National Size Estimation of the Most at Risk Populations for HIV in Sri Lanka

REPORT
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LEAD CONSULTANT:

Management Frontiers (Pvt) Limited
(Management Consultants)
20/74 – 1/1, Fairfield Gardens,
Colombo 8,
Sri Lanka.
Tel: +94 112 674667/8
Web: www.managementfrontiers.com

Team of Consultants:

Team Leader: Dr. Nimal Kasturiaratchi
Project Manager: Prasantha Abeykoon
Study Coordinator: Dr. Ivana Bozicević
Community Health Specialist: Dr. Shamini Prathapan
Social Behavioural Specialist: Prof. Aleksandar Štulhofer
RDS Statisticians: Zoran Dominković, Sandra Sevic
Survey Supervisor: Priyanjith Abeykoon

INTERNATIONAL TECHNICAL ADVISORS TO LEAD CONSULTANT

Dr. Ivana Bozicevic, WHO Collaborating Centre for HIV Strategic Information
Zoran Dominkovic, WHO Collaborating Centre for HIV Strategic Information
Sandra Sevic, WHO Collaborating Centre for HIV Strategic Information

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FORWORD

Knowing the sizes of the key populations is very important in programme planning purposes. A gold-standard population data source, such as a census, does not exist for key population groups who are at risk of contracting HIV, namely Men who have Sex with Men, Female Sex Workers, Beach Boys, Transgenders or People Who Inject Drugs. So, it is required to use other methods to calculate the size of these populations. Because these approaches are not randomized, the data they produce might be biased in one direction or another. Employing multiple approaches reduces the chance of bias. The approaches were incorporated within a biological and behavioral surveillance study of key populations funded by the Global Fund. The three approaches used in the current population size estimation study were:

- the multiplier method, which gathers data on use from various services, projects, and studies and compares them to reported service use in the bio behaviour surveillance survey;
- the "mapping and enumeration" method, which asks primary and secondary key informants from specific groups to estimate how many members of their population exist, segregate in hot spots and the proportion is used to enumerate the total Key Population size estimation; and
- the "Delphi" method, which asks respondents from specific groups to estimate how many members of their population exist, then stakeholders were asked to review these data and decide on most reasonable and plausible upper and lower bounds for the size of the populations.

The survey was carried out by Management Frontiers (Pvt) Ltd., with the technical assistance from University of Sri Jayewardenepura and WHO Collaborating Centre, Zagreb, Croatia under the leadership of National STD/AIDS Control Programme (NSACP). The financial support for this survey was through the Global Fund to fight AIDS, Tuberculosis and Malaria. We would like to thank all the survey participants for their support, participation and sharing their personal experience.

As National STD/AIDS Control Programme we are very happy to follow transparent, all inclusive standard approaches when working with the key populations. With this more updated and realistic size estimate data we hope we can plan for improved coverages and reach our ultimate target of "Ending AIDS by 2025".

Dr. Lilani Rajapaksha
Consultant Veneriologist
Director
National STD/AIDS Control Programme

Dr. Sriyakanthi Beneragama
Consultant Epidemiologist,
Co-ordinator/Special Projects,
National STD/AIDS Control Programme

ACRONYMS

ADIC	Alcohol & Drug Information Centre
AIDS	Acquired Immune Deficiency Syndrome
BB	Beach Boy
CBOs	Community Based Organization
CSO	Civil Society Organizations
DS	Divisional Secretariat
DU	Drug User
FPA	Family Planning Association
FRO	Field Research Officer
FS	Field Supervisor
FSW	Female Sex Worker
GFATM	The Global Fund to Fight AIDS, Tuberculosis and Malaria
HIV	Human Immunodeficiency Virus
IBBSS	Integrated Biological and Behavioural Surveillance Survey
KI	Key Informant
KP	Key Population
L1	Level 1
L2	Level 2
MoH	Ministry of Health
MSM	Men who have Sex with Men
MSW	Male Sex Worker
NGO	Non-Governmental Organization
NSACP	National STD/AIDS Control Programme
PLHIV	People Living with HIV
PWID	People who Inject Drugs
RDS	Respondent-Driven Sampling
SAC	Surveillance Advisory Committee
STI	Sexually Transmitted Infection
SW	Sex Worker (or Sex Work)
TG	Transgender
TGW	Transgender women
UNAIDS	United Nations Joint Program on HIV and AIDS
WG	Working Group
WHO	World Health Organization
WHO CC	WHO Collaborating Centre

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EXECUTIVE SUMMARY

This report describes the process and the results of the size estimation study of key populations (KPs) in Sri Lanka, which was based on the methods of the geographical mapping with enumeration and the multiplier, as well as the results of the consensus-building workshop that utilised the Delphi process to arrive at the final population size estimates (PSE). Following KPs were included in the size estimation study: female sex workers (FSWs), men who have sex with men (MSM), male sex workers (MSW), transwomen, people who inject drugs (PWID) and beach boys (BBs).

The divisional secretariat (DS) was selected as the unit area for geographical mapping. DSs were divided into three categories based on the general population census conducted in 2012, and 49 DSs were included in mapping and enumeration. Mapping and enumeration data were collected through Level 1 and Level 2 activities. The output of Level 1 activity is a comprehensive list of unique spots where KPs can be found, time of their operation and estimated minimum and maximum number of KPs at each spot. This information was provided by secondary key informants (KIs). Level 2 activities include visits to the spots identified at Level 1 to validate their existence and interview primary KIS about the minimum and maximum number of KP members that socialize at the hotspots on peak days and during an average month. Two types of corrections (adjustments) were applied on the mean (minimum-maximum) estimate of a KP during an average month: an adjustment for mobility (KP individuals interviewed at the identified spots in Level 2 activities were asked about their mobility across spots) and an adjustment for hidden populations (based on information collected in IBBS based on RDS carried out in 2018).

Extrapolation of the PSE from DSs which were mapped to the district, provincial and national level was done using the adjusted estimated number of KPs calculated in each of the randomly selected DS.

Several service-based and unique object-based multipliers were obtained to estimate the size of KPs in cities were integrated bio-behavioural surveys (IBBS) were carried out in 2018.

Final population size estimates were discussed and agreed upon at the stakeholders meeting held in June 2018. In addition to inputs on point estimates of the population size, a goal of this process was to establish upper and lower plausibility bounds for the estimates based on this study, previous PSE studies in Sri Lanka, expert opinion and the UNAIDS estimates for Asia and the Pacific region. The workshop used a modified Delphi method to achieve consensus.

Results
A total of 1,170 primary KIs were interviewed during L1 activities.

Female sex workers

For FSW, a total of 456 spots were validated during L2 activities, and 376 primary and 233 secondary KIs were interviewed. Mapping and enumeration resulted in an estimate of 2,811 FSW (range: 2,370-3,251) during an average month. Adjustment for mobility gave an estimate of 2,563, while an additional adjustment for a hidden population an estimate of 6,139 (range: 5,249-7,180). The extrapolated estimated number of FSW in Sri Lanka based on mapping is 31,748 (27,148 – 37,131).

The median estimated size of FSW in Colombo based on the multiplier is 2,155 (95% CI 1,812-2,660) while in Galle it is 1,134 (95% CI 983-1,342). In Kandy, the multiplier estimate was not possible to calculate because of missing programme (NGO) data. There were two rounds of Delphi estimations to reach the consensus estimate. The group agreed on the national estimate of 30,000 (20,000 – 35,000) FSW in Sri Lanka.

Men who have sex with men

A total of 164 spots were identified for MSM in L2 activities, and interviews were carried out with 139 primary and 81 secondary KIs. Without any adjustment, there were 994 MSM found in L2 activities (range: 833-1,155) during an average month. Adjustment for mobility gave a slightly lower average estimate of 952, while adjustment for a hidden population the estimate of 1,570 (range: 1,303-1,814). The estimate of 8,120 (6,739 – 9,381) of MSM was obtained through the extrapolation procedure, which was based on mapping data.

The median of the estimated size of MSM based on the available multiplier data in Colombo is 2,960 (95% CI 2,621-3,365), while in Galle it is 2,491 (95% CI 2,045 - 3,214). In Anuradhapura the median was not possible to calculate due to heterogeneity in the estimates.

Three rounds of a Delphi process were conducted.[a] A consensus estimate of 40,000 (30,000 – 50,000) MSM was reached using the median estimated number participants provided in the third round.

Male sex workers

MSW were identified at 158 spots. Without adjustments, there was an average of 587 MSW (range: 469-704) during an average month at the spots mapped. Adjustment for mobility gave an estimate of 561, while adjustment for "a hidden population" the estimate of 778 (range: 626-937). The extrapolated number of MSW in Sri Lanka is 4,024 (3,240 – 4,848). The final estimation from the consensus meeting was that 15% (10% - 21%) of MSM engage in sex work, which translates to 6,000 (4,000 – 8,400) of MSW in Sri Lanka.

People who inject drugs

For PWID, a total of 41 KIs (33 of these primary and 8 secondary) were interviewed in L2 activities, and 17 spots in five DSs were identified. Without adjustments the average number of

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[a] Participants discussing the MSM data provided diverging estimates, ranging from 12,000 to 700,000 of MSM in Sri Lanka. Lower estimates were mostly provided by those involved in planning HIV programmes for MSM and higher estimates were driven by LGBT activists.

PWID during an average month is 368 (range: 315 - 404). Adjustment for mobility gave a slightly lower average estimate of 356, while adjustment for a hidden population the estimate of 517 (range: 451-582). The extrapolated number of PWID in Sri Lanka is 2,672 (2,333 – 3,012). The median of the size estimates based on the multiplier data in Colombo is 682 (95% CI 542-916). However, the agreement reached at the consensus meeting was that there are 900 (650 – 1,200) PWID in Sri Lanka, and the largest number lives in the Colombo district (n=677).

Transwomen

55 spots were transwomen socialise were visited, and mapping yielded an unadjusted estimate of 189 (range: 154-224) transwomen. Adjustment for mobility gave a slightly lower average estimate of 183, while adjustment for "a hidden population" the estimate of 331 (range: 269-380). Extrapolation procedure yielded an estimate of 711 (1,393 – 1,966) transwomen in Sri Lanka, while the multiplier method produced an estimate of 531 (95% CI 467-614) transwomen in Colombo and 117 (95% CI 110-126) in Jaffna.

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The final PSE was reached after the first round of the Delphi process - 2,200 (2,000 – 3,500) of transwomen at the national-level.

Beach boys

During L2 activities, 31 unique spots were BBs congregate were visited. Without any adjustment the average number of BBs during an average month is 2,355 (range: 2,092 - 2,618). Adjustment for mobility gave a slightly lower average estimate of 2,216, while adjustment for "a hidden population" the estimate of 3,357 (range: 2,989-3,725). The extrapolated estimated number of BBs at the national-level based on mapping is 11,056 (9,821 – 12,291). The multiplier method produced an estimate of 1,022 (95% CI 859-1,515) BBs in Galle. The agreement reached at the consensus meeting was that there are 4,500 (3,000 – 6,000) BBs in Sri Lanka.

Key limitations

Methods based on mapping tend to underestimate hidden populations. To address this weakness of the method, community guides were part of the mapping teams as that ensured a better access to information about KPs as well as KP themselves. To adjust for migration in this study, information was collected on mobility across spots and its frequency. Final estimates are also adjusted for a part of a population that is "hidden" i.e. unlikely to visit outdoor venues using data from IBBS based on RDS. However, the quality of data on a sub-set of population that do not visit outdoor venues depends on the representativeness of RDS. In some DSs, the estimated size of KPs as reported by respondents is very low, and that is in particular the case with MSM, MSW and PWID. Also, the number of spots found is low for some populations, such as PWID, BB and transwomen.

The key source of a bias in the multiplier estimates in general is the selection bias in the survey leading to dependence between data sources. This could happen if those in contact with the service provider are more likely to be included in the survey than those not in the programme.

Efforts were done to ensure that in both data sources populations are defined in the same way, in terms of time-periods and geographic areas, and that unique objects were not distributed to ineligible individuals.

Data provided by NGOs on the number of KP individuals who got a certain service could have been to some extent inaccurate as the numbers were often rounded (for example, FSW, beach boys, transgender and MSM who were clients of NGOs).

The selected data extrapolation method assumes a linear relationship between the total general population and the number of KPs in DSs, i.e. the proportion of a KP is constant in all geographical areas in a country. This may not be true for areas where some geographical characteristics are related to the number of KPs, such as the number of tourists (increased proportion of BBs and FSW), larger cities (more opportunity for PWID to inject, also MSM often migrate to larger cities) and other characteristic. A statistical test of the relationship was conducted for each KP, showing no evidence for a linear relationship for BBs and strong evidence for a linear relationship for other KPs.

The accuracy of the Delphi method depends on the knowledge of participants about a certain KP, the type of work they are involved in and their level of expertise.

Overall, the approaches used in this round of PSE were robust and in line with the WHO and UNAIDS recommendations. Resulting estimates of the size of KPs should be used to improve the scale, coverage, and further roll-out and evaluation of HIV prevention programmes among these populations.

1. Background

Sri Lanka consists of nine provinces and twenty-five (25) districts and has a population of twenty-one million and two hundred thounsand (21.2 million). Sri Lanka has been classified by UNAIDS as a country with a low-level HIV epidemic, with a national HIV prevalence of less than 0.1%. According to UNAIDS, an estimated 4,000 (2,700-6,000) adults (15 years and above) were living with HIV in Sri Lanka at the end of 2016.[1]

Knowing the size of key populations (KPs) at higher risk of HIV such as sex workers (SW), men who have sex with men (MSM) and people who inject drugs (PWID) is essential for intervention planning, resource allocation and for advocacy efforts. It also enables to estimate the number of people infected with HIV, evaluate coverage with interventions, project disease burden and model and project HIV transmission. Credible estimates of population size contribute to documenting progress in HIV prevention scale-up and in obtaining continued funding for the provision of various services. Measuring the size of KPs is, however, challenging since behaviours that put individuals at increased risk of HIV are often stigmatizing, which creates challenges in reaching these populations.

The size of KPs can be estimated using different methods, each having its strengths and weaknesses.[2][3] UNAIDS and WHO recommend that multiple methods are used in order to generate an estimate of a size of a KP for an area, given the variability in estimates produced by single studies.[4]

Methods to estimate the size of KPs can be broadly categorized into methods based on collection of data directly from a KP, including existing institutional data (mapping, census and enumeration, multiplier, and capture–recapture), and methods whereby data are collected from a general population (population-based surveys, network scale-up).[5]

A geographical mapping and enumeration and the multiplier method were deemed as the most appropriate approaches for population size estimations in Sri Lanka for two reasons: firstly, mapping and enumeration were successfully done in 2013; secondly, in 2017-2018 Integrated Biological and Behavioural Surveillance (IBBS) surveys based on respondent-driven sampling (RDS) were carried out in several KPs, which provided an opportunity to implement the multiplier method in conjunction with the IBBS implementation.[6] In line with the WHO recommendations, individuals from KPs were included in planning and implementation of studies. The choice of the geographical mapping and the multiplier method was also based on experiences in other countries in Asia where these methods have been used, and results applied to improve targeted HIV prevention programmes for KPs.[7]

Mapping and enumeration carried out in 2013 estimated a total of 14,132 female sex workers (FSWs) in Sri Lanka (ranging from a minimum of 12,329 to a maximum of 15,935); 7,551 MSM (range 6,547-8,554), 17,459 (15,338-19,542) drug users (around 2% were estimated to inject drugs, which translates to approximately 350 PWID), and 1,314 (1,142-1,486) beach boys (BB).[5]

The population size estimation study done in 2018 was led by the National STI and AIDS Control Program (NSACP) in Sri Lanka, and conducted by the Management Frontiers Ltd., with the technical Assistance from the World Health Organization Collaborating Centre (WHO CC) for HIV Strategic Information based in Zagreb, Croatia.

1.1 Objectives

The key objectives of conducting a comprehensive PSE of the key population groups under purview using most suitable methodology such as multiplier method in all the selected regions across the country are to generate estimates of the size of the specified key population groups and distribution in each site, by different categories in the selected sites and extrapolate the results to find-out finally districts, provinces and national level figures, to describe the sexual network patterns of the key population groups in all the locations and to provide locations of hotspots (disaggregated by KP group) where HIV risk activities predominantly take place. This report describes the process and the results of the size estimation of KPs in Sri Lanka, based on the methods of geographical mapping and enumeration and multiplier. The geographical mapping also aimed to identify locations frequented by KPs and characterise specific spots in terms of operational typologies and the types of KPs present. Along with the design and implementation of the size estimation studies, the technical team of the WHO CC for HIV Strategic Information also conducted a process of capacity building in size estimations for the staff of the Ministry of Health and staff of the NGOs and other agencies that were involved in the implementation activities.

1.2 Collaborating institutions

1.2.1 National STD and AIDS Control Program

The studies were led by the National STD and AIDS Control Program of Sri Lanka, which coordinates all the activities related to planning and implementation of the HIV strategic information system and the prevention and treatment response. Ministry of Health as well as other government ministries and agencies provided a strong commitment and support during project implementation.

1.2.2 Management Frontiers Ltd.

Management Frontiers (Pvt) Limited, a firm of management consultants in Sri Lanka conducted the PSE survey on behalf of the NSACP with the technical assistance of local Technical Consultants and foreign consultants from the World Health Organization Collaborating Centre (WHO CC) for HIV Strategic information, Croatia.

1.2.3 World Health Organization Collaborating Centre (WHO CC) for HIV Strategic Information

The WHO CC for HIV Strategic Information has extensive experience in design and implementation of HIV surveillance-related activities, particularly in low-level and concentrated epidemics. As a technical partner of WHO and other UN agencies, WHO CC provided technical support in design and implementation of HIV IBBS and population size estimations in over 20 countries of Asia, eastern Europe and North Africa and the Middle East.

For this population size estimation study, WHO CC developed a protocol and data collection tools, trained field teams, analysed data and wrote this report.

1.3 Guidance and oversight

1.3.1 The Surveillance Advisory Committee (SAC)

The Surveillance Advisory Committee (SAC) is chaired by the Director of the NSACP and includes representatives of the NSACP (Consultant Venereologists, Head of the Strategic Information Management Unit and Epidemiologist), Universities (Public health specialists) and civil society organizations (CSOs) working with KPs, representatives from Sri Lanka Police. The SAC Coordinator is the epidemiologist from the NSACP.

The SAC was responsible for reviewing and approving the study protocol, monitoring the progress and quality of the field work, liaising with the GFATM and ensuring the timely completion of all activities and submission of deliverables.

1.4 Pre-mapping activities

Several activities had to be conducted before roll-out of the studies, and included:
- Meetings with stakeholders
- Development of a protocol and data collection tools
- Recruitment of staff
- Training of field teams
- Preparation of documents for Ethics Clearance and obtaining Ethics clearance
- Submission of the Incepotion Report and the Risk Assesment Plan to the SAC

Ethical approval for the study was granted by the Ethics Review Committee, Faculty of Medicine, University of Sri Jayewardenepura.

2.   Methods

2.1.   Eligibility criteria

Following KPs were included in the size estimation study: FSWs, MSM, male sex workers (MSW), transwomen, PWID, and beach boys (BBs).

Eligibility criteria for inclusion in the study were:

- **FSW:** Any female who sells sex in exchange of money or goods. This includes the following sub-types of FSW: street, lodge/hotel, brothel, home/shanty, karaoke/casino/nightclub, and vehicle based FSW.

- **MSM:** Man who has anal sex with another man, irrespective of sexual orientation. This includes nachchis (effeminate males who have sex with other males) and male sex workers. **MSW** – an MSM who sells sex to other men.

- **PWID:** A person injects drugs for non-medical purposes.

- **BB:** Beach boys are defined as men (homosexual, heterosexual or bisexual) who cruise in and around beach areas and who have anal and/or vaginal sex with tourists.

- **Transgender (transwomen):** a person who was assigned to be a male at birth but who self-identifies as a transgender/transwoman and has penetrative sex with men.

- Additional eligibility criteria for inclusion in IBBS (relevant for the multiplier method) included:
  - Being older than 18 years of age
  - Able to provide verbal informed consent (e.g. was not under the influence of alcohol or other drugs) in order to participate in the IBBS survey.
  - Reside or work in the area where IBBS was done for at least 12 months before the IBBS

2.2.   Mapping and enumeration

2.2.1. Selection of geographical units for data collection

The Divisional Secretariat division (DS division) is the smallest administrative division under the decentralized provincial administration and has defined boundaries. The DS Division or "zone' was selected as the unit area for geographical mapping, as was the case in the last round of mapping carried out in 2013. Data on DSs were used from the Census of Population and Housing 2012, available from Department of Census and Statistics Sri Lanka (statistics.gov.lk), District and Divisional Secretariat Portal (www.ds.gov.lk) and aggregated at Statoids Divisions of Sri Lanka (www.statoids.com/ylk.html).

DSs were divided into three categories (i.e. terciles) based on the general population census 2012 information: high density (n=110, total population ranging from 323,257 – 61,638), medium density (n=110, 61,484 – 32,609 population) and low density (n=111, 32,386 – 298 population). Random sampling was applied using the Random Integer Set Generator (random.org) to select 25% (n=28), 12.5% (n=14) and 6.25% (n=7) of DSs from high, medium and low density DSs, respectively. The process of generating random numbers is described in Appendix 1. Selected DSs (n=49) are shown in Appendix 2 and in Table 1 below. Due to random sampling selection procedures, no DS from the Northern province was not included in the sample.

Table 1: Divisional secreteriats selected for mapping, by province and district

No.	Province	District	Divisional secreteriat
1	Central	Matale	Ukuwela
2	Central	Matale	Pallepola
3	Eastern	Trincomalee	Kinniya
4	Eastern	Trincomalee	Kantalai
5	Eastern	Trincomalee	Echchilampattu
6	Eastern	Ampara	Ampara
7	Eastern	Ampara	Addalachchenai
8	Eastern	Ampara	Alayadiwembu
9	Eastern	Batticaloa	Eravur Town
10	North Central	Polonnaruwa	Elahera
11	North Central	Anuradhapura	Kahatagasdigiliya
12	North Central	Anuradhapura	Palagala
13	North Central	Anuradhapura	Mahavilachchiya
14	North Western	Puttalam	Wennappuwa
15	North Western	Puttalam	Dankotuwa
16	North Western	Puttalam	Nattandiya
17	North Western	Puttalam	Mundel
18	North Western	Puttalam	Vanathavilluwa
19	North Western	Kurunegala	Polgahawela
20	North Western	Kurunegala	Mawathagama
21	North Western	Kurunegala	Bingiriya
22	North Western	Kurunegala	Kuliyapitiya East
23	North Western	Kurunegala	Maspotha
24	Sabaragamuwa	Ratnapura	Ratnapura
25	Sabaragamuwa	Ratnapura	Pelmadulla
26	Sabaragamuwa	Ratnapura	Balangoda
27	Sabaragamuwa	Ratnapura	Eheliyagoda
28	Sabaragamuwa	Ratnapura	Kiriella
29	Sabaragamuwa	Kegalle	Mawanella
30	Sabaragamuwa	Kegalle	Rambukkana
31	Sabaragamuwa	Kegalle	Yatiyanthota
32	Southern	Galle	Hikkaduwa
33	Southern	Galle	Elpitiya
34	Southern	Galle	Karandeniya

No.	Province	District	Divisional secreteriat
35	Southern	Matara	Dickwella
36	Southern	Matara	Malimbada
37	Southern	Hambantota	Katuwana
38	Southern	Hambantota	Sooriyawewa
39	Uva	Badulla	Bandarawela
40	Uva	Moneragala	Katharagama
41	Western	Colombo	Colombo
42	Western	Colombo	Kaduwela
43	Western	Colombo	Kesbewa
44	Western	Colombo	Ratmalana
45	Western	Colombo	Padukka
46	Western	Gampaha	Katana
47	Western	Gampaha	Biyagama
48	Western	Gampaha	Aththanagalla
49	Western	Kalutara	Beruwala

2.2.2. Data collection

Data were collected through two types of activities: Level 1 and Level 2. Level 1 activities entail collection of information from secondary key informants (KIs) about locations of hotspots where KPs socialize in selected DSs, and interviewing KIs about the minimum and maximum number of KP individuals that socialize at those hotspots. Before Level 1 activities, consultation meetings with stakeholders (local health officials, STI clinicians and NGO representatives) were conduced for several adjoining DSs. The aim of these meetings was to prepare a list of locations (by KP) that should be visited within each DS and at which KPs are likely to be present.

Secondary KIs are persons who are knowledgeable about their local area and likely to have contacts with KPs, such as pimps, local food sellers, hotel staff, taxi drivers, as well as those who interact with KPs in their professional capacities (police, health care staff, and NGO workers). For different KPs different KIs can be interviewed. KP members themselves can also act as secondary KIs.

The output of Level 1 activity is a comprehensive list of unique spots where KPs can be found, time of their operation and estimated minimum and maximum number of KPs at each spot. To facilitate data collection during Level 1 and Level 2 activities, each targeted DS was divided into smaller geographic zones based on administrative boundaries and/or other physical features and landmarks.

Level 2 activities include visits to the spots identified at Level 1 to validate their existence. In Level 2, interviews are conducted with KPs themselves (primary KIs) about operational characteristics of the hotspots: the minimum and maximum number of KP members that socialize at the hotspots on peak days and during an average month, type of the hotspot (public place, brothel, night club, etc) and locations of other hotspots that they might know. Primary KIs are FSW, PWID, MSM, transwomen and BBs. Hotspots the most frequently mentioned in Level 1 data collection were visited first. Peer educators (community mobilisers) accompanied the study teams to the identified spots and mobilised primary KIs for interviews.

2.2.3. Data collection instruments

Level 1 questionnaire
The L1 questionnaire was used to collect the following information by interviewing secondary KIs:
- Geographic locations where KPs are found (name of the spot, address of the spot, type of the spot, time of operation of the spot)
- Types of KPs found at spots (MSM, Transgender, PWID, FSW and BB)
- Minimum and maximum estimates of KP individuals that can be found at each location on a peak day of a week.

L1 interviews continued until new secondary KIs stop providing information on new hotspots. i.e. when saturation of hotspots within the zone is achieved.

Level 2 questionnaire
Data collected in the L2 questionnaire include the types and estimate of KPs that can be found at a given spot on a peak day and during an average month in a year, and the type of a hotspot (public place, bar, bus station, etc). Primary KIs were also asked about their mobility across spots, which is needed for adjustment of the size of a KP by reducing double counting of KP members frequenting multiple spots. Both questionnaires were completed electronically, using tablets.

2.3. Multiplier method

Several service-based and unique object-based multipliers were obtained to estimate the size of KPs in cities were IBBS were carried out, and these are:
- FSW: Colombo, Kandy and Galle
- MSM: Anuradhapura, Galle and Colombo
- PWID: Colombo
- Beach boys: Galle
- Transwomen: Colombo and Jaffna

2.3.1. Procedures for a service multiplier PSE

This entails obtaining data from programmes servicing a KP on the total number of KP individuals who got a certain service during a specific period. During formative assessment information was collected on the programmatic sources that can be used for the multiplier estimates in order to tailor the IBBS questionnaire accordingly. During administration of the IBBS questionnaire, all respondents were asked whether they accessed a specific service during a specified time period. To strengthen accuracy, efforts were made to ensure that service data counts include all the KP members accessing the service, are unduplicated and that service data are for the appropriate period.

Following programmatic data were attempted to be collected for the period May, June, July 2017:
MSM Colombo:
- Number of individual MSM who were clients of the NGO Heart to Heart
- Number of individual MSM who received a condom from the NGO Heart to Heart
- Number of individual MSM who were escorted to an STI clinic by the staff of the NGO Heart to Heart

MSM Galle:
- Number of individual MSM who were clients of the NGO Sathya Guna Foundation
- Number of individual MSM who received a condom from the NGO Sathya Guna Foundation
- Number of individual MSM who were escorted to an STI clinic by the staff of the NGO Sathya Guna Foundation

MSM Anuradhapura:
- Number of individual MSM who were clients of the NGO Rajarata Gemi Pahana
- Number of individual MSM who received a condom from the NGO Rajarata Gemi Pahana
- Number of individual MSM who were escorted to an STI clinic by the staff of the NGO Rajarata Gemi Pahana

PWID Colombo:
- Number of individual PWID who were clients of the NGO Mithuru Mithuro
- Number of individual PWID who received a condom from the NGO Mithuru Mithuro
- Number of individual PWID who were clients of rehabilitation centre in Colombo
- Number of individual PWID who were arrested by police in Colombo

FSW Kandy:
- Number of individual FSW who were clients of the NGO Laksetha Sahana Sewa
- Number of individual FSW who received a condom from the NGO Laksetha Sahana Sewa
- Number of individual FSW who were escorted to an STI clinic by the staff of the NGO Laksetha Sahana Sewa

FSW Colombo:
- Number of individual FSW who were clients of the NGO Abhimani
- Number of individual FSW who received a condom from the NGO Abhimani
- Number of individual MSM who were escorted to an STI clinic by the staff of the NGO Abhimani

FSW Galle:
- Number of individual FSW who were clients of the NGO Saviya Development
- Number of individual FSW who received a condom from the NGO Saviya Development
- Number of individual MSM who were escorted to an STI clinic by the staff of the NGO Saviya Development

Transwomen, Colombo:
- Number of individual transwomen who were clients of the NGO Heart to Heart
- Number of individual transwomen who received a condom from the NGO Heart to Heart

Transwomen, Jaffna:
- Number of individual transwomen who were clients of the NGO Journey for Healthy Life
- Number of individual transwomen who received a condom from the NGO Journey for Healthy Life

Beach boys, Galle:
- Number of individual BB who were clients of the NGO Samadhi Foundation
- Number of individual BB who received a condom from the NGO Samadhi Foundation
- Number of individual BB who were escorted to an STI clinic by the staff of the NGO Samadhi Foundation

2.3.2. Procedures for a unique object multiplier PSE

The unique object multiplier method consists of a distribution of a unique object to the target population before the implementation of a survey. A week before the IBBS implementation, a study team consisting of field workers of NGOs that provide prevention services to KPs distributed a specified number of objects to members of the target population as widely as possible. The number of unique objects distributed was determined by the number of contacts the distributing outreach organisations anticipate reaching within one week. Each member of the population received only one object. Staff assessed the inclusion criteria before distributing the unique object to an individual and verified that he/she had not received a unique object from a different staff member. They also informed the target population members to keep the object because they might be asked about it in the near future by another project staff member during IBBS, remember it and not give it to anyone else. The locations where objects were distributed were determined based on sites where NGOs conduct their outreach activities (parks, streets, beaches, markets, etc). In the IBBS questionnaire, all respondents were asked whether they received a unique object by NGO staff during the specified time period.

3. Training, roles and responsibilities of different staff categories and quality assurance

3.1. Training

WHO CC for HIV Strategic Information facilitated a 2-days training workshop for representatives of the NGOs that were carrying out mapping and enumeration and NGOs that provided data for the multiplier. The training focused on the study design, data collection instruments, practical aspects of field work including the challenges in accessing/ interacting with KIs during data collection. Practical sessions were spent exercising the use of data collection forms and recording information for Level 1 and Level 2 activities.

During a training on RDS, a session was held on how to collect data for the multiplier method.

3.2. Roles and responsibilities of staff during mapping and enumeration

Level One – Each team consists of two interviewers representing non-KP and KP individuals to facilitate interaction with the secondary KIs, and a team co-ordinator who is in charge of taking geo-coordinates of locations (used to minimize duplicates) and supports interviewers.

Level Two - Staff are organized into five different teams - FSW team, MSM team, PWID, TG and BB team. During data collection, the teams were supported by community mobilisers (current or former members of local KP communities). Community mobilisers are trusted by the KP communities and play a critical role in enhancing participation of primary KIs in the study. Ethnicity and language ability of field staff members was considered when assigning teams to the different zones. Geo-coordinates of locations were taken again during L2 activities as that enabled to create a unique list of locations that were validated as being locations where KPs can be found.

3.3. Quality assurance at field and documentation-level

There were several activities that helped to assure quality of data collected. Field supervisors had a crucial role in assuring data quality, and had the following responsibilities:

- conduct morning and evening meetings with the teams. The morning meeting addressed planning the day's activities and ensuring that the field research officers (FROs) are correctly recording data in data collection forms. The evening meetings were focused on discussing and sharing the experiences from the field including issues and challenges faced, reviewing all data collection forms the FROs completed on the day and addressing the gaps or discrepancies in the forms.

- ensure that the hotspot names and locations are well recorded.
- visit the field and carry out quality checks by interviewing KIs in some of the randomly identified hotspots.
- review the list of KIs on data collection forms to ensure the quality of KIs recruited within a DS.
- ensure that data collection forms are complete and that missing data are kept to the minimum

Data were collected electronically using tablets, and quality was checked again by study co-ordinator in Colombo.

4. Data management and analysis

4.1. Mapping and enumeration

At the end of each day and after completion of Level 1 activity, the field supervisors reviewed and collated data from the L1 questionnaires to generate unique lists of hotspots and estimates for each KP group. These unique lists of hotspots were used to plan the Level 2 activities.

Existence of hotspots was validated in Level 2 activities. Estimates obtained from interviewing primary KIs during Level 2 field work were taken as the final unadjusted estimates. To arrive at a single estimate, the mid-point ("mean") of the minimum and maximum estimates were used. Two types of corrections (adjustments) were applied on the mean (min-max) estimate of a KP during an average month:

- An adjustment for mobility was done to reduce double counting of KP frequenting multiple spots. The KP individuals interviewed at the identified spots in Level 2 activities were asked about their mobility across spots (for example, FSW were asked whether they solicit clients at more than one spot in a day, and if so, at how many spots, on average).
- An adjustment for hidden populations was done based on the assumption that a certain number of KP individuals do not socialize at venues and will therefore not be reached with mapping. To estimate this, IBBS questionnaires included questions to determine the proportion of respondents that do not visit outdoor places to find partners and socialize there with other members of their respective KP.

The following formula was used to adjust for mobility:

$S_2 = S_1 (1 - p_1) + (S_1 * p_1/m_1)$

S_2 = estimated number of KP individuals in an area

S_1 = estimated number of KP individuals at a spot level

p_1 = proportion of KP individuals that visit more than one spot in a day

m_1 = mean number of spots that KP members visit in a day

The following formula was used to adjust for a "hidden population" at sites were IBBS was done:

$S_3 = S_2 / (1-p_2)$

S_s = size of a KP adjusted for mobility

S_3 = estimated size after adjusting for "a hidden population"

p_2 = estimated proportion of a KP who do not frequent hotspots (assumed to be "hidden")

4.2. Multiplier method

The following formula was applied to estimate the population size:

N= M/P

Where:

N = the estimated size of a KP

P = proportion of respondents in an IBBS survey who reported receiving a service or a unique object during a specific period

M = Number of KP individuals (MSM, FSW, etc) recorded in the service registry in the same period (or a number of KP individuals who were given an object by the outreach team).

A 95% confidence interval (CI) of a size estimate was calculated applying the 95% CI for a proportion of an indicator generated by the RDS-Analyst software package.

4.3. Extrapolation of mapping and enumeration results

The aim of extrapolation is to produce a point estimate and a range (low and high estimate) for the population size among each of the six KP groups in Sri Lanka at a district, province and national level. The basis for calculation is the adjusted estimated number of KPs calculated in each of the randomly selected DS obtained through mapping and enumeration.

For each sampled DS, an estimated number of KP members, including low and high estimate, was used to calculate a proportion of KP members among the total general population based on the census 2012 data. This was calculated for each KP and DS separately. To determine plausibility of estimates, relationship between the estimated number of a KP and the general population was tested using the coefficient of determination (R^2).

The pooled mean of proportions of mid-estimate, low and high estimate was calculated using the formula:

$$p = \frac{\sum_i^n M_{DS_i}}{\sum_i^n N_{DS_i}}$$

where:

p = proportion of a KP among the general population

n = number of sampled DSs (n=49)

M_{DS} = estimated number of a KP in a DS

N_{DS} = number of the general population in a DS based on the census done in 2012

The pooled proportion was applied to census data of each DS, district, province and national counts to establish estimates at the district, province and national level.

4.4. Comparison of results of the size estimations methods

In provinces where both the multiplier and the mapping and enumeration methods were employed, comparisons are done to assess the extent to which results are diverging from each other and reasons behind differences in estimates. In addition, results are compared with the previous round of mapping and with the UNAIDS estimates for Asia and the Pacific region.

4.5. Consensus meeting

Final population size estimates were discussed and agreed upon at the stakeholders meeting held in June 2018. In addition to inputs on point estimates of the population size, a goal of this process was to establish upper and lower plausibility bounds for the estimates based on the shared local and international data and on the expert opinion. Plausibility bounds are not the same as statistical CIs but rather bounds established that make 'plausible sense' in a specific context.

The workshop used a modified Delphi method to achieve consensus. Participants were presented with the results of estimation methods used in this study. Following the discussion of results, each participant provided his/her own estimates. Google forms were used to collect participants' estimates (Appendix 4). The data collection form included questions on the estimated most likely number, minimum and maximum number of FSW, MSM, TGW, BB and PWID in Sri Lanka. For MSW, the estimate of the most likely, minimum and maximum proportion (%) of MSM who sell sex was collected. In addition to national estimates, participants classified each district into low/medium/high according to the estimated proportion of KP among adult general population. Those estimates were collated and presented to the group after all participants entered their estimates using the form. For the consensus estimate, median values of the most likely, minimum and maximum estimates were used. For district classification each density category was assigned a value: low=1, medium=2, high=3; an arithmetic mean was calculated and each district was assigned an average density. When needed, adjustments to the estimates were made and additional rounds of estimation were conducted.

5. Ethical considerations

The study was designed to respect international ethical guidelines, specifically those relating to studies done in KPs.[8] Following issues were in particular deemed important:

- Safety of staff and respondents: Meetings had been held with the police and law enforcement agencies in each district before the project started in order to inform them of the nature and the purpose of the study and avoid possible challenging situations during the implementation phase.

- Consent and voluntary participation: Interviews with KIs were conducted only after describing the study procedures. They were informed that the participation in the study was voluntary. Since no personal data were collected, informed consent was not sought.

- Confidentiality: No names of respondents were recorded anywhere in data sources. The electronic database is password-protected and only authorized officials have access to the data files.

6. Results of L1 activities

A total of 1,170 primary KIs were interviewed during L1 activities. The Western province yielded the highest number of KIs interviewed (52%), followed by the Southern province (12,8%).

Table 2: Number of primary key informants interviewed by province and district

Province	District	Number	Proportion of each province in total (%)
Central	Matale	40	3.4
Eastern	Trincomalee	25	
	Ampara	57	
Total Eastern		82	7.0
North Central	Batticaloa	7	
	Polonnaruwa	3	
	Anuradhapura	13	
Total North Central		23	2.0
North Western	Puttalam	41	
	Kurunegala	47	
Total North Western		88	7.5
Sabaragamuwa	Ratnapura	80	
	Kegalle	38	
Total Sabaragamuwa		118	10.1
Southern	Galle	93	
	Matara	28	
	Hambantota	29	
Total Southern		150	12.8
Uva	Badulla	27	
	Moneragala	35	
Total Uva		62	5.3
Western	Colombo	441	
	Gampaha	140	
	Kalutara	26	
Total Western		607	51.9
Total		**1,170**	**100.0**

The commonest type of primary KIs were FSW (21,3%), followed by taxi drivers (16,2%) and MSM (10,0%).

Table 3: Number of primary key informants by the type of key informant

Key Informant Group	Number	(%)
FSW	249	21.3
MSM	117	10.0
DU / PWID	18	1.5
TG	45	3.8
BB	26	2.2
Taxi driver	190	16.2
Local food seller	50	4.3
Pimp / Brothel owner / Madam	27	2.3
Watchman / Security staff	37	3.2
Hotel / Lodge worker	47	4.0
Bar worker / Owner / Patron	12	1.0
Porter	24	2.1
Petty shop owner	75	6.4
Pharmacist	27	2.3
Lottery seller	79	6.8
Sanitary worker on the streets / toilets	23	2.0
NGO staff	68	5.8
Health care service provider	16	1.4
Government / Law enforcement official	11	0.9
Street family	1	0.1
Public / Private transport staff	14	1.2
Construction worker / Labourer	14	1.2
Total	**1,170**	**100.0**

7. Estimates of female sex workers

7.1 Mapping

A total of 456 spots were validated during L2 activities in all the provinces (n=8) and 43 DSs, and 376 primary and 233 secondary KIs were interviewed.

Spots (total n=456) visited by FSW were found in the following provinces:
- Western (53.5%, n= 244)
- Sabaragamuwa (12.3%, n= 56)
- North Western (7.9%, n= 36)
- Southern (7.5%, n= 34)
- Eastern (7.0%, n=32)
- Uva (6.6%, n=30)
- Central (4.6%, n=21)
- North Central (0.9%, n= 4)

At 72.1% (n=329) of spots interviews were done with FSW, while at the remaining ones with secondary KIs. The majority of the spots were validated during the first visit (70.8%, n=323), while the remaining ones required a second visit.

Spots were described as follows: street/public place (39.5%, n=180), spa (20.8%, n=95), lodge/hotel (13.8%, n=63), shanti (9.6%, n=44), home (9.2%, n=42), other (1.9%, n=9), brothel (1.8%, n=8), karaoke/night club (1.1%, n=5), beach (0.9%, n=4), park (0.9%, n=4), massage parlor (0.4%, n=2). The busiest day at spots is Saturday (n=174), followed by Friday (n=173), Sunday (n=44), Thursday (n=30), Wednesday (n=18), Tuesday (n=15) and Monday (n=2). Spots are the most frequented between noon - 5 pm (n=245), 5 pm – 9 pm (n=141), 9 pm – late night (n=60), and morning – noon (n=10).

Mobility was found at 20.6% (n=94) of spots. At 78 spots FSW visit in total two spots on a peak day, while at 16 they visit three spots.

Based on mapping, there is an average number of 2,811 FSW (range: 2,370 - 3,251) in an average month. Adjustment for mobility gave an estimate of 2,563, while an additional adjustment for a hidden population an estimate of 6,139 (range: 5,249 – 7,180).

The average unadjusted number of FSW per spot is 6.

Table 4: Size estimates on a peak day and during an average month, adjusted for mobility and the proportion of the population that is "hidden", FSW

	Low estimate	High estimate	Average estimate
On a peak day	1,977	2,616	2,297
During an average month	2,370	3,251	2,811
Adjustment for mobility across spots	2,244	3,056	2,563
Adjustment for the "hidden population"	**5,249**	**7,180**	**6,139**

7.2. Extrapolation of Mapping Data

Using the estimates from randomly selected and mapped DSs, the proportion of FSW among the general population was calculated. The variation in the proportion of FSW among the general population in the sampled DSs was high and has ranged from 0,000% to 0,775%. There were 12 DSs were FSW were not found during mapping. The highest proportion of FSW in a DS was found in Echchilampattu (88 FSW, 0.775%), Ratmalana (716 FSW, 0.749%) and Dickwella (344, 0.629%). The proportional contribution of FSW in the general population in all sampled DSs is available in the Appendix 3. The relationship between estimated FSW and census population was strong (R^2=0.449).

The pooled mean of proportions was calculated using the average (n=6,139), low (n=5,249) and high (n=7,180) estimates. In DSs were mapping was conducted there is a difference between pooled/extrapolated estimates and mapping estimates. For example, in the Colombo DS, the pooled estimate (0.013%) is 10.08 times lower than the adjusted estimate from mapping (0.131%). These differences are expected and compensated at the province and national-level and were taken into account at the consensus meeting.

The extrapolated estimated number of FSW in Sri Lanka is 31,748 (27,148 – 37,131). District-level and province-level estimates are shown in tables below. Estimates per DS are available in the Appendix 3.

Table 5: Estimated number of FSW at the district-level based on the extrapolated proportion of 0.156% (0.133% – 0.182%)

District	District population	Estimated average number of FSW	Low estimate	High estimate
Ampara	731,620	**1,141**	976	1,334
Anuradhapura	919,028	**1,433**	1,225	1,676
Badulla	904,641	**1,411**	1,206	1,650
Batticaloa	462,088	**721**	616	843
Colombo	2,305,466	**3,595**	3,074	4,205
Galle	994,330	**1,551**	1,326	1,813
Gampaha	2,259,241	**3,523**	3,013	4,120
Hambantota	643,033	**1,003**	857	1,173
Jaffna	718,721	**1,121**	958	1,311
Kalutara	1,180,342	**1,841**	1,574	2,153
Kandy	1,287,551	**2,008**	1,717	2,348
Kegalle	808,470	**1,261**	1,078	1,474
Kilinochchi	108,241	**169**	144	197
Kurunegala	1,518,541	**2,368**	2,025	2,769
Mannar	150,662	**235**	201	275
Matale	479,188	**747**	639	874
Matara	761,135	**1,187**	1,015	1,388
Moneragala	404,786	**631**	540	738
Mullaitivu	189,864	**296**	253	346
Nuwara Eliya	699,440	**1,091**	933	1,276
Polonnaruwa	387,423	**604**	517	707
Puttalam	752,484	**1,173**	1,003	1,372
Ratnapura	1,018,707	**1,589**	1,358	1,858
Trincomalee	436,876	**681**	583	797
Vavuniya	237,561	**370**	317	433
Total	**20,359,439**	**31,748**	**27,148**	**37,131**

Table 6: Estimated number of FSW at the province-level based on the extrapolated proportion of 0.156% (0.133% - 0.182%)

Province	Province population	Estimated average number of FSW	Low estimate	High estimate
Central	2,392,016	**3,730**	3,190	4,362
Eastern	1,877,807	**2,928**	2,504	3,425
North Central	1,431,327	**2,232**	1,909	2,610
North Western	2,316,353	**3,612**	3,089	4,224
Northern	1,452,348	**2,265**	1,937	2,649
Sabaragamuwa	1,727,146	**2,693**	2,303	3,150
Southern	2,319,900	**3,618**	3,093	4,231
Uva	1,225,412	**1,911**	1,634	2,235
Western	5,617,130	**8,759**	7,490	10,244
Total	**20,359,439**	**31,748**	**27,148**	**37,131**

Figure 1: Average FSW population in Provinces
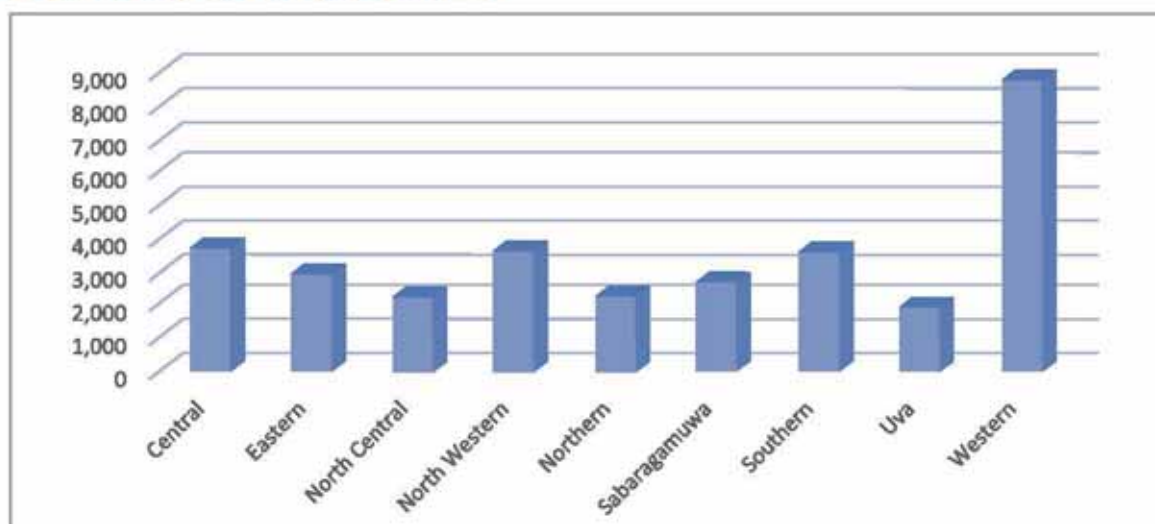
7.3. Multiplier method

Following are the estimated prevalences of FSW that seek paying partners (clients) at outdoor places (sites such as streets, parks, bus stations, taxi stations, etc.) collected in IBBS in 2018 (these data were obtained to calculate population size adjusted for the proportion of FSW that do not visit outdoor places to find partners - i.e. the population that is assumed to be "hidden").

- Kandy: 52.3% (95% CI 47.2, 57.4)
- Colombo: 45.3% (95% CI 38.9, 51.7)
- Galle: 26.4% (95% CI 21.3, 31.5)

The median estimated size of FSW in Colombo based on the multiplier is 2,155 (95% CI 1,812-2,660) while in Galle it is 1,134 (95% CI 983 - 1,342). In Kandy, this was not possible to calculate because of missing programme (NGO) data.

Data on the number of individual FSW who were escorted to an STI clinic from NGOs were deemed to be of low quality and therefore could not be used to make the estimates based on the multiplier method.

Table 7: Size estimates based on the multiplier data, FSW

Multiplier Methods	Colombo	Kandy	Galle
1. Unique object			
No. of unique objects distributed	100	100	100
Received unique object, IBBS (%, 95% CI)	10.2 (5.5, 14.8)	14.6 (10.8 18.4)	18.5 (12.6, 24.3)
Population size estimate	980 (676-1,818)	685 (543-925)	540 (412-794)
2. Number of individual FSW who were clients of an NGO	1,400	150	550
Reported being a client of an NGO in IBBS (%, 95% CI)	31.4 (25.5, 37.4)	11.0 (7.9, 14.1)	40.5 (34.3, 46.8)
Population size estimate	4,459 (3,743-5,490)	1,364 (1,064-1,899)	1,358 (1,175-1,603)
3. Number of individual FSW who received a condom from an NGO	625	NA	455
Reported receiving condoms from an NGO in IBBS (%, 95% CI)	29.0 (23.5, 34.5)	6.5 (4.4, 8.7)	40.1 (33.9, 46.3)
Population size estimate	2,155 (1,812 - 2,660)	NA	1,134 (983-1,342)
4. Number of individual FSW who were escorted to an STI clinic	18	NA	18
Reported being escorted to an STI clinic by the staff of an NGO in IBBS (%, 95% CI)	21.9 (16.3, 34.5)	4.2 (2.4, 6.0)	35.5 (29.3, 41.9)
Population size estimate	82 (52-110)	NA	51 (43-62)
Median values	1, 2, 3 2,155 (1,812-2,660)	Median not possible Range: 685-1,364	1, 2, 3 1,134 (983-1,342)

Programme data were collected from the NGOs Abhimani for Colombo, Saviya Development in Galle and Laksetha Sahana Sewa in Kandy.

8. Estimates of Men Who have Sex with Men and Male Sex Workers

8.1. Mapping (MSM)

A total of 164 spots were identified for MSM in L2 activities, and interviews carried out with 139 primary and 81 secondary KIs.

MSM spots (n=164) were found in the following provinces:
- Western (68.9%, n=113)
- Sabaragamuwa (8.5%, n=14)
- North Western (6.1%, n=10)
- Southern (6.1%, n=10)
- Eastern (5.5%, n=9)
- Uva (3.0%, n=5)
- North Central (1.8%, n=3)

The majority of the spots were validated during the first visit (n=107), while the remaining ones required a second visit.

Spots were described as follows: street/public place (75.6%, n=124), public toilet (10.9%, n=18), shanti (5.5%, n=9), beach (4.3%, n=7), lodge/hotel (1.2%, n=2), home (1.2%, n=2), spa (0.6%, n=1), park (0.6%, n=1). The busiest day at spots is Saturday (n=73), followed by Friday (n=48), Sunday (n=36), Thursday (n=5) and Wednesday (n=2). Spots are most frequented between 5 pm - 9 pm (n=87), then noon – 5 pm (n=40), 9 pm – late night (n=35), and morning – noon (n=1).

Mobility was found at 24,3% of spots. As reported, at 33 spots MSM visit in total two spots on a peak day, at seven they visit three spots while at one four spots.

Following are the estimated prevalences of MSM that do not visit outdoor sites (streets, parks, bus stations, etc.) to find partners, as collected in IBBS in 2018 (these data were obtained to calculate population size adjusted for the proportion of MSM that is assumed to be "hidden").

- Anuradhapura: 25.2% (95% CI 20.6-29.2)
- Colombo: 32.1 (26.3, 37.9)
- Galle: 85.6% (95% CI 82.1, 89.1)

Without any adjustment, there were 994 MSM enumerated is L2 activities (range: 833-1,155) during an average month. Adjustment for mobility gave a slightly lower average estimate of 952, while adjustment for a hidden population the estimate of 1,570 (range: 1,303-1,814).

The average unadjusted number of MSM per spot is 6.

Table 8: Size estimates on a peak day and during an average month, adjusted for mobility and the proportion of the population that is "hidden" MSM

	Low estimate	High estimate	Average estimate
On a peak day	678	901	**790**
During an average month	833	1,155	**994**
Adjustment for mobility across spots	798	1,089	**952**
Adjustment for the "hidden population"	1,303	1,814	**1,570**

8.2.   Extrapolation of mapping data (MSM)

Proportional contribution of MSM in the general population was calculated using estimates from randomly selected and mapped DSs. The variation in the proportion of MSM in the general population in sampled DSs was high and has ranged from 0,000% to 0,217%. In total, there were 21 DSs were MSM were not found. The highest proportion of MSM in a DS was in Ratmalana (207 MSM, 0,217%) and Colombo (491 MSM, 0,152%). The results for all sampled DSs are available in Appendix 3. The relationship between estimated number of MSM and census population was strong (R^2=0.407).

The pooled mean of proportions was calculated using the mid (n=1,570), low (n=1,303) and high (n=1,814) adjusted estimates from all 49 selected DS and DS census data. In DSs were mapping was conducted there is a difference between pooled/extrapolated estimates and adjusted mapping estimates (for example, in Ratmalana the difference is 0.217% / 0.040%= 5.43). These differences are expected and compensated at the province and national-level.

The extrapolated estimated number of MSM in Sri Lanka is 8,120 (6,739 – 9,381). The estimated number of MSM at a district and province-level is shown in tables below. Estimates per DS are available in Appendix 3.

Table 9: Estimated number of MSM at the district-level based on the extrapolated proportion of 0.040% (0.033% - 0.046%)

District	District population	Estimated average number of MSM	Low estimate	High estimate
Ampara	731,620	292	242	337
Anuradhapura	919,028	367	304	423
Badulla	904,641	361	299	417
Batticaloa	462,088	184	153	213
Colombo	2,305,466	919	763	1,062
Galle	994,330	397	329	458
Gampaha	2,259,241	901	748	1,041
Hambantota	643,033	256	213	296
Jaffna	718,721	287	238	331
Kalutara	1,180,342	471	391	544
Kandy	1,287,551	514	426	593
Kegalle	808,470	322	268	373
Kilinochchi	108,241	43	36	50
Kurunegala	1,518,541	606	503	700
Mannar	150,662	60	50	69
Matale	479,188	191	159	221
Matara	761,135	304	252	351
Moneragala	404,786	161	134	187
Mullaitivu	189,864	76	63	87
Nuwara Eliya	699,440	279	232	322
Polonnaruwa	387,423	155	128	179
Puttalam	752,484	300	249	347
Ratnapura	1,018,707	406	337	469
Trincomalee	436,876	174	145	201
Vavuniya	237,561	95	79	109
Total	20,359,439	8,120	6,739	9,381

Table 10: Estimated number of MSM at the province-level based on the extrapolated proportion of 0.040% (0.033% - 0.046%)

Province	Province population	Estimated average number of MSM	Low estimate	High estimate
Central	2,392,016	954	792	1102
Eastern	1,877,807	749	622	865
North Central	1,431,327	571	474	660
North Western	2,316,353	924	767	1067
Northern	1,452,348	579	481	669
Sabaragamuwa	1,727,146	689	572	796
Southern	2,319,900	925	768	1,069
Uva	1,225,412	489	406	565
Western	5,617,130	2,240	1,859	2,588
Total	20,359,439	8,120	6,739	9,381
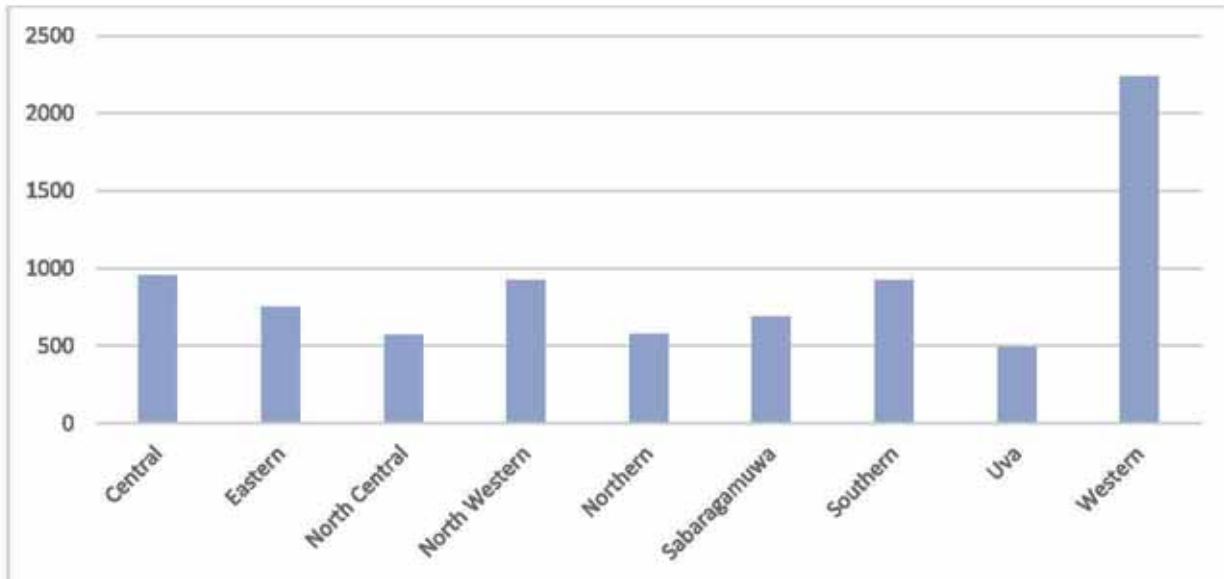
8.3. Multiplier method (MSM)

The median of the estimated size of MSM based on the available multiplier data in Colombo is 2,960 (95% CI 2,621-3,365), while in Galle it is 2,491 (95% CI 2,045 - 3,214). In Anuradhapura the median was not possible to calculate due to heterogeneity in the estimates.

Table 11: Size estimates based on the multiplier data, MSM

	Colombo	Anuradhapura	Galle
1. Unique object			
No. of unique objects distributed	100	100	100
Reported receiving unique object, IBBS (%, 95% CI)	20.2 (14.2,26.2)	19.9 (16.1,23.8)	18.9 (13.8,24.1)
Population size estimate	495 (382-704)	502 (420-621)	529 (415- 725)
2. Number of individual MSM who were clients of an NGO	3,200	1,200	780
Reported being a client of an NGO in IBBS (%, 95% CI)	59.6 (53.1,66.1)	53.6 (48.6,58.5)	26.9 (21.2,32.7)
Population size estimate	5,424 (4,841- 6,026)	2,238 (2,051-2,469)	2,900 (2,385-3,679)
3. Number of individual MSM who received a condom from an NGO	2,950	65	675
Reported receiving condoms from an NGO	49.1 (42.1,56.1)	44.9 (40.0, 49.9)	27.1 (21.2,33.0)

	Colombo	Anuradhapura	Galle
in IBBS (%, 95% CI)			
Population size estimate	6,008 (5,258-7,007)	145 (130-163)	2,491 (2,045-3,214)
4. Number of individual MSM who were escorted to an STI clinic	140	0	25
Reported being escorted to an STI clinic by the staff of an NGO in IBBS (%, 95% CI)	29.1 (23.4,34.9)	9.3 (6.7, 11.9)	22.3 (17.4,27.3)
Population size estimate	481 (401- 598)	NA	112 (92- 144)
Indicator	1, 2, 3,4	Median not possible due to very different estimates Range: 145-2,238	1, 2, 3
Median values	2,960 (2,621-3,365)		2,491 (2,045 - 3,214)

Programme data were collected from the NGOs Heart to Heart in Colombo, Sathya Guna Foundation in Galle and Rajarata Gemi Pahana in Anuradhapura

8.4. Mapping (MSW)

Male sex workers (MSW) were identified at 158 spots. Mobility was found at 12,9% of spots (at 18 spots MSW reportedly visit all together two spots on a peak day, and at three they visit three spots).

Following are the data from IBBS on the proportion of MSW (defined in the IBBS as MSM who sold sex to a man in the past 12 months) who do not visit outdoor sites to find partners:

- Galle: 70.5% (95% CI 62.3 - 78.7)
- Anuradhapura: 13.9% (6.3-21.5)
- Colombo: 24.2% (19.6- 29.8)

Without adjustments, there was an average of 587 MSW (range: 469-704) during an average month at the spots mapped. Adjustment for mobility gave an estimate of 561, while adjustment for "a hidden population" the estimate of 778 (range: 626-937).

The average unadjusted number (using a monthly average) of MSW per spot is 4.

Table 12: Size estimates on a peak day and during an average month, adjusted for mobility and the proportion of the population that is "hidden", MSW

	Low estimate	High estimate	Average estimate
On a peak day	325	516	**421**
During an average month	469	704	**587**
Adjustment for mobility across spots	453	675	**561**
Adjustment for the "hidden population"	626	937	**778**

8.5. Extrapolation of mapping data (MSW)

Proportional contribution of MSW in the general population was calculated using the estimates from randomly selected and mapped DSs. The variation in the proportion of MSW in the general population in sampled DSs was high, ranging from 0,000% to 0,139%. There were 19 DSs were MSW were not found. The highest proportion of MSW was in the Ratmalana DS (132 MSW, 0.139%).

The pooled mean of proportions was calculated using the mid (n=778), low (n=626) and high (n=937) estimates from 49 selected DSs and DS census data. The relationship between the estimated number of MSW and the census population was strong (R^2=0.421). In DSs were mapping was conducted there is a difference between pooled/extrapolated estimates and adjusted mapping estimates (for example, in Ratmalana the difference is 0.139% / 0.020% = 6.95). These differences are expected and compensated at the province and national-level and were taken into account at the consensus meeting.

The extrapolated number of MSW in Sri Lanka is 4,024 (3,240 – 4,848). The results per district and province are shown in the tables below. Estimates per DSs are available in Appendix 3.

Table 13: Estimated number of MSW at the district-level based on the extrapolated proportion of 0.020% (0.016% – 0.024%)

District	District population	Estimated average number of MSW	Low estimate	High estimate
Ampara	731,620	145	116	174
Anuradhapura	919,028	182	146	219
Badulla	904,641	179	144	215
Batticaloa	462,088	91	74	110
Colombo	2,305,466	456	367	549
Galle	994,330	197	158	237
Gampaha	2,259,241	447	360	538
Hambantota	643,033	127	102	153
Jaffna	718,721	142	114	171
Kalutara	1,180,342	233	188	281
Kandy	1,287,551	255	205	307
Kegalle	808,470	160	129	193
Kilinochchi	108,241	21	17	26
Kurunegala	1,518,541	300	242	362
Mannar	150,662	30	24	36
Matale	479,188	95	76	114
Matara	761,135	150	121	181
Moneragala	404,786	80	64	96
Mullaitivu	189,864	38	30	45
Nuwara Eliya	699,440	138	111	167
Polonnaruwa	387,423	77	62	92
Puttalam	752,484	149	120	179
Ratnapura	1,018,707	201	162	243
Trincomalee	436,876	86	70	104
Vavuniya	237,561	47	38	57
Total	20,359,439	4,024	3,240	4,848

Table 14: Estimated number of MSW at the province-level based on the extrapolated proportion of 0.020% (0.016% – 0.024%)

Province	Province population	Estimated average number of MSW	Low estimate	High estimate
Central	2,392,016	**473**	381	570
Eastern	1,877,807	**371**	299	447
North Central	1,431,327	**283**	228	341
North Western	2,316,353	**458**	369	552
Northern	1,452,348	**287**	231	346
Sabaragamuwa	1,727,146	**341**	275	411
Southern	2,319,900	**459**	369	552
Uva	1,225,412	**242**	195	292
Western	5,617,130	**1,110**	894	1,338
Total	**20,359,439**	**4,024**	**3,240**	**4,848**

Figure 3: Average MSW population in Provinces
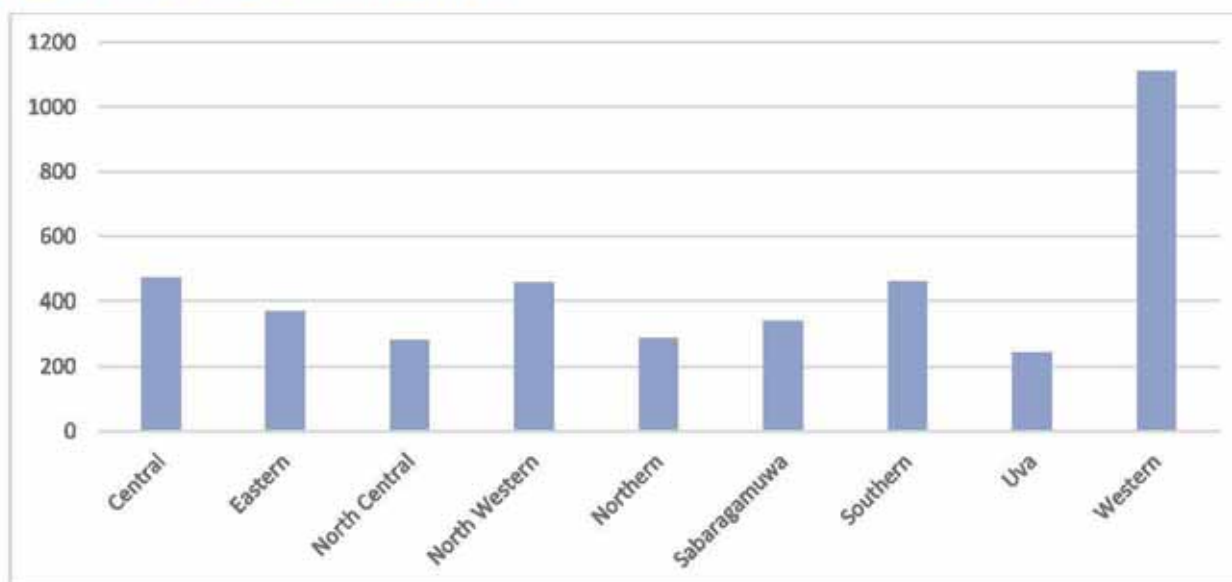
9 Estimates of people who inject drugs

9.1. Mapping

A total of 41 KIs (33 of these primary and 8 secondary) were interviewed in L2 activities, and 17 spots in five DSs were identified. The majority of spots (n=14) are located in the Western province, Colombo district. Three spots were located in the Eastern province. Of these three, two spots were in the district Ampara and one in the district Batticaloa.

These 17 spots were characterized as streets (n=7), shanti (n=4), other (n=3), beach (n=2) and abandoned land (n=1). Seven spots were found as active during the first visit, while remaining 10 were visited twice. The peak days for the spots are Friday (n=10), Monday (n=4), Saturday (n=2), Sunday (n=1), while the peak time is 5 pm -9 pm (n=10), before noon (n=6) and from noon-5 pm (n=1).

Mobility was recorded at only two out of 17 spots, and PWID who socialize at those two spots tend to visit only one other spot. The proportion of PWID who do visit outdoor sites (streets, parks, bars) in order to buy drugs and socialize with other PWID is 30.8% (95% CI 24.2-37.5), as obtained from IBBS in Colombo.

As shown in Table 15, without any adjustment the average number of PWID during an average month is 368 (range: 315-404). Adjustment for mobility gave a slightly lower average estimate of 356, while adjustment for a hidden population the estimate of 517 (range: 451-582). The average unadjusted number of PWID per spot is 22.

Table 15: Size estimates on a peak day and during an average month, adjusted for mobility and the proportion of the population that is "hidden", PWID

	Low estimate	High estimate	Average estimate
On a peak day	311	386	349
During a month	315	404	368
Adjustment for mobility across spots	311	402	356
Adjustment for the "hidden population"	451	582	517

9.2. Extrapolation of Mapping Data

The proportional contribution of PWID was calculated using the adjusted estimates from randomly selected and mapped DSs. The estimated proportion of PWID in the general population in the sampled DSs varied from 0,000% to 0,131%. In the majority of sampled DSs (n=44) PWID were not found. The highest proportion of PWID at the DS-level was in Colombo (425 PWID, 0.131%). The proportion of PWID in all sampled DSs is available in Appendix 3. The relationship between estimated number of PWID and census population was strong (R^2=0.273).

The pooled mean of proportions was calculated using the mid (n=517), low (n=451) and high (n=582) estimates from 49 selected DSs and DS census data. The resulting proportion is 0.013% (0.011% - 0.015%) of PWID among the general population. In DSs were mapping was conducted there is a difference between pooled/extrapolated estimates and adjusted mapping estimates (for example, in Colombo the difference is 0.131% / 0.013% = 10.08).

The extrapolated number of PWID in Sri Lanka is 2,672 (2,333 – 3,012). The results at a district and province-level are shown in the tables below (estimates per DS are available in Appendix 3).

Table 16: Estimated number of PWID at the district-level based on the extrapolated proportion of 0.013% (0.011% – 0.015%)

District	District population	Estimated average number of PWID	Low estimate	High estimate
Ampara	731,620	96	84	108
Anuradhapura	919,028	121	105	136
Badulla	904,641	119	104	134
Batticaloa	462,088	61	53	68
Colombo	2,305,466	303	264	341
Galle	994,330	131	114	147
Gampaha	2,259,241	297	259	334
Hambantota	643,033	84	74	95
Jaffna	718,721	94	82	106
Kalutara	1,180,342	155	135	175
Kandy	1,287,551	169	148	190
Kegalle	808,470	106	93	120
Kilinochchi	108,241	14	12	16
Kurunegala	1,518,541	199	174	225
Mannar	150,662	20	17	22
Matale	479,188	63	55	71
Matara	761,135	100	87	113
Moneragala	404,786	53	46	60
Mullaitivu	189,864	25	22	28

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District	District population	Estimated average number of PWID	Low estimate	High estimate
Nuwara Eliya	699,440	92	80	103
Polonnaruwa	387,423	51	44	57
Puttalam	752,484	99	86	111
Ratnapura	1,018,707	134	117	151
Trincomalee	436,876	57	50	65
Vavuniya	237,561	31	27	35
Total	**20,359,439**	**2,672**	**2,333**	**3,012**

Table 17: Estimated number of PWID at the province level based on the extrapolated proportion of 0.013% (0.011% - 0.015%)

Province	Province population	Estimated average number of PWID	Low estimate	High estimate
Central	2,392,016	**314**	274	354
Eastern	1,877,807	**246**	215	278
North Central	1,431,327	**188**	164	212
North Western	2,316,353	**304**	265	343
Northern	1,452,348	**191**	166	215
Sabaragamuwa	1,727,146	**227**	198	255
Southern	2,319,900	**305**	266	343
Uva	1,225,412	**161**	140	181
Western	5,617,130	**737**	644	831
Total	**20,359,439**	**2,672**	**2,333**	**3,012**

Figure 4: Average PWID population in Provinces
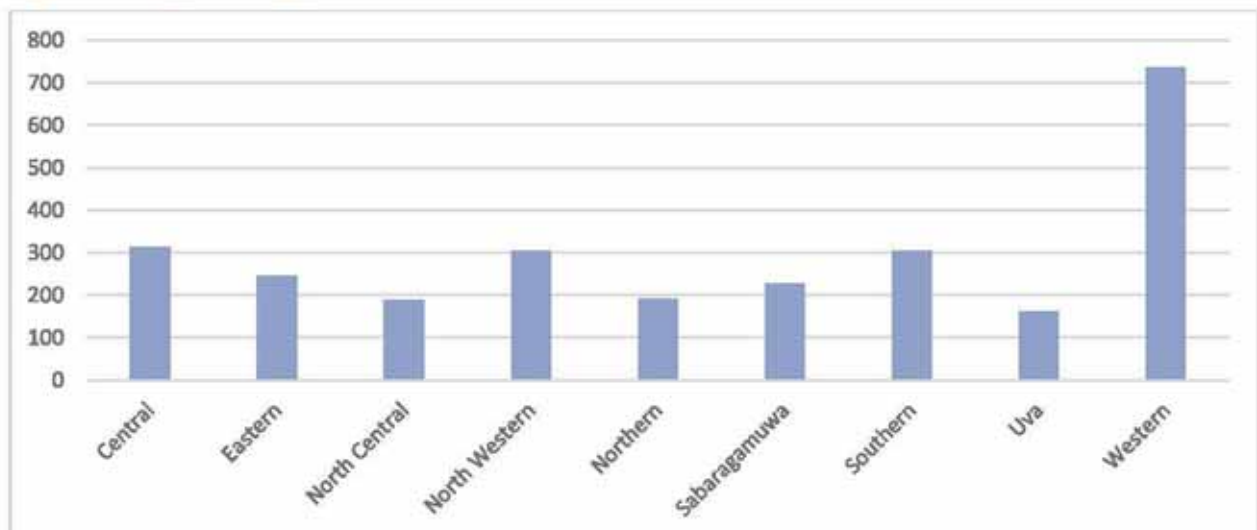
9.3. Multiplier

The median of the size estimates based on the multiplier data in Colombo is 682 (95% CI 542-916).

Table 18: Size estimates based on the multiplier data, PWID

Multplier Methods	Colombo
1. Unique object	
No. of unique objects distributed	100
Reported receiving unique object, IBBS (%, 95% CI)	15.6 (11.3, 19.8)
Population size estimate	641 (505-885)
2. Number of individual PWID who were clients of an NGO	142
Reported being clients of an NGO in IBBS (%, 95% CI)	20.8 (15.5, 26.2)
Population size estimate	682 (542-916)
3. Number of individual PWID who received a condom from an NGO	130
Reported receiving a condom from an NGO in IBBS (%, 95% CI)	8.2 (4.3, 12.0)
Population size estimate	1,585 (1,083-3,250)
4. Treated for drug use at the rehabilitation center	N/A
Reported being treated for drug use at the rehabilitation center in IBBS (%, 95% CI)	13.7 (9.0,18.5)
Population size estimate	N/A
5. Arrested by police because of drug use in Colombo	N/A
Reported being arrested by police because of drug use in Colombo in IBBS (%, 95% CI)	5.8 (8.9-18.5)
Population size estimate	N/A
Indicator	1, 2, 3
Median values	682 (542-916)

Programme data on the use of prevention services were collected from the NGO, Mithuru Mithuro in Colombo.

10. Estimates of transwomen

10.1. Mapping

During L2 activities, 78 KIs were interviewed (44 primary and 34 secondary KIs) and 55 spots were transwomen socialise were visited. Spots were located in the Western province (n=47), Southern (n=4), Uva (n=2), Sabaragamuwa (n=1) and North Central (n=1).

Spots were found in the following districts:
- Western province: Colombo (n=36); Gampaha (n=11)
- Southern: Hambantota (n=3); Galle (n=1)
- Uva: Moneragala (n=2)
- Sabaragamuwa: Ratnapura (n=1)
- North Central: Anuradhapura (n=1)

Saturday was mentioned as the busiest day of the week (n=27), followed by Sunday (n=14) and Friday (n=12), while at one spot it was Wednesday and at another Thursday.

The most frequently mentioned peak time was from 5 pm – 9 pm (n=26), 9 pm-late night (n=18), followed by noon – 5 pm (n=9) and morning - noon (n=2). Types of spots were described as streets/public places (65.5%; n=36), shanti (12.7%; n=7), other (9.1%; n=5), beach (5.5%; n=3), public toilet (5.5%; n=3) and home (1.8%; n=1).

Thirty spots were visited once, while 25 required a second visit. Primary KIs were interviewed at 29 spots, and secondary KIs at 26 spots. At only two spots it was indicated that there was mobility on a peak day, and that included a visit to only one other spot.

From IBBS data collected, 42.3% (95% CI 35.6-49.9) of transwomen in Colombo and 69.9% (63.9-75.5) in Jaffna do not visit outdoor places to find partners, and these are considered as estimates of "a hidden population" for the purpose of adjustment.

As shown in table 10.1, without any adjustment the average number of transwomen during an average month is 189 (range: 154-224). Adjustment for mobility gave a slightly lower average estimate of 183, while adjustment for "a hidden population" the estimate of 331 (range: 269-380).

The average unadjusted number of transwomen per spot is 3.

Table 19: Size estimates on a peak day and during an average month, adjusted for mobility and the proportion of the population that is "hidden", transwomen

	Low estimate	High estimate	Average estimate
On a peak day	127	183	**155**
During an average month	154	224	**189**
Adjustment for mobility across spots	149	217	**183**
Adjustment for the "hidden population"	269	380	**331**

10.2. Extrapolation of mapping data

The proportion of transwomen in the general population was calculated using the estimates from randomly selected and mapped DSs. The proportion of transwomen among the general population at a DS-level ranged from 0,000% to 0,101%. In total, there were even 37 DSs were transwomen were not found. The highest proportion of transwomen in any DS was in Katharagama (n=18, 0.101%) and Ratmalana (n=66, 0.070%). The results for all sampled DSs are available in Appendix 3. The relationship between the estimated number of transwomen and the census population was strong (R^2=0.393).

The pooled mean of proportions was calculated using the mid (n=331), low (n=269) and high (n=380) estimates. The resulting proportion is 0.008% (0.007% - 0.010%) of transwomen in the general population. In DSs were mapping was conducted there is a difference between pooled/ extrapolated estimates and adjusted mapping estimates (for example, in Katharagama the difference is 0.101% / 0.008% = 12.63).

The extrapolated number of transwomen in Sri Lanka is 1,711 (1,393 – 1,966). The results per district and province are shown in tables below. Estimates per DS are available in Appendix 3.

Table 20: Estimated number of transwomen at the district level based on the extrapolated proportion of 0.008% (0.007% - 0.010%)

District	District population	Estimated average number of transwomen	Low estimate	High estimate
Ampara	731,620	61	50	71
Anuradhapura	919,028	77	63	89
Badulla	904,641	76	62	87
Batticaloa	462,088	39	32	45
Colombo	2,305,466	194	158	223
Galle	994,330	84	68	96
Gampaha	2,259,241	190	155	218
Hambantota	643,033	54	44	62
Jaffna	718,721	60	49	69
Kalutara	1,180,342	99	81	114
Kandy	1,287,551	108	88	124
Kegalle	808,470	68	55	78
Kilinochchi	108,241	9	7	10
Kurunegala	1,518,541	128	104	147
Mannar	150,662	13	10	15
Matale	479,188	40	33	46
Matara	761,135	64	52	74
Moneragala	404,786	34	28	39
Mullaitivu	189,864	16	13	18
Nuwara Eliya	699,440	59	48	68
Polonnaruwa	387,423	33	27	37
Puttalam	752,484	63	51	73
Ratnapura	1,018,707	86	70	98
Trincomalee	436,876	37	30	42
Vavuniya	237,561	20	16	23
Total	**20,359,439**	**1,711**	**1,393**	**1,966**

Table 21: Estimated number of transwomen at the province level based on the extrapolated proportion of 0.008% (0.007% - 0.010%)

Province	Province population	Estimated average number of transwomen	Low estimate	High estimate
Central	2,392,016	**201**	164	231
Eastern	1,877,807	**158**	128	181
North Central	1,431,327	**120**	98	138
North Western	2,316,353	**195**	158	224
Northern	1,452,348	**122**	99	140
Sabaragamuwa	1,727,146	**145**	118	167
Southern	2,319,900	**195**	159	224
Uva	1,225,412	**103**	84	118
Western	5,617,130	**472**	384	543
Total	**20,359,439**	**1,711**	**1,393**	**1,966**

Figure 5: Average TGW population in Provinces
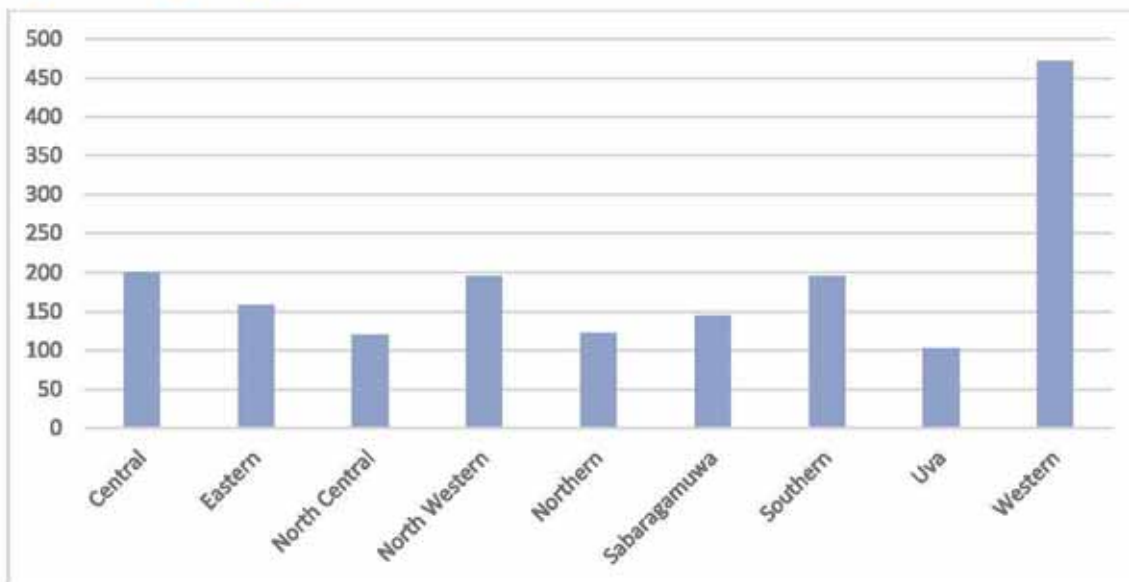
10.3. Multiplier

The median of the estimated size based on the multiplier data in Colombo is 531 (95% CI 467-614), while in Jaffna it is 117 (95% CI 110-126).

Table 22: Size estimates based on the multiplier data – Transwomen

Multiplier Method	Colombo	Jaffna
1. Unique object		
N of unique objects distributed	100	100
Reported receiving unique object, IBBS (%, 95% CI)	16.7 (12.2, 21.1)	34.0 (26.7, 41.4)
Population size estimate	599 (474–826)	294 (242–375)
2. Number of individual transwomen who were clients of an NGO	300	90
Reported being a client of an NGO in IBBS (%, 95% CI)	60.3 (53.3, 67.2)	76.9 (71.3, 82.5)
Population size estimate	498 (446–563)	117 (110–126)
3. Number of individual transwomen who received a condom from an NGO	275	45
Reported receiving condoms from an NGO in IBBS (%, 95% CI)	51.8 (44.8, 58.9)	44.6 (37.6, 51.5)
Population size estimate	531 (467–614)	101 (87–120)
4. Number of individual transwomen who were escorted to an STI clinic	NA	NA
Reported being escorted to an STI clinic by the staff of an NGO in IBBS (%, 95% CI)	25.5 (18.8, 32.0)	27.8 (21.1, 34.7)
Population size estimate	NA	NA
Indicator	1, 2, 3	1, 2, 3
Median values	531 (467–614)	117 (110–126)

Programme data were collected from the NGOs Heart to Heart for Colombo, and Journey for Life in Jaffna.

11. Estimates of beach boys

11.1. Mapping

During L2 activities, 73 KIs were interviewed (69 of these were primary and 4 were secondary KIs) and 31 unique spots were BBs congregate were visited. Spots were located in the Southern (districts Galle and Matara) and Western (district Colombo) provinces. All spots, except one, were located in the Southern province. The majority of spots were in the Galle district (n=25), followed by five in Matara and one in Colombo.

At the majority of spots January was mentioned as a peak month (n=17), followed by December (n=14). The busiest days in the week were Monday (n=16), Sunday (n=6) and Friday (n=5). The most frequently mentioned peak time was from noon-5 pm (n=13) and 9 pm – late night (n=8), followed by morning (before noon, n=6) and 5-9 pm (n=4). Types of spots

were predominantly described as "other" (58.1%, n=18) and beaches (38.7%, n=12), while one spot was described as a street.

All spot except two were visited once. Only at two spots it was indicated that BB visit other spots on a peak day to find partners. Overall, the mobility was found to be low.

For BB, no information was available from IBBS on how many visit outdoor sites. Instead, we used the information on the proportion that meets tourists on a beach (66,4%, 95% CI 61.3% - 71.5%) to estimate the proportion of the "hidden population". Therefore, the final estimates are adjusted for the proportion that does not meet tourists on a beach (33.6%), assuming that they represent a "hidden population".

As shown in Table 23, without any adjustment the average number of BB during an average month is 2,355 (range: 2,092-2,618). Adjustment for mobility gave a slightly lower average estimate of 2,216, while adjustment for "a hidden population" the estimate of 3,357 (range: 2,989 - 3,725). The average number of BB per spot is 76 (unadjusted).

Table 23: Size estimates on a peak day and during an average month, adjusted for mobility and the proportion of the population that is "hidden" - Beach boys

	Low estimate	High estimate	Average estimate
Peak day	2,039	2,553	2,296
During a month	2,092	2,618	2,355
Adjustment for mobility across spots	1,973	2,459	2,216
Adjustment for the "hidden population"	2,989	3,725	3,357

11.2. Extrapolation of mapping data

The variation in the proportion of BBs in the sampled DSs was high and ranged from 0,000% to 3,294% among the general population. The highest proportion of BB in a DS was in Hikkaduwa (n=3,357, 3.294%). As there is very weak evidence of a linear relationship between the general population and the BB population (R^2=0.002) the extrapolation process was conducted only in selected districts where sampling was done and BBs were found (n=3). The pooled mean of proportions was calculated using the mid (n=3,357), low (n=2,989) and high (n=3,725) estimates in 49 selected DSs and DS census data.

The extrapolated estimated number of BBs in Sri Lanka is 11,056 (9,821 – 12,291). The results per district and province are shown in the tables below. Estimates per DS are available in Appendix 3.

Table 24: Estimated number of BBs at the district level based on the extrapolated proportion of 0.272% (0.242% – 0.303%)

District	District population	Estimated average number	Low estimate	High estimate
Colombo	2,305,466	6,277	5,576	6,978
Galle	994,330	2,707	2,405	3,009
Matara	761,135	2,072	1,841	2,304
Total	**4,060,931**	**11,056**	**9,821**	**12,291**

Table 25: Estimated number of BBs at the province level based on the extrapolated proportion of 0.272% (0.242% – 0.303%)

Province	Province population	Estimated average number	Lower bound	Upper bound
Southern	1,755,465	4,779	4,245	5,313
Western	2,305,466	6,277	5,576	6,978
Total	**4,060,931**	**11,056**	**9,821**	**12,291**

11.3. Multiplier

The median of the estimated size based on the multiplier data in Galle is 1,022 (95% CI 859-1,515). The indicator on clients being escorted to STI services could not be used due to a small number of BBs from programmatic data.

Table 26: Size estimates based on the multiplier data – Beach boys

Multiplier Method	Galle
1. Unique object	
Number of unique objects distributed	100
Reported receiving unique object, IBBS (%, 95% CI)	**10.9 (6.6, 15.1)**
Population size estimate	**917 (663-1,515)**
2. Number of individual BB who were clients of an NGO	**600**
Reported being a client of an NGO in IBBS (%, 95% CI)	27.1 (22.2, 32.0)
Population size estimate	**2,222 (1,875-2,727)**
3. Number of individual BB who received a condom from an NGO	275
Reported receiving a condom from an NGO in IBBS (%, 95% CI)	26.9 (21.9, 32.0)
Population size estimate	1,022 (859-1,256)
4. Number of individual BB who were escorted to an STI clinic	12
Reported being escorted to an STI clinic by the staff of an NGO in IBBS (%, 95% CI)	21.6 (16.8, 26.3)
Population size estimate	**56 (46-71)**
Indicator	**1, 2, 3**
Median value	**1,022 (859-1,515)**

Programme data were collected from the NGOs Samadhi Foundation in Galle

12. Comparison of size estimation data, including comparisons with previous Population Size Estimates

FSW

Mapping and enumeration carried out in 2013 estimated a total of 14,132 FSWs in Sri Lanka (ranging from a minimum of 12,329 to a maximum of 15,935). The largest number of spots were identified in the Western (46.0%) and the North Central province (13.6%).

In 2018, 53.5% of all spots found were in the Western province followed by the Sabaragamuwa (12.3%) province. In 2018, unadjusted estimate of FSW from mapping is 2,811, while adjusted 6,139 (low estimate 5,249- high estimate 7,180). After extrapolating mapping data to the national level, the estimated number of FSW in Sri Lanka is 31,748 (27,148 – 37,131), which is larger compared to the estimates in 2013.

The median estimated size of FSW in Colombo based on the multiplier is 2,155 (95% CI 1,812-2,660) while in Galle it is 1,134 (95% CI 983-1,342). The estimates from extrapolation using mapping data suggest that there are 3595 (3,074 – 4,205) FSW in the Colombo district, while 1,551 (1,326 – 1,813) in the Galle district.

MSM

During mapping in 2013 it was found that there were 7551 MSM (range 6,547-8,554). The highest number of spots were identified in the Western (62.6%) and Southern province (8.7%) and 7% in Central. This is similar to the findings from 2018 when 68.9% of spots were located in the Western province, 8.5% in Sabaragamuwa and 6.1% in North Western and Southern (each). The unadjusted estimate of MSM from mapping is 994, while adjusted 1,570 (range 1,303-1,814). After extrapolating mapping data to the national level, estimated number of MSM in Sri Lanka is 8,120 (6,739 – 9,381), similar to 2013 estimates.

Substantially higher estimates were obtained from the multiplier method – Colombo: 2,960 (95% CI 2,621-3,365); Galle: 2,491 (95% CI 2,045-3,214). Extrapolated estimates from mapping data are lower: 919 (763 – 1,062) in the Colombo district and 397 (329 – 458) in the Galle district.

MSW

In 2013, it was found that there were 2,627 (range: 2,317-3,027) MSW in Sri Lanka. The unadjusted estimate of MSW from mapping in 2018 is 587, while adjusted 778 (range: 626-937). MSW were found at 158 spots. After extrapolating mapping data to the national level, estimated number of MSW in Sri Lanka is 4,024 (3,240 – 4,848), larger than 2013 estimates.

PWID

In mapping done in 2013, it was estimated there were 423 PWID (range: 328-516) and 60.5% of these were from the Western province, followed by 20.6% from the North Western province and 8.0% from the Central province.[b]

In 2018, 17 spots were identified, and of these 82.4% were in the Western province and 17.6% in Eastern (in no other province PWID were found). In 2018, the unadjusted estimate of the size of PWID population is 368, while adjusted 517 (range: 451-582), which is more than in 2013. After extrapolating mapping data to the national level, the estimated number of PWID in Sri Lanka is 2,672 (2,333 – 3,012), substantially higher than 2013 estimates.

The multiplier method produced the estimate of 682 (95% CI 542-916) PWID in Colombo – again more than in 2013. However, the estimated number based on the extrapolation of the mapping data for the Colombo district is 303 (264 – 341) PWID.

Transwomen

While not directly comparable to transwomen, mapping done in 2013 found that there were 2,693 (range 2,335-3,051) nachchis (76.5% were from the Western province and 7.7% from Southern).

In 2018, 55 spots visited by transwomen were identified during mapping (85.5% from Western and 7.3% from Southern province). Mapping yielded unadjusted estimates of 189 and adjusted of 331 (range: 269-380). The median estimate from the multiplier is 531 (95% CI 467-614) transwomen in Colombo and 117 (95% CI 110-126) in Jaffna. After extrapolating mapping data to the national level, estimated number of transwomen in Sri Lanka is 1,711 (1,393 – 1,966), similar to 2013 estimates.

Beach boys

In 2013, it was found that there were 1,314 (range: 1,142-1,486) BBs on a peak day and 2,001 (range: 1,750-2,251) during a peak month.[c] The highest proportion of BBs was found in the Southern province (45.4%), followed by 26.6% from Western and 25.6% from Eastern provinces.

In 2018, 31 spots were found and 96.8% (n=30) were in the Southern province, while the remaining one spot in Colombo. In this round, more beach boys were found than in 2013 – without adjustments 2,355, and with adjustments 3,357 (range: 2,989-3,725). In Galle, the multiplier method estimated the size of the BB population to be 1,022 (95% CI 859-1,515). After extrapolating mapping data to the national level, the estimated number of BB in Sri Lanka is 11,056 (9,821 – 12,291), which is higher than the 2013 estimates.

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[b] Information on how many spots were found is not available in the 2013 report

[c] Information on how many spots were found is not available in the 2013 report

13. Final estimates based on consensus of key stakeholders

Based on the understanding of different biases and strengths and weaknesses of the methods, key stakeholders discussed and determined the most plausible estimates of KPs.

The workshop started with the description of results of the mapping, enumeration and multiplier methods, as well as previous round of PSE conducted in 2013 and the regional UNAIDS estimates for Asia and Pacific region.

The workshop followed a modified Delphi method to achieve consensus. Workshop participants provided their own estimates using google forms (in Appendix 4). The estimates of all participants were collated and presented to the group. After the discussion, additional rounds of estimations followed when needed, until a consensus estimate was no longer likely to change.

13.1. Female sex workers

There were two rounds of Delphi estimations to reach the consensus estimation. The group agreed on the national estimate of 30,000 (20,000 – 35,000) FSW in Sri Lanka. This estimation includes easy-to-reach FSW at hotspots and hard-to-reach FSW who are using other means of seeking clients; earlier estimation conducted in 2013 only included easy-to-reach FSW at hotspots.

There was a discussion about district level estimation, in particular about the Colombo and Gampaha districts. In the last round of the Delphi process, Colombo was the only district with the consensus density of "high" for FSW among adult females in Sri Lanka. This has allowed for a higher number of FSW in the Colombo district, as most participants considered that FSW are mostly concentrated in Colombo.

Table 27: Comparison of various estimates - FSW

Description	No. of FSW			% among female general population aged 15-49 years		
	Average	Low estimate	High estimate	Average	Low estimate	High estimate
Mapping & enumeration, 2018	31,748	27,148	37,131	0.63%	0.54%	0.73%
Multiplier, 2018 (Colombo)	2,155	1,812	2,660	0.35%	0.29%	0.43%
Multiplier, 2018 (Kandy)	-	685	1,364	-	0.21%	0.43%
Multiplier, 2018 (Galle)	1,134	983	1,342	0.45%	0.39%	0.53%

Description	No. of FSW			% among female general population aged 15-49 years		
Mapping & enumeration, 2013	14,132	12,329	15,935	0.28%	0.24%	0.31%
UNAIDS estimates for Asia and Pacific	17,739	9,123	118,094	0.35%	0.18%	2.33%
Consensus meeting 2018	**30,000**	**20,000**	**35,000**	**0.59%**	**0.39%**	**0.69%**

Table 28: District-level estimates based on the consensus meeting – FSW

District	Average density*	%	Number of females aged 15-49 years	Estimated number of FSW
Ampara	Low	0.39%	163,285	769
Anuradhapura District	Medium	0.59%	223,562	1,579
Badulla district	Low	0.39%	193,872	913
Batticaloa	Low	0.39%	129,042	608
Colombo District	High	0.69%	620,499	5,112
Galle district	Medium	0.59%	252,717	1,785
Gampaha District	Medium	0.59%	603,484	4,262
Hambantota district	Low	0.39%	149,068	702
Jaffna District	Low	0.39%	136,615	643
Kaluthara District	Low	0.39%	301,989	1,422
Kandy district	Medium	0.59%	319,779	2,258
Kegalle District	Low	0.39%	194,763	917
Kilinochchi District	Low	0.39%	28,205	133
Kurunegala district	Low	0.39%	391,311	1,842
Mannar District	Low	0.39%	26,723	126
Matale District	Low	0.39%	115,837	545
Matara district	Low	0.39%	189,715	893
Moneragala district	Low	0.39%	119,036	560
Mullaitivu District	Low	0.39%	24,052	113
Nuwara Eliya District	Low	0.39%	163,547	770
Polonnaruwa District	Low	0.39%	105,944	499
Puttalam	Low	0.39%	193,923	913
Ratnapura District	Medium	0.59%	277,482	1,960
Trincomalee	Low	0.39%	97,487	459
Vavuniya District	Low	0.39%	46,482	219

*Average density is a result of the consensus meeting participants' classification of districts into low/medium/high proportion of a KP among a specific adult population.

13.2. Men who have sex with men

Participants discussing the MSM data provided diverging estimates, ranging from 12,000 to 700,000 of MSM in Sri Lanka. Lower estimates were mostly provided by those involved in planning HIV programmes for MSM and higher estimates were driven by LGBT activists. Other sources of potential MSM population size were taken into account: MSM using dating websites and apps (40,000 at LankaLove, 2,109 at PlanetRomeo, 2,000 MSM on Grindr in the Colombo city) and the number of MSM tested at STI clinics (n=2,469). It was noted that only a fraction of MSM are using these services.

Three rounds of a Delphi process were conducted. A consensus estimate of 40,000 (30,000 – 50,000) MSM was reached using the median estimated number participants provided in the third round.

As the mapping and enumeration method is likely to underestimate MSM, the consensus meeting estimate is a more probable one. In addition, the consensus meeting estimate for the Colombo and Galle districts is almost compatible with the multiplier estimate for those districts. The consensus national estimate of MSM aligns with the number of MSM using dating apps, though presumably only a fraction of MSM are using those service. Therefore, it is likely that the number of MSM in Sri Lanka is larger.

Table 29: Comparison of various estimates - MSM

	No. of MSM			% among male general population aged 15-49 years		
	Average	Low	High	Average	Low	High
Mapping & enumeration, 2018	8,120	6,739	9,381	0.15%	0.13%	0.18%
Multiplier, 2018 (Colombo)	2,960	2,621	3,365	0.48%	0.43%	0.55%
Multiplier, 2018 (Galle)	2,491	2,045	3,214	0.92%	0.75%	1.18%
Multiplier, 2018 (Anuradhapura)	-	145	2,238	-	0.06%	0.96%
Mapping & enumeration, 2013	7,551	6,547	8,554	0.14%	0.12%	0.16%
UNAIDS estimates (Asia and Pacific)	90,501	4,820	217,417	1.69%	0.09%	4.06%
Consensus meeting 2018	**40,000**	**30,000**	**50,000**	**0.75%**	**0.56%**	**0.93%**

Table 30: District-level estimates based on the consensus meeting – MSM

District	Average density	%	Number of males aged 15-49 years	Estimated number of MSM
Ampara	Low	0.56%	180,130	1,002
Anuradhapura District	Medium	0.75%	234,254	1,737
Badulla district	Low	0.56%	213,317	1,186
Batticaloa	Low	0.56%	147,794	822
Colombo District	High	0.93%	616,405	5,714
Galle district	High	0.93%	271,385	2,516
Gampaha District	High	0.93%	619,984	5,747
Hambantota district	Low	0.56%	154,148	857
Jaffna District	Medium	0.75%	155,998	1,157
Kaluthara District	Medium	0.75%	313,950	2,328
Kandy district	Medium	0.75%	358,351	2,657
Kegalle District	Medium	0.75%	212,718	1,577
Kilinochchi District	Low	0.56%	29,181	162
Kurunegala district	Medium	0.75%	420,408	3,117
Mannar District	Low	0.56%	26,125	145
Matale District	Low	0.56%	125,675	699
Matara district	Medium	0.75%	206,511	1,531
Moneragala district	Low	0.56%	121,383	675
Mullaitivu District	Low	0.56%	23,995	133
Nuwara Eliya District	Low	0.56%	182,259	1,014
Polonnaruwa District	Medium	0.75%	108,821	807
Puttalam	Medium	0.75%	201,796	1,496
Ratnapura District	Medium	0.75%	283,118	2,099
Trincomalee	Low	0.56%	100,189	557
Vavuniya District	Low	0.56%	47,197	262
Total				39,997

13.3. Male sex workers

A simplified approach to estimate the MSW population was used at the consensus meeting by estimating the proportion of MSM who sell sex. Only one round of estimation was conducted for this KP. The group discussed whether the HIV prevention needs of MSW were different than those of MSM. The final agreement was that 15% (10% - 21%) of MSM engage in SW. This translates to 6,000 (4,000 – 8,400) MSW in Sri Lanka. This estimate is slightly higher compared to the estimate from mapping and enumeration.

Table 31: Comparison of various estimates - MSW

Description	# MSW			% among the male general population aged 15-49 years		
	Average	Low	High	Average	Low	High
Mapping & enumeration, 2018	4,024	3,240	4,848	0.08%	0.06%	0.09%
Mapping & enumeration, 2013	2,627	2,317	3,027	0.05%	0.04%	0.06%
Consensus meeting, 2018 (% of MSM)	**6,000 15%**	**4,000 10%**	**8,400 21%**	**0.11%**	**0.07%**	**0.16%**

Table 32: District-level estimates based on the consensus meeting - MSW

District	Average density	%	Number of males aged 15-49 years	Estimated number of MSW
Ampara	Low	0.06%	180,130	98
Anuradhapura District	Medium	0.11%	234,254	257
Badulla district	Low	0.06%	213,317	116
Batticaloa	Low	0.06%	147,794	81
Colombo District	High	0.20%	616,405	1,174
Galle district	High	0.20%	271,385	517
Gampaha District	High	0.20%	619,984	1,181
Hambantota district	Medium	0.11%	154,148	169
Jaffna District	Low	0.06%	155,998	85
Kaluthara District	Medium	0.11%	313,950	344
Kandy district	Medium	0.11%	358,351	393
Kegalle District	Low	0.06%	212,718	116
Kilinochchi District	Low	0.06%	29,181	16
Kurunegala district	Medium	0.11%	420,408	461
Mannar District	Low	0.06%	26,125	14
Matale District	Low	0.06%	125,675	69
Matara district	Low	0.06%	206,511	113
Moneragala district	Low	0.06%	121,383	66
Mullaitivu District	Low	0.06%	23,995	13
Nuwara Eliya District	Medium	0.11%	182,259	200
Polonnaruwa District	Low	0.06%	108,821	59
Puttalam	Medium	0.11%	201,796	221
Ratnapura District	Low	0.06%	283,118	155
Trincomalee	Low	0.06%	100,189	55
Vavuniya District	Low	0.06%	47,197	26

13.4 Transwomen

There is not much experience or existing data about this population in Sri Lanka. The estimates were reached after the first round of the Delphi process: 2,200 (2,000 – 3,500) of transwomen in Sri Lanka – the number which is consistent with the mapping and enumeration estimates.

Table 33: Comparison of various estimates - Transwomen

Description	No. of Transwomen			% among the male general population aged 15-49 years		
	Average	Low	High	Average	Low	High
Mapping & enumeration, 2018	1,711	1,393	1,966	0.03%	0.03%	0.04%
Multiplier, 2018 (Colombo)	531	467	614	0.09%	0.08%	0.10%
Multiplier, 2018 (Jaffna)	117	110	126	0.08%	0.07%	0.08%
Mapping & enumeration, 2013*	2,693	2,335	3,051	0.05%	0.04%	0.06%
UNAIDS estimates (Asia and Pacific)	1,071	1,071	3,213	0.02%	0.02%	0.06%
Consensus meeting, 2018	**2,200**	**2,000**	**3,500**	**0.04%**	**0.04%**	**0.07%**

*In the 2013 PSE study, nanchis were sampled, and some of those were transwomen

Table 34: District-level estimates based on the consensus meeting- Transwomen

District	Average density	%	Number of males aged 15-49 years	Estimated number of transwomen
Ampara	Low	0.04%	180,130	65
Anuradhapura District	Low	0.04%	234,254	84
Badulla district	Low	0.04%	213,317	77
Batticaloa	Low	0.04%	147,794	53
Colombo District	High	0.07%	616,405	388
Galle district	Medium	0.04%	271,385	107
Gampaha District	Medium	0.04%	619,984	245
Hambantota district	Low	0.04%	154,148	55
Jaffna District	High	0.07%	155,998	98
Kaluthara District	Medium	0.04%	313,950	124
Kandy district	Medium	0.04%	358,351	142
Kegalle District	Low	0.04%	212,718	76
Kilinochchi District	Low	0.04%	29,181	10
Kurunegala district	Low	0.04%	420,408	151
Mannar District	Low	0.04%	26,125	9
Matale District	Low	0.04%	125,675	45
Matara district	Low	0.04%	206,511	74
Moneragala district	Low	0.04%	121,383	44

District	Average density	%	Number of males aged 15-49 years	Estimated number of transwomen
Mullaitivu District	Low	0.04%	23,995	9
Nuwara Eliya District	Low	0.04%	182,259	66
Polonnaruwa District	Low	0.04%	108,821	39
Puttalam	Low	0.04%	201,796	73
Ratnapura District	Medium	0.04%	283,118	112
Trincomalee	Low	0.04%	100,189	36
Vavuniya District	Low	0.04%	47,197	17
Total				2,199

13.5. People Who Inject Drugs

The consensus estimates were reached after the first round of the Delphi process. An additional study was taken into account during the discussion, which estimated that there were 957 PWID in Colombo (*Source: Report on trends, patterns and prevalence of injecting drug users in Sri Lanka. Colombo: National Dangerous Drug Control Board, Ministry of Law and Order & Southern Development, 2015*). According to this report, the highest prevalence of PWID is in the Colombo district. This report strongly influenced the discussion. There was also an agreement that Colombo had the highest prevalence of PWID, resulting in addition of a "weight" for the Colombo district (4x), while proportionately decreasing estimates for other districts.

The estimate for Sri Lanka is 900 (650 – 1,200) PWID, and the largest number of PWID lives in the Colombo district (677). The Colombo district consensus estimate is consistent with the multiplier method estimate, while the national estimate is three times lower in comparison with the mapping and enumeration estimate. This shows that the consensus meeting might have underestimated the number of PWID in Sri Lanka.

Table 35: Comparison of various estimates - PWID

Description	No. of PWID			% among the general population aged 15-49 years		
	Average	Low	High	Average	Low	High
Mapping & enumeration, 2018	2,672	2,333	3,012	0.03%	0.02%	0.03%
Multiplier, 2018 (Colombo)	682	542	916	0.06%	0.04%	0.07%
Mapping & enumeration, 2013	423	328	516	0.004%	0.003%	0.005%
UNAIDS estimates (Asia and Pacific)	6,254	104	108,405	0.06%	0.001%	1.04%
Consensus meeting - 2018	**900**	**650**	**1,200**	**0.009**	**0.006**	**0.012**

Table 36: District-level estimates based on the consensus meeting – PWID

District	Average density	%	Number of the general population aged 15-49	Estimated number of PWID	Estimated number of PWID with weighting
Ampara	Low	0.006%	343,415	25	8
Anuradhapura District	Low	0.006%	457,816	34	10
Badulla district	Low	0.006%	407,189	30	9
Batticaloa	Low	0.006%	276,836	21	6
Colombo District	High	0.012%	1,236,904	169	677
Galle district	Medium	0.009%	524,102	54	16
Gampaha District	Medium	0.009%	1,223,468	126	38
Hambantota district	Low	0.006%	303,216	22	7
Jaffna District	Low	0.006%	292,613	22	7
Kaluthara District	Low	0.006%	615,939	46	14
Kandy district	Low	0.006%	678,130	50	15
Kegalle District	Low	0.006%	407,481	30	9
Kilinochchi District	Low	0.006%	57,386	4	1
Kurunegala district	Low	0.006%	811,719	60	18
Mannar District	Low	0.006%	52,848	4	1
Matale District	Low	0.006%	241,512	18	5
Matara district	Low	0.006%	396,226	29	9
Moneragala district	Low	0.006%	240,419	18	5
Mullaitivu District	Low	0.006%	48,047	4	1
Nuwara Eliya District	Low	0.006%	345,806	26	8
Polonnaruwa District	Low	0.006%	214,765	16	5
Puttalam	Low	0.006%	395,719	29	9
Ratnapura District	Low	0.006%	560,600	42	13
Trincomalee	Low	0.006%	197,676	15	4
Vavuniya District	Low	0.006%	93,679	7	2

13.6 Beach Boys

The significant part of the discussion about BB population was focused on estimates at the district level since the BB population is unevenly spread across the districts. To facilitate the discussion, districts were divided into those who have an active BB population and those where BB were not present.

The national estimate of BBs was reached after the first round of the Delphi process; however, an additional round was conducted to reach higher quality estimate at a district level. Also, an additional weight was added to the Galle district (4x) while keeping Kaluthara district constant and proportionally decreasing estimates for other districts. There was a strong agreement that most BB are based in the Galle and Kaluthara districts.

The national consensus median estimate was 4,500 (3,000 – 6,000) BBs. The range is larger than for other KPs, and that shows a higher uncertainty of the estimates.

Table 37: Comparison of various estimates - BBs

Description	No. of BB			% among the general male population aged 15-49 years		
	Average	Min	Max	Average	Min	Max
Mapping & enumeration 2018*	11.056	9,821	12,291	0,21%	0,18%	0,23%
Multiplier 2018 (Galle)	1,022	859	1,515	0,38%	0,32%	0,56%
Mapping & enumaration 2013	1,314	1,142	1,486	0,02%	0,02%	0,03%
Consensus meeting 2018	**4,500**	**3,000**	**6,000**	**0,08%**	**0,06%**	**0,11%**

*The extrapolation is limited to only those districts were BB were found during mapping and enumeration.

Table 38: District level estimates based on the consensus meeting - BBs

District	Average density	%	Number of the general male population aged 15-49	Estimated number of BBs	Estimated number of BBs with weighting
Ampara	Low	0.06%	180,130	219	86
Batticaloa	Low	0.06%	147,794	180	71
Colombo	Low	0.06%	616,405	749	295
Galle	High	0.11%	271,385	660	2,639
Gampaha	Medium	0.08%	619,984	1,131	446
Hambantota	Low	0.06%	154,148	187	74
Kaluthara	Medium	0.08%	313,950	572	572
Matara	Low	0.06%	206,511	251	99
Puttalam	Medium	0.08%	201,796	368	145
Trincomalee	Medium	0.08%	100,189	183	72
Total					**4,499**

Figure 6: District level estimates of BBs
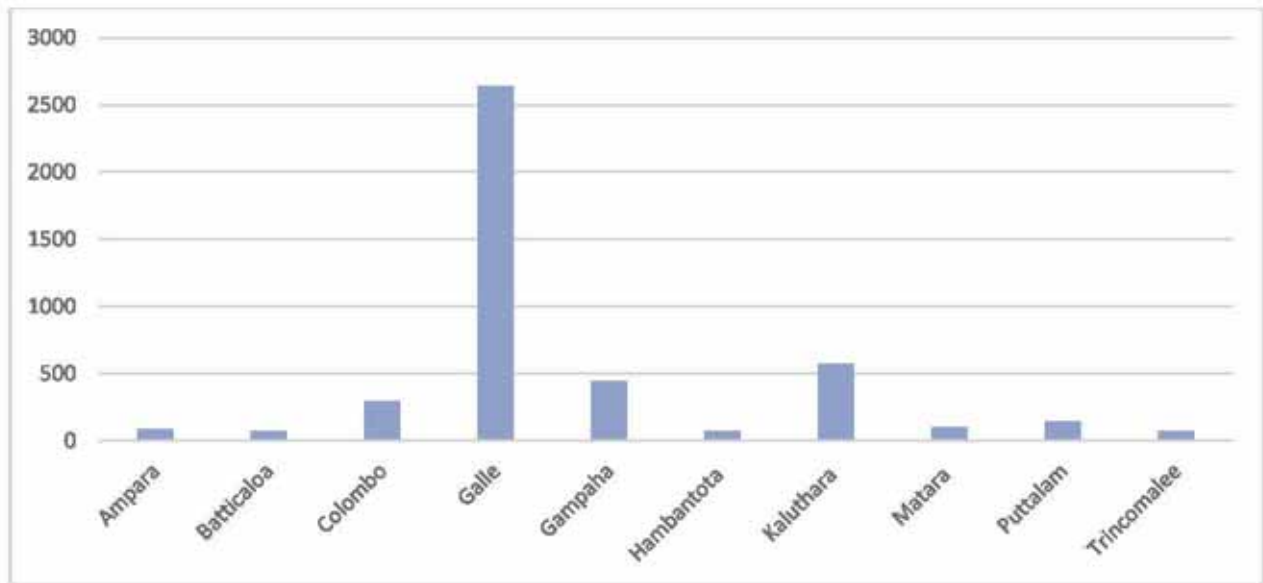
14.   Strengths and Weaknesses of the Data

Methods based on mapping tend to underestimate hidden populations. To address this weakness of the method, community guides were part of the mapping teams as that ensured a better access to information about KPs as well as KP themselves. In addition, mapping should be completed in a short enough time to compensate for migration so that individuals are not counted more than ones. To adjust for migration in this study, information was collected on mobility across spots and its frequency. Final estimates are also adjusted for a part of a population that is "hidden" i.e. unlikely to visit outdoor venues using data from IBBS based on RDS. However, the quality of data on a sub-set of population that do not visit outdoor venues depends on the representativeness of RDS.

Mapping method requires a reliable sample frame of venues so the final quality of estimates depends heavily on how successful field work was in identifying the universe of venues visited by KPs. In some DSs, the estimated size of KPs as reported by respondents is very low, and that is in particular the case with MSM, MSW and PWID. Also, the number of spots found is low for some populations, such as PWID, BBs and transwomen.

An advantage of the approach used in this round of mapping is that the random selection of DSs provided a good basis for the national-level extrapolation procedure.

The key source of a bias in the multiplier estimates in general is the selection bias in the survey leading to dependence between data sources. This could happen if those in contact with the service provider are more likely to be included in the survey than those not in the programme. Efforts were taken to ensure that in both data sources populations are defined in the same way, in terms of time-periods and geographic areas, and that unique objects were not distributed to ineligible individuals.

Data provided by NGOs on the number of KP individuals who got a certain service could have been to some extent inaccurate as the numbers were often rounded (for example, FSW, beach boys, transgender and MSM who were clients of NGOs). Some data for the multiplier were not obtained, such as police arrests in PWID, and the number of PWIDs who were clients of the rehabilitation centre in Colombo.

The selected data extrapolation method assumes a linear relationship between the total general population and the number of KPs in DSs, i.e. the proportion of a KP is constant in all geographical areas in a country. This may not be true for areas where some geographical characteristics are related to the number of KPs, such as the number of tourists (increased proportion of BBs and FSW), larger cities (more opportunity for PWID to inject, also MSM often migrate to larger cities) and other characteristic. A statistical test of the relationship was conducted for each KP, showing no evidence for a linear relationship for BBs and strong evidence for a linear relationship for other KPs.

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The accuracy of the Delphi method depends on the knowledge of participants about a certain KP, the type of work they are involved in and their level of expertise. If the existing knowledge or perception of participants is far from the true number of KP individuals, the consensus estimates reached will reflect those biases. The bias may be stronger at a district level, as meeting was held in one district and there was not enough representation from remaining districts. The Delphi method can also result in a "forced consensus", when the group has vastly different opinions. Also, a median as a measure can always be calculated even though most participants disagree with the estimate, resulting in a "forced consensus".

15. Conclusions and recommendations

The overall goal of this study was to provide evidence on the size of KPs for HIV in in Sri Lanka using different approaches, with a view to improving the scale, coverage, and aligned roll-out of HIV prevention programmes among these populations.

This provides an important point for macro- and micro-level planning of HIV services and for allocating programme resources, including the prioritization of districts, determining the volume of services required, and coordinating the provision of HIV prevention programmes throughout the country. Repeated size estimation along with programme data can improve ongoing assessment of programme coverage and quality, and informs effective program scale up.

Following are the recommendations based on the study results:

- Efforts should be done to improve the quality of programmatic data from NGOs and other service providers. This is important not only for the purpose of the size estimation, but for understanding the coverage with specific services.

- NGOs in Kandy and Anuradhapura should in particular improve the quality of data on services for KPs.

- Some programme data are not useful for the multiplier method, such as individual KP members who are escorted to STI services by NGO staff, since the numbers provided by NGOs are too low.

- If the multiplier method will be done in the next round of PSE, it is crucial that more programmatic indicators are collected and that their quality is at the appropriate level. For example, HIV testing data could not be used for this round of size estimation as there are no individual-level records.

- Due to the small number of MSM found in mapping and much higher estimates obtained via the multiplier method, it is likely that the methods based on mapping are not suitable for the MSM population. However, mapping spots visited by MSM remains important for planning outreach prevention services.

- As there are various perceptions of the number of MSM, it is recommended that diverse stakeholders work more closely together to facilitate exchange of knowledge about the MSM population. Also, additional studies about MSM are recommended, such as a national-level survey that would determine the extent of the same-sex sexual behaviour in men.

- Similarly, formative research is necessary to understand a range of issues relevant for conducting HIV-related studies in transwomen, as little is known about this population in Sri Lanka.

- Since a small number of spots were found for PWID, BB and transwomen, organisations that provide outreach or other services should be asked to collect data on locations visited by those KPs.

- According to IBBS data, large proportions of KPs do not socialise (find partners, inject dugs) at outdoor places. That has implications for programme planning in terms of finding mechanism for HIV prevention service delivery for those hidden sub-groups. This is in particular relevant for KPs in Galle and transwomen in Jaffna.

- This study found that mobility for BBs is low. Since this is an unexpected finding, it should be researched further in other studies.

- NAP should explore whether a network-scale up survey can be done in conjunction with another general population-based survey. That would provide another useful source of data for population size estimation purposes.