

**Size-estimation of Key Population: Men who have Sex  
with Men (MSM); Sex Workers (SWs); and People Who  
Injecting Drug (PWID)**

## Executive Summary

Thailand has received funding from the Global Fund for the HIV infection prevention project in which the Most At Risk Population (MARPS) were considered as hard to reach and needed a population estimation. In Thailand, network scale up method was used in 2010 to estimate hard to reach population and found that there were 67,900 – 160,700 female sex workers, 89,900 – 213,200 men who's has sex with men and 40,300 – 97,300 injecting drug users. The result was only a rough estimation of the MARPs in which a new round of estimation should be used to compare with the previous one.

The purpose of this survey was to estimate men who' had sex with men, female sex workers, and injecting drug users in Thailand. Both Reference group and Summation methods were utilized.

The study samples were Thai, aged 12-65 years which inhabits in the household at least 3 months in the past year and the household itself inhabits in the area for at least 6 months. Stratified multi-stage sampling was used to stratify by Thailand in Northern, Central, North-Eastern, Southern region and Bangkok area. Within the regions, primary care units were sampling. Then the Probability Proportional to Size was used to allocate the study samples. A total sample of 3,790 from 10 provinces throughout Thailand were collected with 95% confidence interval and level of 95%, 10% of the mean error, and design effect of 11.5

The field workers from Khon Kaen University was responsible for data collection in 8 provinces across Thailand, Chiangmai University responsible for Chiangmai, and Epidemiology Unit of ministry of Public health responsible for Bangkok, consecutively. A face to face interview was used to collect 1) general information 2) social relations 3) community relations and 4) acceptance level. This study was ethical considered by the Khon Kaen University Institutional Review Board.

The average age of the samples were at 40 years with standard deviation of 15.548, median of 42.0 and interquartile range at 25. Male and female were quite equivalent where 90.1% were Buddhism and 8.3% were Islamic. Most were married and living together. The samples lived in the municipality and inhabits at least 20 years. From Reference group method, the network size was 264.60 with standard deviation of 489.73, median of 153 and interquartile range 238 while the network size from Summation method was 249.31 with standard deviation of

479.07, median of 131 and interquartile range 195. The consistency of both methods resulted in only 5.8% difference for the network size.

Within an average network size, men who's had sex with men accounted for 0.38, female sex workers accounted for 0.35 and injecting drug users accounted for 0.24. Size estimation from both methods were 93,593-99,332 men who's had sex with men, 85,489-90,731 female sex workers and 71,083-75,441 injecting drug users. It should be noted that Summation method provided a greater number than Reference group method. The samples reflect different perception; female sex workers and injecting drug users were low level while men who's had sex with men was middle level.

In overall, it can be estimated that there will be approximately 99,000 men who's had sex with men, 90,000 female sex workers and 75,000 injecting drug users.

The study in 2010 was the first Thailand national study where regional network size was estimated from individual sample and sum up into national figure. In addition, definition of "know" was to meet at least one in the past two years (2008-2009). Whereas the latest study estimated national figure directly and defined "know" as to meet at least once in the past year (2013).

One of the strength of this method was to resolve resource and budget constraint. The validity of the result relied heavily on error from both sampling and non-sampling procedures. The barrier effect and transmission effect were determined by sampling frame, sample sizes, probability sampling procedure, and representativeness. Based on reference group method, it has indicated that the samples provide less number of known people than actual in larger population and vice versa. The summation method is easier to use for network size calculation but social network recognition is not accurate, resulting in less known people than actual, different characterization and limited recall memory. Therefore, it can be concluded that the actual estimation may lie between both methods.

Important suggestions:

- 1) Estimation results should be compare with other related studies including local operational experience before adapting for planning and control the problems of hard to reach population.
- 2) An extended study is needed where more detailed planning is required since this study could not provide in depth information of the population.

- 3) May consider to operate the survey occasionally but not often than two years to use the data to evaluation the population trend. Also, develop data collection method to cover more population samples.
- 4) Develop and update the registration system with correct information in order to ease future studies more accurate.

## TABLE OF CONTENT

<b>CHAPTER 1: INTRODUCTION .....</b>	<b>8</b>
<b>1. INTRODUCTION .....</b>	<b>8</b>
1.1 BACKGROUND.....	8
1.2 OBJECTIVES .....	9
1.3 AREAS OF STUDY .....	9
1.4 EXPECTED RESULTS .....	9
<b>CHAPTER 2: METHODOLOGY .....</b>	<b>10</b>
<b>2. METHODOLOGY .....</b>	<b>10</b>
2.1 UNIT OF SURVEY .....	10
2.2 TARGETED POPULATION .....	10
2.3 POPULATION SAMPLING.....	10
2.4 SAMPLING METHODS .....	10
2.5 SAMPLE SIZE .....	11
2.6 SURVEY TOOLS .....	12
2.7 DATA COLLECTION METHOD .....	13
2.8 ESTIMATED NUMBER OF POPULATION .....	15
<b>CHAPTER 3: SURVEY RESULT.....</b>	<b>18</b>
<b>3. SURVEY RESULT.....</b>	<b>18</b>
3.1 GENERAL INFORMATION THE STUDY SAMPLES.....	18
3.2 ESTIMATION OF NETWORK SIZE BY REFERENCE GROUP METHOD .....	23
3.3 ESTIMATION OF REGIONAL NETWORK SIZE BY SUMMATION METHOD .....	24
3.4 ESTIMATION OF THE MOST AT RISK POPULATIONS.....	25
3.5 LEVEL OF ACCEPTANCE OF RESPONDENTS TO BEHAVIOR OF MARPS .....	26
<b>CHAPTER 4: DISCUSSION .....</b>	<b>28</b>
<b>4. DISCUSSION .....</b>	<b>28</b>
4.1 SIZE ESTIMATION BY NETWORK SCALE UP METHOD COMPARING TO OTHER METHODS.....	28
4.2 BEING UNKNOWN/UNACCEPTED EFFECT THE ESTIMATION .....	31
4.3 STATISTICS DISCREPANCY .....	31
4.4 DIFFERENCES OF SIZE ESTIMATION BETWEEN REFERENCE GROUP AND SUMMATION METHODS.....	31
<b>CHAPTER 5: CONCLUSION.....</b>	<b>36</b>
<b>5. CONCLUSION.....</b>	<b>36</b>
5.1 NATIONAL ESTIMATES: NUMBER OF THE MOST AT RISK POPULATION ON HIV INFECTION AND TRANSMISSION .....	36
5.2 RECOMMENDATIONS.....	36

## LIST OF TABLES

	Page	
Table 2.1	Scope of Known Population which used to frame questions to set regional network size by reference group method	15
Table 2.2	Alters network group which has social relation, which used to frame questions to set network size by summation method	16
Table 3.1	General information of the study samples	18
Table 3.2	Number of population and information for site-estimation by reference group method – differentiate by region	23
Table 3.3	Number of population and information for site-estimation by summation method – differentiate by region	24
Table 3.4 A	The mean number of MARPs within network size	25
Table 3.4 B	Estimated number of the Most at Risk Population on HIV infection and transmission, comparing between reference group method ad summation method	26
Table 3.5	The standard deviation, median, interquartile range of acceptance level of the Most At Risk Population on HIV infection and transmission by region	27

## LIST OF DIAGRAM

	Page
<b>Diagram I.</b> Stratified Multi-stage Sampling Size	10

## CHAPTER 1: INTRODUCTION

### 1. Introduction

#### 1.1 Background

Thailand has received funding from the Global Fund on HIV Prevention Program for Most At Risk Populations (MARPs) including Female Sex Worker (FSWs), Men who have Sex with Men (MSM), and Injecting Drug User (IDU). These key populations are defined as hard to reach group and they are high risk groups for HIV infection and transmission. Understand prevalence situation and social characteristics of these populations are essential to plan project work-plan for prevention and care program for infected population.

Estimation of hard to reach populations by using Network Scale-Up Method (NSUM) is a technique which has been developed since 1996. This method is used mainly to estimate number of hidden population which is hard-to-count i.e., HIV positive women who were infected by raping or homeless people. It is also well recognized and widely used in various country for instance, United States of America or Ukraine as this is a low investment method and require less time to conduct comparing to other population survey methods or development of surveillance system. Moreover, this NSUM does not need to interview MARPs directly, it focuses on interviewing general population about MARPs to learn about size and information of hidden and hard to reach populations whom are normally hard to search for.

Results of MARPs size estimation study on HIV infection and transmission project in Thailand in 2010 revealed population number of different groups including FSW – 67,900 to 160,700, MSM – 89,900 to 213,200, and PWID – 40,300 to 97,300.

Network size can be estimated by using 2 research methods:

1. **Reference group method** lies on assumption that - number of people in a sub-population whom you know – are part of that sub-population whom others know.
2. **Summation method** estimates personal network size by asking respondents to enumerate the people they know in a list of specific relationship types or categories i.e., relative, colleagues, friends, etc.

Even though both methods could only present a crude estimate of MARPs size, under resource limitation in Thailand – these methods provide useful information to help planning for resource



management especially on funding to support for treatment and prevention programs for MARPs.

## **1.2 Objectives**

This study aimed to estimate the size of populations at highest risk for HIV and AIDS, including MSM, FSW, and PWID by applying summation and reference group methods to the study of these populations' social network.

## **1.3 Areas of study**

- 1.3.1 Key research question: estimating the size of hidden populations by using two approaches: 1) reference group method and 2) summation method, to estimate network size (C) of population at highest risk of HIV and AIDS including MSM, FSW, and PWID. This is the indirect method of size estimation (using indirect questioning technique).
- 1.3.2 Study samples: the study population were men and women aged 12-65 years old who had lived in the sampled household not less than 3 months during the past year.
- 1.3.3 Coverage area: throughout the country including Bangkok
- 1.3.4 Period of study: September – November 2014

## **1.4 Expected results**

This network scale up method (by using indirect questioning technique) promises more accuracy in estimating the size of hidden population, comparing to the direct method. The estimation could inform the policy making and program implementation at all levels more suitably to the magnitude of the situation. This method can be applied for size estimation of other hidden populations.

## CHAPTER 2: METHODOLOGY

### 2. Methodology

#### 2.1 Unit of survey

Unit of this survey was households in northern, central, north-eastern, southern regions, and Bangkok area.

#### 2.2 Targeted population

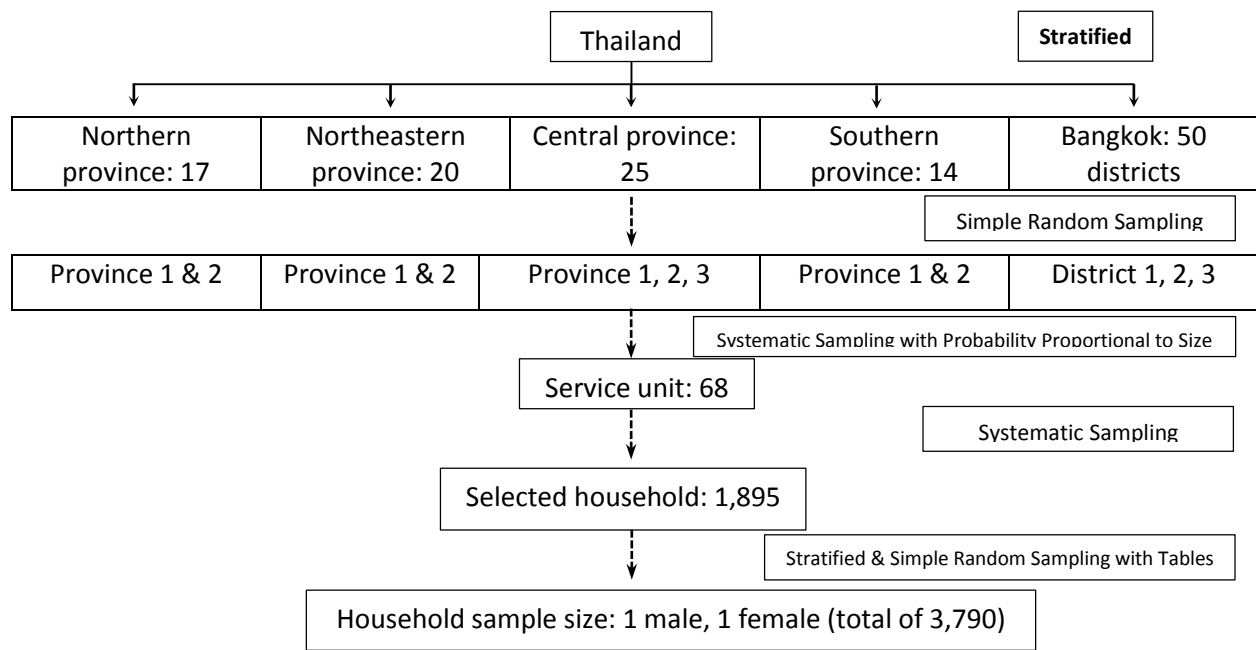
Targeted population was men and women aged 12-65 years old who had lived in the sampled households.

#### 2.3 Population sampling

Study samples were Thai citizen who registered under civil registration, 12-65 years of age, have lived in the sampled household not less than 3 months during the last year. Also the samples have lived in sampled provinces not less than 6 month during the last year.

#### 2.4 Sampling methods

This is a cross sectional survey based on stratified multi-stage sampling. First, the country was stratified in to 4 areas – 4 regions (northern, central, northeastern, and southern) and Bangkok. Then each region was clustered into zone of community health care, while Bangkok is clustered into inner, central and outer Bangkok. Proportional allocation technique was used in selecting samples of each clusters.



**Diagram I.** Stratified Multi-stage Sampling Size

The first stage sampling was to select 2-3 provinces to represent each region, and 3 districts to represent each cluster of Bangkok, by simple random sampling using probability proportional to size (PPS).

The second stage was to select the community health care, primary health care units at community level, situated in the clusters selected in the first stage.

The third stage was to select households in the village or blocks in the community health care zone selected in the second stage by using mapping enumerating households in the village or blocks.

Respondents were then selected from the selected household. One male and one female who aged 12-65 years old were selected from each household, using simple random sample tables. The respondents should be able to communicate and provide informed consent to participate in the study.

## **2.5 Sample size**

The sample size obtained from stratified multi-stage sampling achieving national representativeness was derived from 10 provinces throughout the country, and the number of samples in each province are below:

Bangkok:	3 districts 338 samples
North:	2 provinces, namely Chiang Mai and Kamphaengpech, 690 samples
Central:	3 provinces, namely Lopburi Rayong and Pethchaburi, 965 samples
Northeastern:	2 provinces, namely Ubonrachathani and Nongbualumpoo, 1,272 samples
Southern:	2 provinces, namely Phuket and Pattani, 534 samples

In total, 3,790 samples were selected with 95% confidence interval, margin of error of 10%, and design effect of 11.5.

The sample size of 3,790 is determined by the confidence deviation level and by considering the mean size of network of the study population obtained from the pilot study which is 300, standard deviation of 275. The design effect is adjusted from the similar study (Manop Kanato, 2011).

## 2.6 Survey tools

This size estimation used structured interview questionnaire with 4 pages of A4 size. This questionnaire consisted of 4 parts: 1) general information; 2) social relations; 3) community relations; and 4) acceptance level.

Province	Health care unit	Sampled household	Sampled unit
Lop Buri	7	192	384
Rayong	6	167	334
Ubon Ratchathani	17	498	996
Province	Health care unit	Sampled household	Sampled unit
Nong Bua Lam Phu	5	138	276
Chiang Mai	9	240	480
Kamphaeng Phet	4	105	210
Phetchaburi	4	119	238
Phuket	4	94	188
Pattani	6	173	346
Bangkok	6	169	338
<b>Total</b>	<b>68</b>	<b>1,895</b>	<b>3,790</b>

General information of respondents are household status, gender, age, nationality, marital status, living period in sampled household, education level

Social relations questionnaire asked about number of people respondents has social relations with (specific to Thai nationality), which differentiated into 19 types of social relations. Example of questions: how many family members respondents know (i.e., father, mother, children, husband, wife, etc.); how many relatives (on father side) respondents know, etc.

Community relations contain 19 types of question about number of different types of people respondents know. Types of people must be Thai and known population size i.e., how many Thai people who gave birth during the last year, how many Thai people who passed away during the last year, etc.

Specific types of questionnaire which was used to interview different targeted population: MSM, FSW, and PWID

This size estimation questionnaire was adjusted from questionnaires which has been used in the size estimation of high risk populations on HIV infection and transmission 2010. Selected questions contain data of correct types of known population, and population size is in appropriate period (0.1% - 4.0% of the total studied population).

## **2.7 Data collection method**

### **a. Data collection team**

There were three data collection teams:

- Team of Research Development in Northeast, Khon Khen University is responsible for data collection in 8 provinces, not including Bangkok and Chiang Mai
- Team of the Northern Substance Abuse Center, Chiang Mai University, collecting data in Chiang Mai
- Team of the Bureau of Epidemiology, DDC, collecting data in Bangkok

### **b. Preparation**

Training was conducted for field supervisors and interviewers, covering related issues surrounding key population with higher HIV risk, objectives of the surveys, data collection instrument, data collection method, and data coding systems. In order to ensure that all the teams and team members had common understanding and skills, all teams had practiced in the field nearby the training venue from data collection to data verification.

### **c. Field preparation and household sampling**

Details of locations and components of village and households in the villages were taken from the community health care prior to the data collection. Field workers went into the village to survey blocks and villages in order to draw a village map and to enumerate the number of household existing in the village. Then, listing of household was taken from the local authorities to be used in sampling, planning for data collection, making appointment with the selected household before conducting the interview. Each teams needed to get permission for local authorities before the fieldwork could begin.

#### **d. Interviewing**

In each village or block, six to eight trained interviewers spent around 1-2 days for household data collection. Face-to-face interviews were conducted by interviewers – using structured questionnaire of the project, having interviewee answer in verbal and writing the answers into the questionnaire. All the interview would be done in privacy so that the interviewee felt most comfortable in giving answers.

#### **e. Field supervision**

One field supervisor had been working with 6-8 interviewers. After each day data collection, the interviewers had to hand on all questionnaires of each day with completed data coding and data verification to their supervisor. Also, problems occurred in the field were reported to and solution discussed with the supervisors. Day-by-day planning and problem solving would be done by the supervisors.

#### **f. Ethical issues and rights protection**

This study was reviewed and approved ethically by the Ethical Review Board for Research in Human Beings of Khon Kaen University (No. 517269). It is observational research with no intervention to the participants of this study. All respondents had their rights to refuse to participate in this study. Prior to getting into household, the leaders of the field work team informed all residents of the selected villages/blocks about the study through the community/village leaders. Before interviewing the household members, the interviewers explained about the objectives and data collection methods to all members of the household. Interview must be done by voluntary of the household member. None of the identification data of the respondent (i.e. name or ID number) would be recorded into the questionnaire. None of the questions were sensitive and threatening to the respondents. The questionnaire was designed to ask about number of people in each type of social network of the respondents without mentioning any name. All interviewers were well trained on techniques and manner of interviewing. The interview must be done at the convenient time of each respondent, at private place. All information were kept confidential. The study will report in overview of the results at national level by not mentioning any individual information of respondents.

In data collection, fieldworkers would not record names and address of respondents so that the respondents could be comfortable in providing their information and be assured that their information would be kept confidential. It's only the interviewers who could identify the

owner of each data. All questionnaires would be coded and kept in the manner that no one could identify the owner of each questionnaire. No individual data could be identified from the questionnaire even by some government agencies or by court order.

**g. Data processing and analysis**

In the field, all questionnaires would be primarily reviewed and verified by interviewers and field supervisors. Data would be then processed and double processed in Epidata program in order to examine the consistency (ความแม่นยำ) and feasibility of data. Data collected from each regions were then examined before the specialized statisticians would do the data analysis to obtain the results of the survey at national level.

**2.8 Estimated number of population**

Two analysis processes are applied in this study: a) an estimation of network size (C); and b) backward computation to estimate number of hidden population. The study followed size estimation practices from Southampton Oceanography Centre, Florida University, University of California-Santa Barbara, and University of Georgia. This study then turned up with two approaches in estimating network sizes:

- a) Reference group method lies on assumption that “people in a sub-population whom respondents know – are part of that sub-population whom others know.” Field workers interviewed the study samples by applying face to face questionnaire to estimate network size

Sub-population which has proportion between 0.1 – 4.0 % were selected. Details of sub-populations are listed in the table below:

*Table 2.1 Scope of Known Population which used to frame questions to set network size by reference group method*

No.	Known Population
1	who are mothers who gave birth to a baby boy in the last year
2	who are mothers who gave birth to a baby girl in the last year
3	who passed away (male) in the last year
4	who passed away (female) in the last year
5	who are male, unemployed, aged between 15 – 60 years old (no work, no income)

No.	Known Population
6	who are female, unemployed, aged between 15 – 60 years old (no work, no income)
7	who are monks
8	who has divorced
9	who are male, older than 80 years old
10	who are female, older than 80 years old
11	who are male, non-Thai national
12	who are female, non-Thai national
13	who are male, handicapped and has registered
14	who are female, handicapped and has registered
15	who has accidents on land
16	who are community health volunteers
17	who are students at kindergarten level
18	who are female students at high-school level
19	who teachers at primary and junior-high-school level

b) Summation method - Field workers interviewed the study samples by applying face to face questionnaire to estimate network size. The study samples enumerate the people they know in a list of specific relationship types or categories (Alters) i.e., relatives, colleagues, friends, etc. Network size is calculated by combining total number people in every categories and calculate mean of network size.

Table 2.2 A list of specific relationship types, respondents know

No.	Questions
1	who are your family member (i.e., father, mother, children, husband, wife, siblings)
2	who are relatives on your father’s side
3	who are relatives on your mother’s side
4	who are become your relatives by marry (relatives of husband/wife, son-in-law, daughter-in-law, brother-in-law, sister-in-law)
5	who are friends at your workplace
6	who are friends/colleagues from network of your work
7	who are your neighbors
8	who become your friends knowing at meetings or seminars



No.	Questions
9	who become your friends from religious practice
10	who are your friends from education path (teachers, seniors, juniors)
11	Who become your friends at gyms or playing sports together
12	who become your friends through internet social network i.e., Facebook, Line
13	who become your friends through philanthropy's network
14	who become your friends through hobbies, out-door activities i.e., travel companion
15	who you know from receiving services i.e., buying, hair-dresser, bank employee
16	who you know from politic activities (i.e., local or national level)
17	who you know from similar type of ethnic group (i.e., moving from the same place)
18	who you know from sharing similar interest topics i.e., environment problems
19	who you know by interaction in other activities than the above question: 1-18

This estimation uses a total number of population in each region and Bangkok, using population data from department of the interior, Ministry of the Interior 2014 (64,785,909).

Regions	Number of Population
Bangkok	5,686,252
Central	16,366,870
Northern	11,825,955
North-Eastern	21,775,407
Southern	9,131,425
<b>Total</b>	<b>64,785,909</b>

## CHAPTER 3: SURVEY RESULT

### 3. Survey Result

#### 3.1 General information the study samples

Main respondents in the study samples were head of households or their spouses (this similar in most regions – Bangkok, northern, northeastern, and southern, except central region where main respondents were sons and daughters.) Proportion of gender (male and female) were equal, with 1.2 % of gay population: transgender, gay-man, tom-boy, and lady (the differences is 0.0 – 3.7% among regions.)

Respondents' age was between 25 – 44 years old, with an average age of 40 years old (standard deviation of 15.548, median of 42.0 and interquartile range at 25.) Most of respondents were Buddhist – 90.1% with 8.3% were Muslim. Most were married and living together. The samples live in the municipality and have lived in their households for more than 20 years or an average of 25.1 year (standard deviation of 16.638, median of 22.0 and interquartile range at 26.)

More than half of the samples attained compulsory education (primary and junior-high-school level) with 15.1% are students, and 6.3% are unemployed. Major source of income were from fishery and agriculture.

*Table 3.1 General information of the study samples*

General Info.	Overall	Bangkok	Central	Northern	Northeastern	Southern
1.1 Household information and head of households						
1. Head of households	1,207 (31.8)	136 (40.2)	208 (21.8)	235 (34.1)	468 (36.8)	160 (30.0)
2. Households' spouses	1,040 (27.4)	120 (35.5)	154 (16.1)	224 (32.5)	417 (32.8)	125 (23.4)
3. Son/daughter	946 (25.0)	38 (11.2)	355 (37.1)	159 (23.0)	248 (19.5)	146 (27.3)
4. Households' sibling/spouses	144 (3.8)	21 (6.2)	54 (5.7)	7 (1.0)	31 (2.4)	31 (5.8)
5. Households' parents/spouses	121 (3.2)	1 (0.3)	70 (7.3)	4 (0.6)	9 (0.7)	37 (6.9)
6. Relatives	137 (3.6)	20 (6.0)	16 (1.7)	15 (2.2)	61 (4.8)	25 (4.7)

General Info.	Overall	Bangkok	Central	Northern	Northeastern	Southern
7. Not relatives	71 (1.9)	2 (0.6)	48 (5.0)	4 (0.6)	10 (0.8)	7 (1.3)
8. Others	124 (3.3)	0 (0.0)	51 (5.3)	42 (6.1)	28 (2.2)	3 (0.6)
<b>Total</b>	<b>3,790</b> <b>(100.0)</b>	<b>338</b> <b>(100.0)</b>	<b>956</b> <b>(100.0)</b>	<b>690</b> <b>(100.0)</b>	<b>1,272</b> <b>(100.0)</b>	<b>534</b> <b>(100.0)</b>
<b>1.2 Gender</b>						
1. Male	1,895 (50.0)	169 (50.0)	478 (50.0)	345 (50.0)	636 (50.0)	267 (50.0)
2. Female	1,895 (50.0)	169 (50.0)	478 (50.0)	345 (50.0)	636 (50.0)	267 (50.0)
<b>Total</b>	<b>3,790</b> <b>(100.0)</b>	<b>338</b> <b>(100.0)</b>	<b>956</b> <b>(100.0)</b>	<b>690</b> <b>(100.0)</b>	<b>1,272</b> <b>(100.0)</b>	<b>534</b> <b>(100.0)</b>
<b>1.3 Sexual preference</b>						
1. Kateoy	9 (0.2)	0 (0.0)	5 (0.5)	0 (0.0)	4 (0.3)	0 (0.0)
2. Gay	8 (0.2)	1 (0.3)	4 (0.4)	3 (0.4)	0 (0.0)	0 (0.0)
3. Tom	10 (0.3)	0 (0.0)	9 (0.9)	0 (0.0)	1 (0.1)	0 (0.0)
4. Lady	20 (0.5)	2 (0.6)	18 (1.9)	0 (0.0)	0 (0.0)	0 (0.0)
5. Heterosexual	3,743 (98.8)	335 (99.1)	920 (96.3)	687 (99.6)	1,267 (99.6)	543 (100.0)
<b>Total</b>	<b>3,790</b> <b>(100.0)</b>	<b>338</b> <b>(100.0)</b>	<b>956</b> <b>(100.0)</b>	<b>690</b> <b>(100.0)</b>	<b>1,272</b> <b>(100.0)</b>	<b>534</b> <b>(100.0)</b>
<b>1.4 Age</b>						
1. 12-24	712 (18.8)	24 (7.1)	288 (30.1)	136 (19.7)	117 (9.2)	147 (27.5)
2. 25-44	2,645 (69.8)	273 (80.8)	633 (66.2)	446 (64.6)	966 (75.9)	327 (61.2)
3. 45-65	433 (11.4)	41 (12.1)	35 (3.7)	108 (15.7)	189 (14.9)	60 (11.2)
<b>Total</b>	<b>3,790</b> <b>(100.0)</b>	<b>338</b> <b>(100.0)</b>	<b>956</b> <b>(100.0)</b>	<b>690</b> <b>(100.0)</b>	<b>1,272</b> <b>(100.0)</b>	<b>534</b> <b>(100.0)</b>
<b>1.5 Nationality</b>						
1. Thai	3,776 (99.6)	338 (100.0)	948 (99.2)	689 (99.9)	1,267 (99.6)	534 (100.0)

General Info.	Overall	Bangkok	Central	Northern	Northeastern	Southern
2. Others	14 (0.4)	0 (0.0)	8 (0.8)	1 (0.1)	5 (0.4)	0 (0.0)
<b>Total</b>	<b>3,790</b> <b>(100.0)</b>	<b>338</b> <b>(100.0)</b>	<b>956</b> <b>(100.0)</b>	<b>690</b> <b>(100.0)</b>	<b>1,272</b> <b>(100.0)</b>	<b>534</b> <b>(100.0)</b>
<b>1.6 Region</b>						
1. Buddhism	3,416 (90.1)	311 (92)	942 (98.5)	658 (95.4)	1,272 (100.0)	233 (43.6)
2. Christianity	51 (1.3)	7 (2.1)	2 (0.2)	30 (4.3)	0 (0.0)	12 (2.2)
3. Islam	315 (8.3)	19 (5.6)	7 (0.7)	0 (0.0)	0 (0.0)	289 (54.1)
4. Others	8 (0.3)	1 (0.3)	5 (0.6)	2 (0.3)	0 (0.0)	0 (0.0)
<b>Total</b>	<b>3,790</b> <b>(100.0)</b>	<b>338</b> <b>(100.0)</b>	<b>956</b> <b>(100.0)</b>	<b>690</b> <b>(100.0)</b>	<b>1,272</b> <b>(100.0)</b>	<b>534</b> <b>(100.0)</b>
<b>1.7 Marital status</b>						
1. Single	1,076 (28.4)	59 (17.4)	485 (50.7)	151 (21.9)	197 (15.4)	184 (34.5)
2. Live with partner	2,485 (65.6)	244 (72.2)	397 (41.5)	522 (75.7)	1,008 (79.2)	314 (58.8)
3. Separated	74 (2.0)	9 (2.7)	43 (4.5)	3 (0.4)	7 (0.6)	12 (2.2)
4. Divorce	36 (0.9)	6 (1.8)	13 (1.4)	4 (0.6)	11 (0.9)	2 (0.4)
5. Widow	119 (3.1)	20 (5.9)	18 (1.9)	10 (1.4)	49 (3.9)	22 (4.1)
<b>Total</b>	<b>3,790</b> <b>(100.0)</b>	<b>338</b> <b>(100.0)</b>	<b>956</b> <b>(100.0)</b>	<b>690</b> <b>(100.0)</b>	<b>1,272</b> <b>(100.0)</b>	<b>534</b> <b>(100.0)</b>
<b>1.8 Habitat</b>						
1. Municipality	2,266 (59.8)	338 (100.0)	407 (42.6)	458 (66.4)	727 (57.2)	336 (62.9)
2. Suburb	1,524 (40.2)	0 (0.0)	549 (57.4)	232 (33.6)	545 (42.8)	198 (37.1)
<b>Total</b>	<b>3,790</b> <b>(100.0)</b>	<b>338</b> <b>(100.0)</b>	<b>956</b> <b>(100.0)</b>	<b>690</b> <b>(100.0)</b>	<b>1,272</b> <b>(100.0)</b>	<b>534</b> <b>(100.0)</b>
<b>1.9 Period of staying in the household</b>						

General Info.	Overall	Bangkok	Central	Northern	Northeastern	Southern
1. Less than 5 years	470 (12.1)	40 (11.8)	197 (20.6)	51 (7.4)	68 (5.3)	114 (21.3)
2. 6-10 years	432 (11.3)	27 (8.0)	128 (13.4)	40 (5.8)	99 (7.8)	138 (25.8)
3. 11-15 years	506 (13.2)	27 (8.0)	180 (18.9)	111 (16.0)	128 (10.1)	60 (11.2)
4. 16-20 years	451 (11.9)	42 (12.4)	95 (9.9)	46 (6.7)	168 (13.2)	100 (18.7)
5. More than 20 years	1,931 (51.5)	202 (59.8)	356 (37.2)	442 (64.0)	809 (63.6)	122 (23.1)
<b>Total</b>	<b>3,790 (100.0)</b>	<b>338 (100.0)</b>	<b>956 (100.0)</b>	<b>690 (100.0)</b>	<b>1,272 (100.0)</b>	<b>534 (100.0)</b>
<b>1.10 Education level</b>						
1. no education	112 (3.0)	7 (2.1)	12 (1.3)	32 (4.6)	18 (1.4)	43 (8.1)
2. Elementary	1,482 (39.1)	119 (35.2)	221 (23.1)	355 (51.4)	664 (52.2)	123 (23.0)
3. Junior high school	779 (20.6)	51 (15.1)	319 (33.4)	141 (20.4)	181 (14.2)	87 (16.3)
4. High school	649 (17.1)	43 (12.7)	225 (23.5)	72 (10.4)	197 (15.5)	112 (21.0)
5. Vocational school	347 (9.2)	58 (17.2)	105 (11.0)	53 (7.7)	79 (6.2)	52 (9.7)
6. Bachelor degree or higher	340 (9.0)	58 (17.2)	48 (5.0)	36 (5.2)	121 (9.5)	77 (14.1)
7. Others	81 (2.0)	2 (0.5)	26 (2.7)	1 (0.1)	12 (1.0)	40 (7.5)
<b>Total</b>	<b>3,790 (100.0)</b>	<b>338 (100.0)</b>	<b>956 (100.0)</b>	<b>690 (100.0)</b>	<b>1,272 (100.0)</b>	<b>534 (100.0)</b>
<b>1.11 Employment status</b>						
1. Employer	71 (1.9)	8 (2.4)	19 (2.0)	7 (1.0)	20 (1.6)	17 (3.2)
2. Self-employ (no employee)	1,537 (40.6)	128 (37.9)	109 (11.4)	313 (45.4)	784 (61.6)	203 (38.0)

General Info.	Overall	Bangkok	Central	Northern	Northeastern	Southern
3. Corporate employee	732 (19.3)	62 (18.3)	356 (37.2)	147 (21.3)	96 (7.5)	71 (3.3)
4. Government employee	231 (6.1)	52 (15.4)	32 (3.3)	24 (3.5)	93 (7.3)	30 (5.6)
5. State enterprise employee	97 (2.6)	9 (2.7)	57 (6.0)	6 (0.9)	17 (1.3)	8 (1.5)
6. Home business (no wage)	295 (7.8)	9 (2.7)	94 (9.8)	32 (4.6)	128 (10.1)	32 (6.0)
7. Aggregation	14 (0.4)	0 (0.0)	12 (1.3)	0 (0.0)	2 (0.2)	0 (0.0)
8. Students	573 (15.1)	13 (3.8)	243 (25.4)	103 (14.9)	78 (6.1)	136 (25.5)
9. Unemployed/retired	240 (6.3)	57 (16.9)	34 (3.6)	58 (8.4)	54 (4.2)	37 (6.9)
<b>Total</b>	<b>3,790 (100.0)</b>	<b>338 (100.0)</b>	<b>956 (100.0)</b>	<b>690 (100.0)</b>	<b>1,272 (100.0)</b>	<b>534 (100.0)</b>
<b>1.12 Occupation</b>						
1. Law maker, senior official, manager	25 (0.7)	2 (0.6)	0 (0.0)	3 (0.4)	17 (1.3)	3 (0.6)
2. Professional work	243 (6.4)	52 (15.4)	35 (3.7)	24 (3.5)	70 (5.5)	62 (11.6)
3. Technicians	86 (2.3)	7 (2.1)	21 (2.2)	15 (2.2)	30 (2.4)	13 (2.4)
4. Clerk	39 (1.0)	0 (0.0)	19 (2.0)	1 (0.1)	10 (0.8)	9 (1.7)
5. Service workers, sale person in markets and stores	257 (6.8)	24 (7.1)	24 (2.5)	64 (9.3)	138 (10.8)	7 (1.3)

General Info.	Overall	Bangkok	Central	Northern	Northeastern	Southern
6. Workers in agriculture and fishery industries	972 (25.6)	2 (0.6)	32 (3.3)	171 (24.8)	703 (55.3)	64 (12.0)
7. Workers in handcraft industries	195 (5.1)	14 (4.1)	12 (1.3)	57 (8.3)	58 (4.6)	54 (10.1)
8. Basic professional careers	1,687 (44.5)	231 (68.3)	573 (59.9)	347 (50.3)	217 (17.1)	319 (59.7)
9. Factory engine workers, assemble workers	277 (7.3)	6 (1.8)	240 (25.1)	8 (1.2)	21 (1.7)	2 (0.4)
10. Armament troops (Royal Thai Armed Forces)	9 (0.2)	0 (0.0)	0 (0.0)	0 (0.0)	8 (0.6)	1 (0.2)
<b>Total</b>	<b>3,790 (100.0)</b>	<b>338 (100.0)</b>	<b>956 (100.0)</b>	<b>690 (100.0)</b>	<b>1,272 (100.0)</b>	<b>534 (100.0)</b>

### 3.2 Estimation of network size by reference group method

Size of social network calculated by using the mean number of people known in selected subpopulations. These 19 subpopulations were selected from proportion between 0.1 – 4.0% of the total population. By using reference group method, the mean size of social network was 264.60 with standard deviation of 489.73, median of 153 and interquartile range at 238. The adjusted mean size of social network is 212.93.

Table 3.2 Number of population and information for site-estimation by reference group method – differentiate by region

	Overall	Bangkok	Central	Northern	Northeastern	Southern
Total population	64,785,909	5,686,252	16,366,870	11,825,955	21,775,407	9,131,425

Mean of network size by reference group method						
	Overall	Bangkok	Central	Northern	Northeastern	Southern
Mean	264.60	373.48	252.43	233.86	341.29	123.15
Standard deviation	489.73	899.76	636.57	214.90	437.65	168.81
Adjusted mean	212.93	267.08	174.51	208.26	284.12	96.33
Lower	207.03	277.21	203.63	217.76	317.17	108.35
Upper	322.16	469.75	301.23	249.96	365.41	137.95
Median	153.23	158.91	113.51	170.26	215.66	76.62
Interquartile range	238.00	266.74	215.66	187.29	317.82	90.80
Minimum	6	6	6	6	6	6
Maximum	14,364	14,364	12,434	1,776	6,998	1,385

**3.3 Estimation of regional network size by summation method**

Size of social network obtained from calculating mean by adding up all the number of people in a list of specific relationship types (Alters) i.e., relative, colleagues, friends, etc., which were enumerated by the study samples. The network size from summation method was 249.31 with standard deviation of 479.07, median of 131 and interquartile range 195. The adjusted mean size of social network is 185.86

*Table 3.3 Number of population and information for site-estimation by summation method – differentiate by region*

	Overall	Bangkok	Central	Northern	Northeastern	Southern
Total population	64,785,909	5,686,252	16,366,870	11,825,955	21,775,407	9,131,425
Mean of network size by summation method						
Mean	249.31	318.20	335.65	135.58	299.25	130.38
Standard deviation	479.07	578.51	765.22	133.87	430.96	151.46
Adjusted mean	185.86	230.10	243.08	118.41	232.13	109.35



	Overall	Bangkok	Central	Northern	Northeastern	Southern
Lower	233.61	256.30	279.54	125.57	275.54	117.50
Upper	265.01	380.09	391.75	145.58	322.96	143.25
Median	131.00	150.50	175.00	95.50	168.00	87.00
Interquartile range	195.00	311.00	264.00	117.00	241.00	102.00
Minimum	6	16	3	6	7	14
Maximum	16,816	5,796	16,816	1,294	5,032	1,614

### 3.4 Estimation of the Most at Risk Populations

The mean number of MARPs that each sample know are 1.28 gay men/kateoy, 1.02 transgendered, 0.38 men having sex with men, and 0.24 people who injecting drug, as presented in Table 3.4

*Table 3.4 A The mean number of MARPs in the sample network size*

	Gay/Kateoy	MSM	Sex workers	PWID	Transgender
The mean number	1.28	0.38	0.35	0.24	1.02
Standard deviation	3.06	1.27	3.51	2.89	2.11
Adjusted mean	0.83	0.17	0.05	0.02	0.69
Lower	0.91	0.34	0.21	0.13	0.94
Upper	1.64	0.43	0.48	0.35	1.10
Median	0.0	0.0	0.0	0.0	0.0
Interquartile range	2.0	0.0	0.0	0.0	1.0
Minimum	0	0	0	0	0
Maximum	25	20	100	100	25

The estimated number of MARPS are 31,849 – 332,033 gay men/kateoy, 254,361 – 269,959 transgender, 93,593 – 99,332 men having sex with men, 85,489 – 90,731 (female) sex workers, and 71,083 – 75,441 people who injecting drugs. The estimates obtained from the summation method is higher that the reference method by 6.1%, as presented in Table 3.4 b.

*Table 3.4 B Estimated number of MARPS obtained from the summation method and the reference method*

	<b>Summation method</b>	<b>Reference group method</b>	<b>Differences</b>
Gay/Kateoy	332,033	312,849	19,184
Men have Sex with Men (MSM)	99,332	93,593	5,739
Female Sex Workers (FSW)	90,731	85,489	5,242
People With Injecting Drug (PWID)	75,441	71,083	4,358
Transgender	269,959	254,361	15,598

### **3.5 Level of acceptance of respondents to behavior of MARPS**

Respondents of this study had various level of acceptance to behavior of MARPS.

Transgender people, gay men/kateoy are moderately accepted, while sex workers and people who injecting drug are low accepted, as presented in Tabel 3.5.

Table 3.5 The standard deviation, median, interquartile range of acceptance level of the Most At Risk Population on HIV infection and transmission by region

Characteristic	Overall		Bangkok		Central		Northern		Northeastern		Southern	
	S.D.	IQR	S.D.	IQR	S.D.	IQR	S.D.	IQR	S.D.	IQR	S.D.	IQR
1. Gay/Kateoy	2.50 (1.10)	3 (2)	2.70 (1.05)	3 (1)	2.33 (1.54)	1 (2)	2.77 (0.89)	3 (0)	2.55 (1.12)	3 (2)	1.62 (0.92)	1 (2)
2. Men have Sex with Men (MSM)	2.26 (1.08)	3 (2)	2.47 (1.09)	3 (2)	2.20 (1.56)	1 (2)	2.60 (0.95)	3 (0)	2.23 (1.08)	3 (2)	1.48 (0.91)	1 (2)
3. Female Sex Workers (FSW)	1.93 (1.05)	1 (2)	1.88 (1.06)	1 (2)	1.62 (0.94)	1 (2)	2.20 (1.04)	3 (2)	1.82 (1.04)	1 (2)	1.87 (0.99)	1 (2)
4. People With Injecting Drug (PWID)	1.51 (0.89)	1 (1)	1.27 (0.61)	1 (0)	1.58 (0.92)	1 (2)	1.61 (0.95)	1 (2)	1.53 (0.92)	1 (2)	1.30 (0.70)	1 (0)
5. Transgender	2.62 (1.09)	3 (2)	2.82 (1.02)	3 (0)	2.73 (0.92)	3 (0)	2.76 (0.91)	3 (0)	2.68 (1.15)	3 (2)	1.96 (1.00)	1 (2)

## CHAPTER 4: DISCUSSION

### 4. Discussion

#### 4.1 Size estimation by network scale up method comparing to other methods

Size estimation of hard-to-reach population such as People Who Injecting Drug (PWID) by using direct methods has been applied in several countries (UNAIDS, 2003: 13-32, UNAIDS, 2010: 13-34,). These include household survey, enumeration method, multiplier method, nomination method, capture-recapture method, the Truncated Poisson method, compartmental method, respondent driven sampling; RDS. Among these methods, the most common techniques which has been used to collect data for size estimation is household survey: by using structured questionnaire in interviewing respondents who are sampled from households that are selected by probability sampling method, with the sampling frame to obtain representativeness. For many developed countries, this household survey is conducted via phone interview, and for developing countries it is conducted using face to face interview technique. Some developed countries and Thailand use this survey technique to estimate size of MARPs and to examine prevalence of risk behaviors of samples. This method bases on representative samplings which is an advantage as it uses less manpower and expenditure of resources comparing to population census. Moreover, it reduces level of deviation that causes by other enumeration methods. This survey method and estimation results come out of using survey is widely acceptable and applicable at national, regional, and local level. Disadvantages include 1) error can be caused by sampling and non-sampling method, 2) prevalence of some behaviors and size estimation results might not include all of the interested target groups for the fact that network of people with high risk behavior (i.e., sexual risk, drug using, social unacceptable behavior) are not common behaviors and omitted from the sample, and 3) respondents may not provide the truth about stigmatized behavior, social unacceptable behavior, and illegal behavior, especially when interviews are taken place with other household members. This might cause underestimation of the number of MARPs and their prevalence behavior. These are varied by countries and culture.

Because of the disadvantage of household survey to estimate number of MARPs who are hard to reach, and or if they agree to participate in the survey they may not reveal truth about their stigmatized and illegal behavior (Bernrd., Hallett., lavita et al., 2010: ii 11). Indirect method called network scale up method is therefore applied to estimate hard-to-reach or hidden population (by collecting data indirectly from the samples.) For example, asking respondents how many PWID they knows. This is a technique asking respondents about other people, not

respondents themselves – this is preferable technique to use when asking about stigmatized, illegal, hidden, and hard-to-reach population. If asking directly, respondents may not reveal the truth the survey results might be underestimated (Papers from the network scale-up project. Retrieved January 5, 2010, from <http://nersp.nerdc.ufl.edu/ufruss/publication.htm>)

This network scale up method is network analysis principles and statistic calculation to achieve accuracy of size estimation. Indirect questioning technique yields more reliable and valid estimation results. By applying statistic calculation is simple, cost saving, time saving in estimating size of high risk populations. Especially, estimating number of target population within targeted area at provincial and national level.

In a single survey of using this NSUM, size estimation of many group of target population can be obtained within one single survey. However, this method is still developing and the accuracy and reliability of results rely on network size. Because there is no fixed value of network size as it is varied by demographic characteristics, cultural context in each target area. Moreover, this method cannot identify precisely who the MARPs are. Data obtained therefore just only the number of MARPs. Error of NSUM could be caused by 3 effects: 1) barrier effect, 2) transmission effect, and 3) estimation effect.

1) Barrier effect is bias, caused by the fact that probability of knowing people in different subpopulation (groups) will be varied by different demographic characteristic of respondents. For instance, different background of respondents including nationality, socioeconomic status, career, resident, geographic area, etc., have made chance of knowing people from different groups is varied (Zheng T., Salanik M.J. and Gelman AI, 2006: 409 – 423.) This barrier effect could be found more in the study with small sample size than in the study with good representative sample size. For example, zero-status of people are less likely to be reveal by relatives who do not live in the same location, otherwise it's been disclosed by HIV infected people themselves. The barrier effect could cause more problem if the survey include the samples who tend to know hidden population that has small number of group members. This barrier effect cause from incomplete sampling frame (defect of sampling frame) and response bias. In case that the survey use phone interview method, and select its samples from phone number list – but it is less likely that people who know PWID, do not use telephone, then this NSUM yield underestimation of PWID. In opposite, in case that the sampling frame exclude people from rural area – it's possible that size estimation result for national level will be overestimated.

2) Transmission effect – it is bias caused by the fact that respondent does not know relevant information of subpopulations. Respondents do not know every issues of people in their social network especially if the issues are related to socially unacceptable behavior or status for example being people living with HIV. Respondents of this NSUM survey then, may know less number of PWID than actual number because injecting drug is stigmatized behavior. Studies in the United States of America (Shelley G.A., Bernard H.R., Killworth P.D., Johnsen E.C. and McCarty C., 1995: 189-217, Shelley G.A., Killworth P.D., Bernard H.R., Johnsen E.J., McCarty C., and Rice R., 2006:430-444.) found that respondents who live with HIV positive people did not know about serostatus of their household members, friends, and acquaintances. Moreover, the social network size of people living with HIV was significantly smaller than of general people i.e., only one third of the size of general people (Johnsen E.C., Bernard H.R., Killworth P.D., Shelley G.A. and McCarty C., 1995:167-187.)

3) Estimation effect is the fault estimation of number of known people, because subpopulations have unclear definition and timeframe such as subpopulation of FSW has too much of specification, then not all people may recognize their existence at the same level. Therefore, the survey should target for subpopulations which are not too specific to ensure that these subgroups are recognized. It is frequently found that small subgroups might be overestimated or large size of subgroups might be underestimated (Zheng T., Salganik M.J. and Gelman A., 2006: 409-423, Killworth P.D., McCarty C., Bernard H.R., Shelley G.A. and Johnsen E.C., 1998: 289-308.)

Reliability of this NSUM rely very much on the control of sampling and non-sampling method; accuracy and up to date of sampling frame; sufficiency of samples; relevance of sample size calculation and sampling method; probability or non-probability sampling; representativeness of samples; quality of survey tools, data collection method, interviewers, field work management, coding, data processing, and data analysis.

However, NSUM cannot collect data on detail of behavior because the respondents are unable to provide reliable and accurate information about hidden behavior of other people. In contrast, the survey that directly approach hidden population, even achieve smaller sample size, can obtain more detail on behavior and uptake of HIV services.

#### **4.2 Being unknown/unaccepted effect the estimation**

Level of knowing about behavior or personal information is varied which is depended on social norm. This norm judges behavior of people. Moreover, social differential of society in each region make certain character of the social network.

#### **4.3 Statistics discrepancy**

The estimation presented in this report is resulted from crude analysis. There is uncertainty of measurement in this quantitative study. It is clear that the data is not normally distributed, the calculation for confidence interval become complicated because the study applied multi-stage stratified sampling. Confidence interval needs to be correctly statistical weighted, this technique is time-taken and need specific skill. Analysis is ongoing.

#### **4.4 Differences of size estimation between reference group and summation methods**

The accuracy of estimation using NSUM will be directly affected by the estimation of network size (C). Estimation of network size can be done by 2 means:

##### 1) Summation method

Advantage of this method is that calculation of network size is not complicated, and there is no need to use number of total population. Limitations are the recall of known people may not be completed and pattern of social relationship in questionnaire may be not cover all types of existing social network. These two limitations may lead to cause underestimation (undercounting or less than actual number) or by classify known people not to be in the same categories may lead to over-counting. Moreover, classification of social relationship should be thoughtfully conducted with concerning to different country context. The classification of known people should be closed to what will be feasibly classified by the respondents. Lastly, this summation method is not based on any statistical framework, therefore it is uneasy to calculate the uncertainty of measurement.

##### 2) Reference group method:

It is possible that is method could be bias by the size of subpopulation that is used as reference group (Zheng, Salganik, Gelman, 2006: 409-23). It is found that respondents tend to reply about known people (who are members of large group) less than actual number they know, in contrast respondent then to give higher number of known people

who are member of smaller group population (Killworth, McCarty, Bernard et al, 1998: 289-308., Johnsen, Bernard, Killworth et al, 1995: 167-87.) Statistical adjustment is needed to respond to this possible bias results (Brewer, Webster, 1999: 361-73., Shelley, Bernard, Killworth et al, 1995: 189-217., Shelley, Killworth, Bernard et al, 2006: 430-44.) Accuracy of this estimation rely on the accuracy and up to date of population data which is used for reference. Obviously, mean of network size obtained by summation method is lower than mean from reference group method in every regions. Because recalling known people during the last year is not easy. Therefore, it could be assumed that the mean from summation method is lower than actual existing number. When using this mean to calculate will make size estimation higher than existing number.

The mean from reference group method presents direct variation with hidden population estimation which tend to have a higher number than referenced register data. This may result in underestimated results. In conclusion, actual estimation maybe central value of two means of these methods (reference group method and summation method).

#### **4.5 Differences of the Estimation Comparing to the Survey Studies in 2010**

Network Scale Up Method has been first applied in Thailand in 2010, by determining social network size of people who lived in the same region then combined the results of all region to have an overall national estimation. Meaning of “know” that has been used in Thailand is: you know them, they know you, you know their name and appearance, they know your name and appearance, you have had contact at least one time with them in the last 2 years (2008-2009), and you could get in touch with them if needed. This 2010 estimation was based on civil registration in 2009. In contrast, the 2014 size estimation only obtained national estimation, definition of “know” that has been used is: you know them, they know you, you know their name and appearance, they know your name and appearance, you have had contact at least one time with them in the last year (2013), and you could get in touch with them if needed. In 2014 estimation was based on civil registration in 2013.



	Overall	Bangkok	Central	Northern	Northeastern	Southern
Population 2009	58,938,919	5,710,883	11,165,157	11,878,641	21,442,693	8,741,545
Population 2013	64,785,909	5,686,252	16,366,870	11,825,955	21,775,407	9,131,425

	Reference group method			Summation method		
	2010	2014	Differences	2010	2014	Difference
Population	58,938,919	64,785,909	5,846,990	58,938,919	64,785,909	5,846,990
Gay/Kateoy	353,800	312,849	-40,951	818,500	332,033	-486,467
MSM	89,800	93,593	3,793	213,200	99,332	-113,868
Sex Workers	67,900	85,489	17,589	160,700	90,731	-69,969
PWID	40,300	71,083	30,783	97,300	75,441	21,859

The study in 2010, result of summation and reference method was two-times difference because size of social network was so much different. However, the present study the disparity of result is 5.8%. Size estimation of MARPs by using reference method have found that all group number of population is increased, except Gay/Kateoy group members is decreased.

#### 4.6 Applying the estimation methods at different level

Key consideration when applying NSUM to use at different levels:

##### National level

This study by using reference and summation method, social network size is similar which resulted in high consistency in estimation of subgroup of MARPs.

##### Regional level

The 2010 estimation of social network size (Kanato et al 2011), results of summation and reference method is double time difference. Moreover, reference group in each region was

different and difficult to define meaning of network (its boundary). This resulted in low consistency in estimation of subgroup of MARPs.

### **Provincial level**

Result of the study in 2010 (Thaikla and Aramrat, 2010) and 2014 (Kanato et al 2012) came out in the same direction, that is reference group and summation method derived significant estimation of network size. Data of reference group of each province is difference and not up to date, in which resulted in low consistency in estimation of subgroup of MARPs.

### **Local level**

Statistical data of reference group is limited (Thaikla et al 2011), this made calculation by reference group method is difficult. Studies at local level then only use summation method (Poochaduk et al 2011; Leeyatikul and Kanato 2013; Kensila and Kanato 2013).

## **4.7 Data use**

Results derived from reference group method and summation method could be selected to use concerning characterizing of population.

### **1) Size estimation of Men having Sex with Men**

This study obtained estimation number of Gay/Kateoy 312,849 to 332,033, MSM 93,593 to 99,332. The difference in number obtained reflect that respondents has confidence in defining their known people as MSM rather than Gay/Kateoy. However, estimation of Gay/Kateoy is crucial for HIV prevention program planning as this group is at higher risk of HIV by their male to male sexual behavior.

### **2) Size estimation of Sex Workers**

This estimation maybe underestimate because the respondents may not know non-exclusive sex workers. It might be assumed that number of sex workers range between 85,489 and 90,731. These sex work concentrate in urban area, this make it easy for HIV prevention program to reach out this MARP.

### **3) Size estimation of PWID**

Average number of known people who are PWID of respondents is lowest comparing to other MARPs. The estimation of PWID 71,083 to 75,441 might be close to actual number.

Estimation of population with different level of social acceptance flaw.

Difference in social acceptance level and stigmatization of different population will directly affect precision of estimation (Poochaduk et al 2011).

## CHAPTER 5: CONCLUSION

### 5. Conclusion

#### 5.1 National Estimates: Number of the Most at Risk Population on HIV Infection and Transmission

Most at Risk Population	Summation method	Reference group method
Gay/Kateoy	332,033	312,849
Men have Sex with Men (MSM)	99,332	93,593
Female Sex Worker (FSW)	90,731	85,489
People With Injecting Drug (PWID)	75,441	71,083
Transgender	269,959	254,361

Overall, this study came up with the estimated number of different hard-to-reach groups, as below:

Gay men:	330,000
MSM:	99,000
Transgender:	260,000
FSW:	90,000
PWID:	75,000

#### 5.2 Recommendations

- 1) The results of this size-estimation of MARPs (study) should be compared with other related studies. Especially, evidence information from field experience – before using this studied results to lay-out a work-plan for HIV infection and transmission program for hard to reach populations.
- 2) Collection of sufficient information is essential before setting a detail work-plan, as the studied results could not provide in-depth information of MARPs.
- 3) This site-estimation survey should be conducted occasionally to learn an up-to-date information on tendency of HIV infection and transmission among MARPs.

Recommended frequency should not be less than every 2 years. The survey questions should also be adjusted to cover wide characters of this high-risk populations.

- 4) Improvement of data system of general population will provide updated data, this current information will help increasing accuracy of results of network scale up method.
- 5) Applying network scale up method for size estimation at regional, provincial and local level should be conducted with cautions.