | | | |
| 19 | | | |
| 20 | | | |
| 21 | | | |
| 22 | | | |

## ❖ List of NCHADS's surveillance Unit

1. Dr. Mun Phalkun: Chief of Surveillance Unit
2. Dr. Chann Navy: Deputy-chief of Surveillance Unit
3. Dr. Lay Panhavorn: Surveillance Unit
4. Dr. Theng Thithara: Surveillance Unit
5. Mrs. Seng Sopheata: Surveillance Unit
6. Mrs. Kao Chantha: Surveillance Unit

## ❖ List of Data Collectors

1. Mr. Chhay Leangchheng
2. Mr. Hem Saosophanna
3. Mr. Hay Davann
4. Mr. Hok Dara
5. Mr. Kuo Chak
6. Mr. Krouch Kuy
7. Mr. Kong Puthiseth
8. Mr. Lmot Samkol
9. Mr. Ly Socheat
10. Mr. Mat Phlay
11. Mr. Mey Yan
12. Mr. Nhoueng Sovann
13. Mr. Ngann Sorphorn
14. Mr. Oung Kob
15. Mr. Prom Chanthy
16. Mr. Pech Sokhon
17. Mr. Srieng Kimsron
18. Mr. Sam Sourvannak
19. Mr. Seng Menghuor
20. Mr. Sar Sarath
21. Mr. Sam Usphea
22. Mr. Ven Chhunhak
23. Mr. Vong Sokny
24. Mr. Yi Seiha

National Center for HIV/AIDS, Dermatology and STD
Surverllance Unit
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Russey Keo, Phnom Penh
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Website: www.nchads.org
Email: info@nchads.org