Tuberculosis Inventory Study in Indonesia 2016-2017

TB Inventory Study Team

Glion, 1 May 2018

Background

Introduction (1)

- Indonesia among top 5 countries with the highest TB burden
- TB incidence estimated 1,020,000 cases per year (Global TB Report 2017)
- Number of TB case notified: 360,565 (National TB database, 2016)
- Low contribution of private sectors in case notification of TB (NSP 2016-2020)
- 56% of people found on TB treatment were not reported to SITT (National Prevalence Survey, 2013-2014)
- Protocol development workshop for TB inventory studies (September 2014): China, Indonesia, Pakistan, Philippines, Viet Nam

Introduction (2)

- TB surveillance system (manual and electronic) in tiers: health center, district, province and national

- Web and case based TB information system (SITT) started in 2014, mainly covers all public health centers and some government hospitals

- Web and case based DR TB information system (eTB Manager) started in 2009 in 93 PMDT sites Nationally

- Health Minister decree No. 67/2016: mandatory for all health facilities to notify TB cases (excluding laboratories)

Objectives

Objectives

- Main objective
  - To estimate the level of under-reported TB cases in the National Surveillance System (SITT and eTB Manager)
- Specific objectives
  - To quantify the level of under-reporting of TB cases put on treatment to the national surveillance systems, PHC and Non PHC, public and private
  - To understand the relative contribution of types of health facilities to TB treatment and TB under-reporting
  - To assess the difference in under-reporting by age, sex, geographical area and type of health facilities
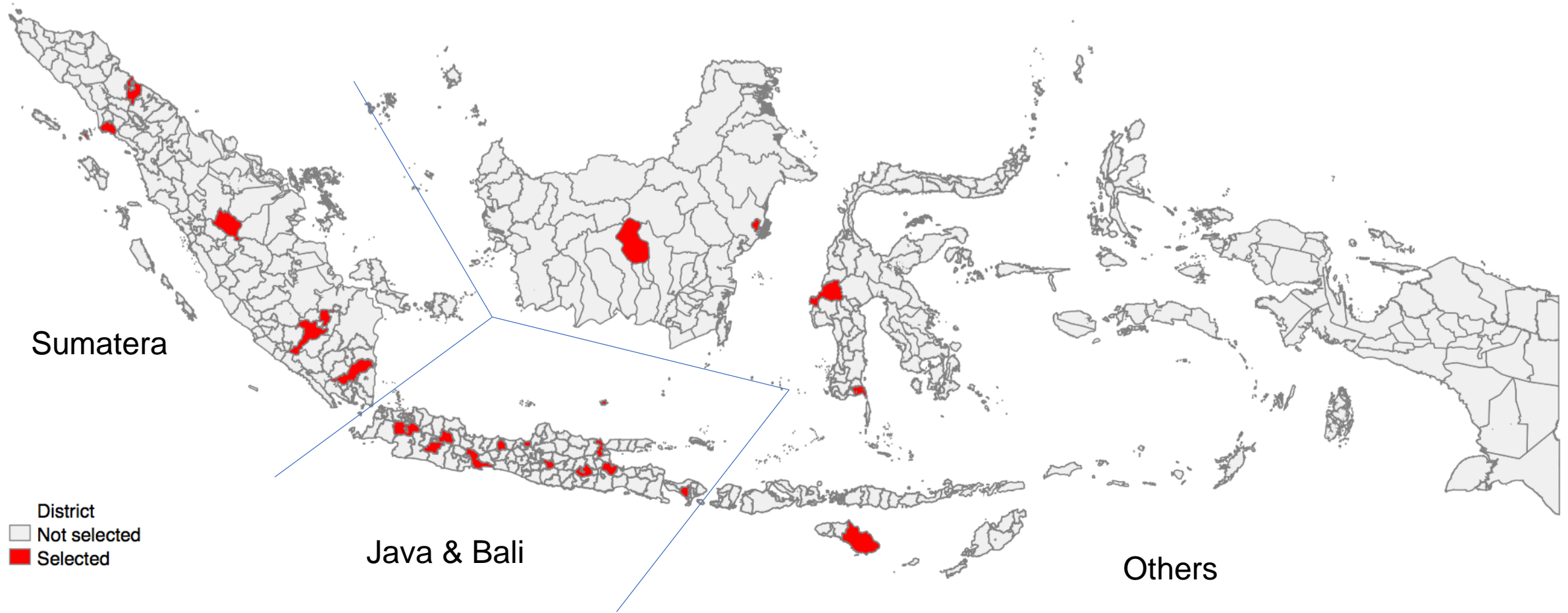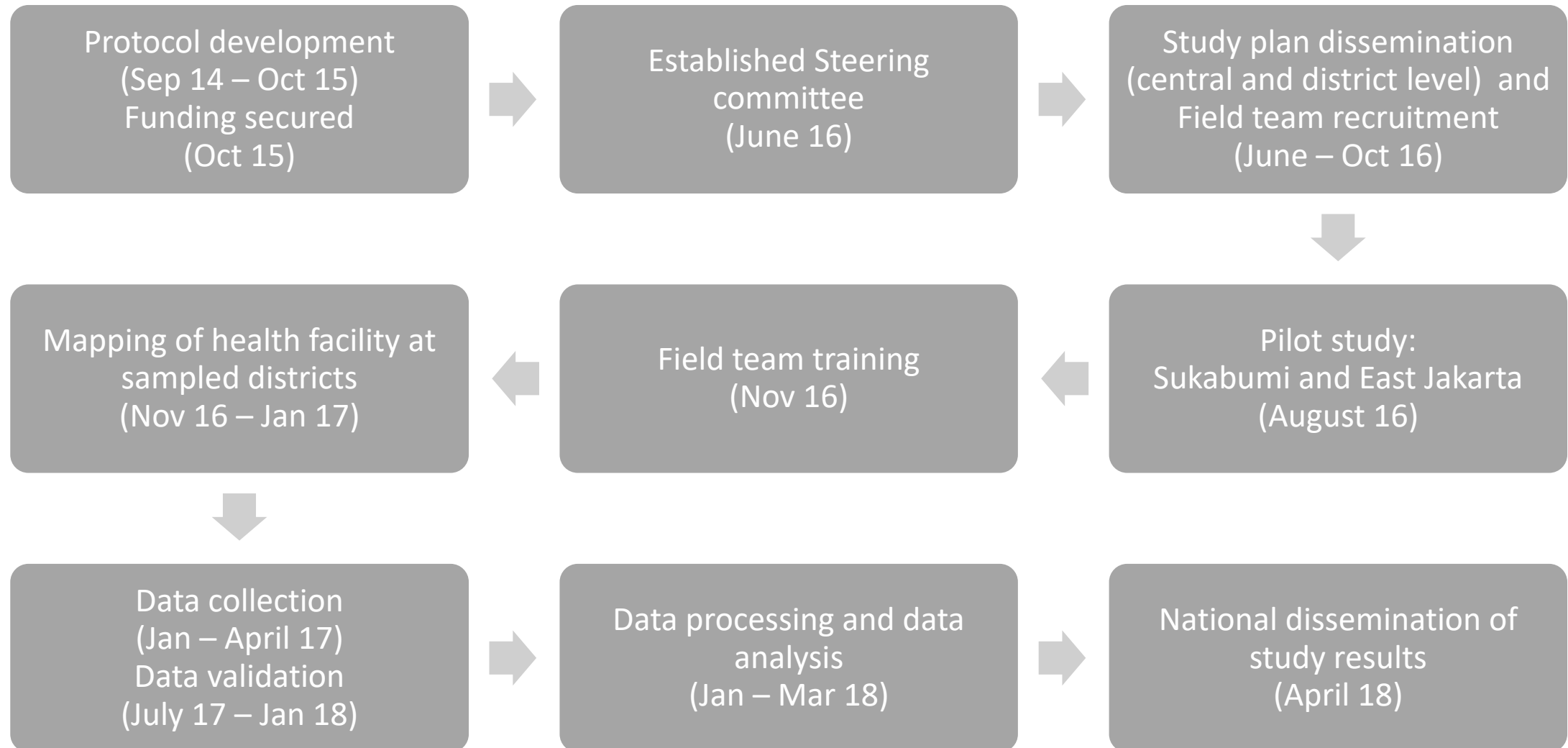
Methods

Overview of Study Design and Analysis

- Sampling design: Stratified cluster sampling design
- Stratification: (1) Sumatera, (2) Java-Bali, and (3) Other
- Sample size of district = 23 (6 in Sumatra, 12 in Java-Bali, and 5 in other provinces)
- Probability proportional to population sampling of districts (clusters) followed by prospective collection of data for cases diagnosed by ALL health-care providers within selected districts for 3 months (1 Jan-31 Mar 2017)
- Record-linkage between the Inventory Study and NTP case based databases to estimate under-reporting

Sampled districts

Selected districts is 23 out of 514 districts
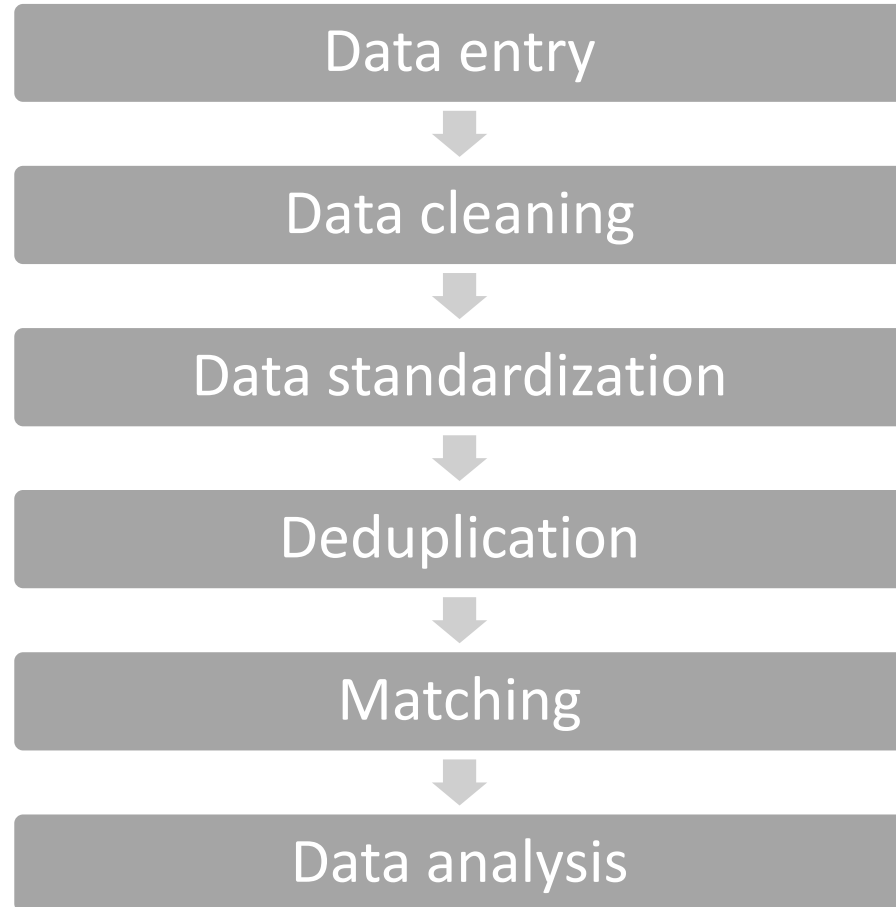Covered about 10% of total population (260 millions)

Sumatera

Java & Bali

Others

District
Not selected
Selected

Key study timelines

Protocol development
(Sep 14 – Oct 15)
Funding secured
(Oct 15)

Established Steering committee
(June 16)

Study plan dissemination (central and district level) and Field team recruitment
(June – Oct 16)

Mapping of health facility at sampled districts
(Nov 16 – Jan 17)

Field team training
(Nov 16)

Pilot study:
Sukabumi and East Jakarta
(August 16)

Data collection
(Jan – April 17)
Data validation
(July 17 – Jan 18)

Data processing and data analysis
(Jan – Mar 18)

National dissemination of study results
(April 18)

Data processing

Data processing steps

Data entry

↓

Data cleaning

↓

Data standardization

↓

Deduplication

↓

Matching

↓

Data analysis

- The process was done using Stata, except incidence estimation was done using R statistics

- Deduplication and matching were done using probabilistic record linkage and manual review
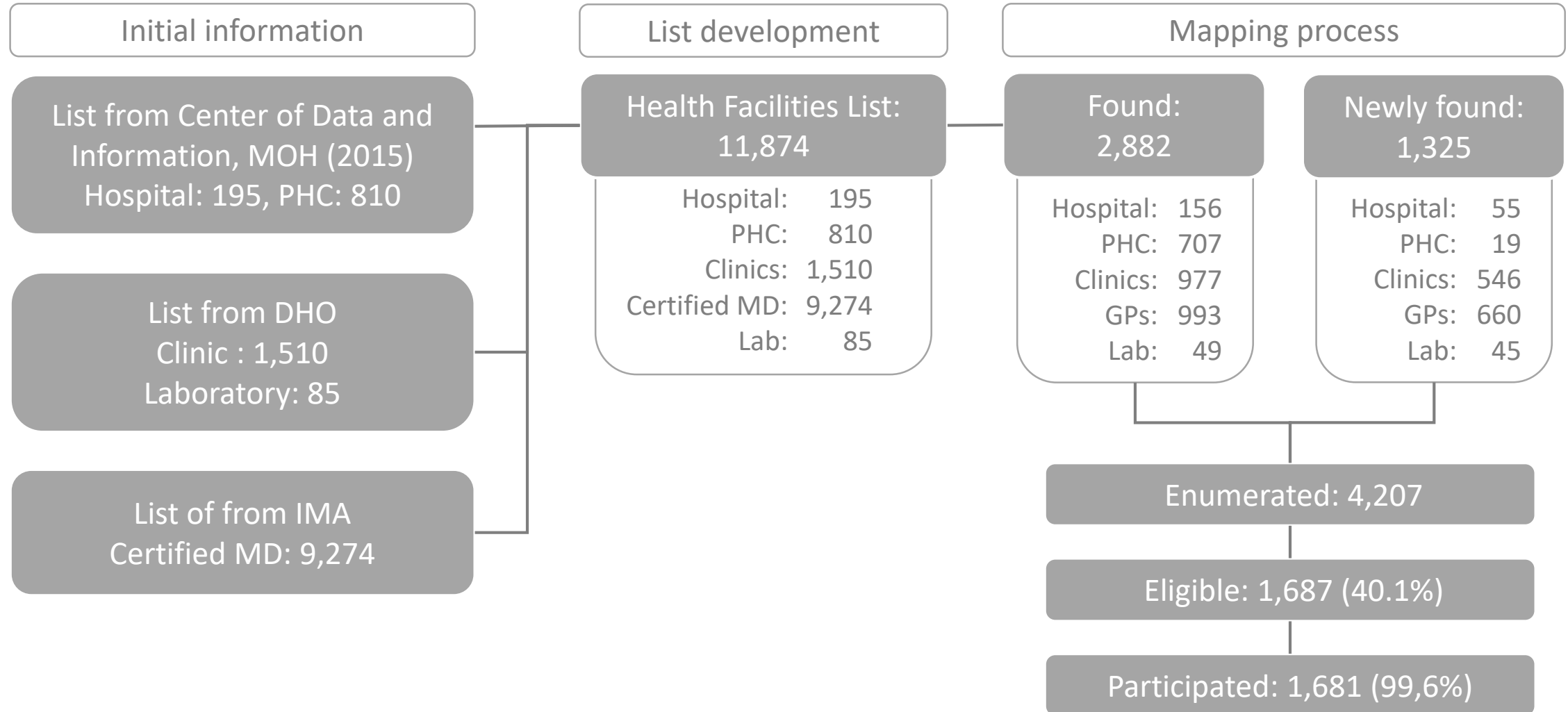
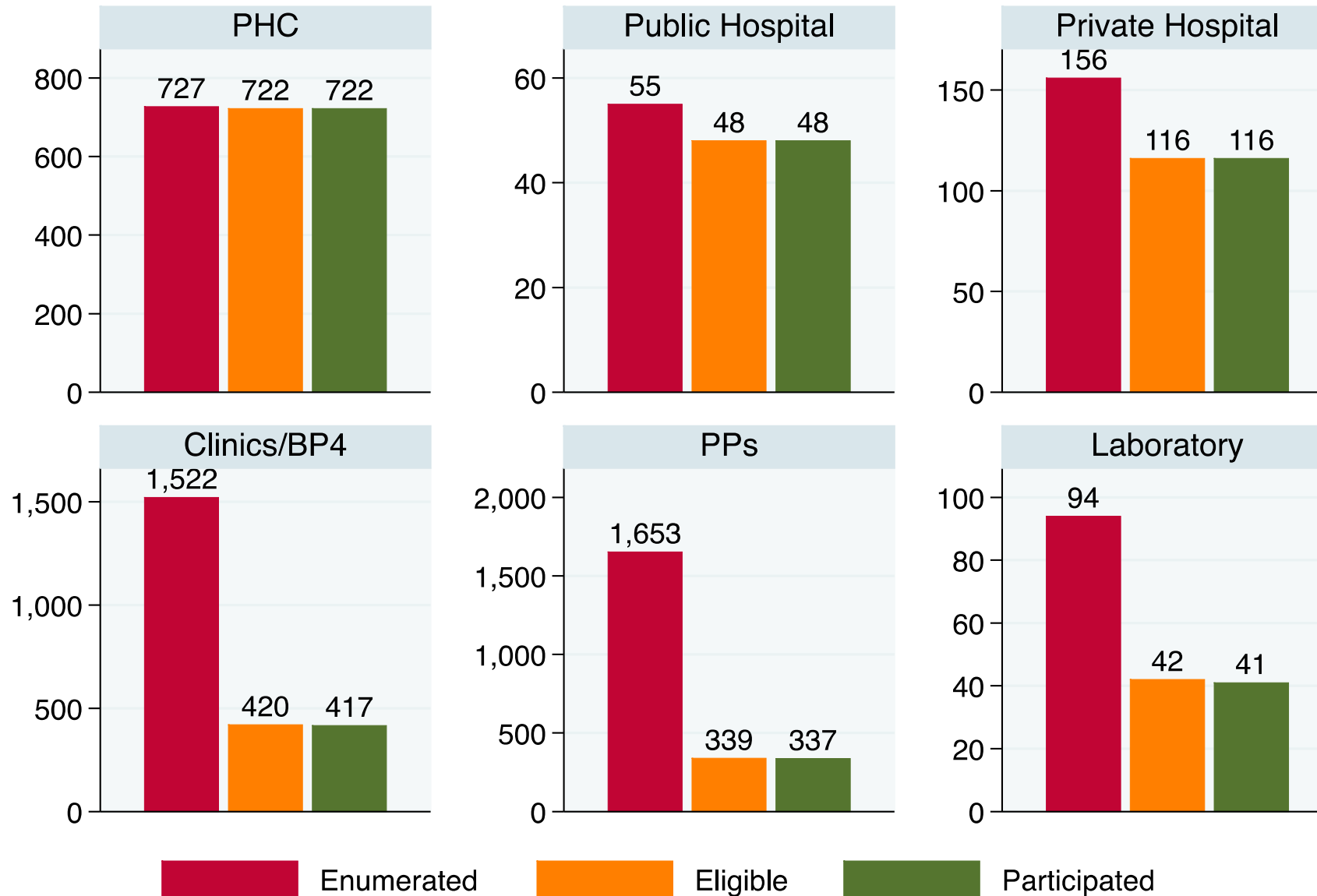# Deduplication of IVS data
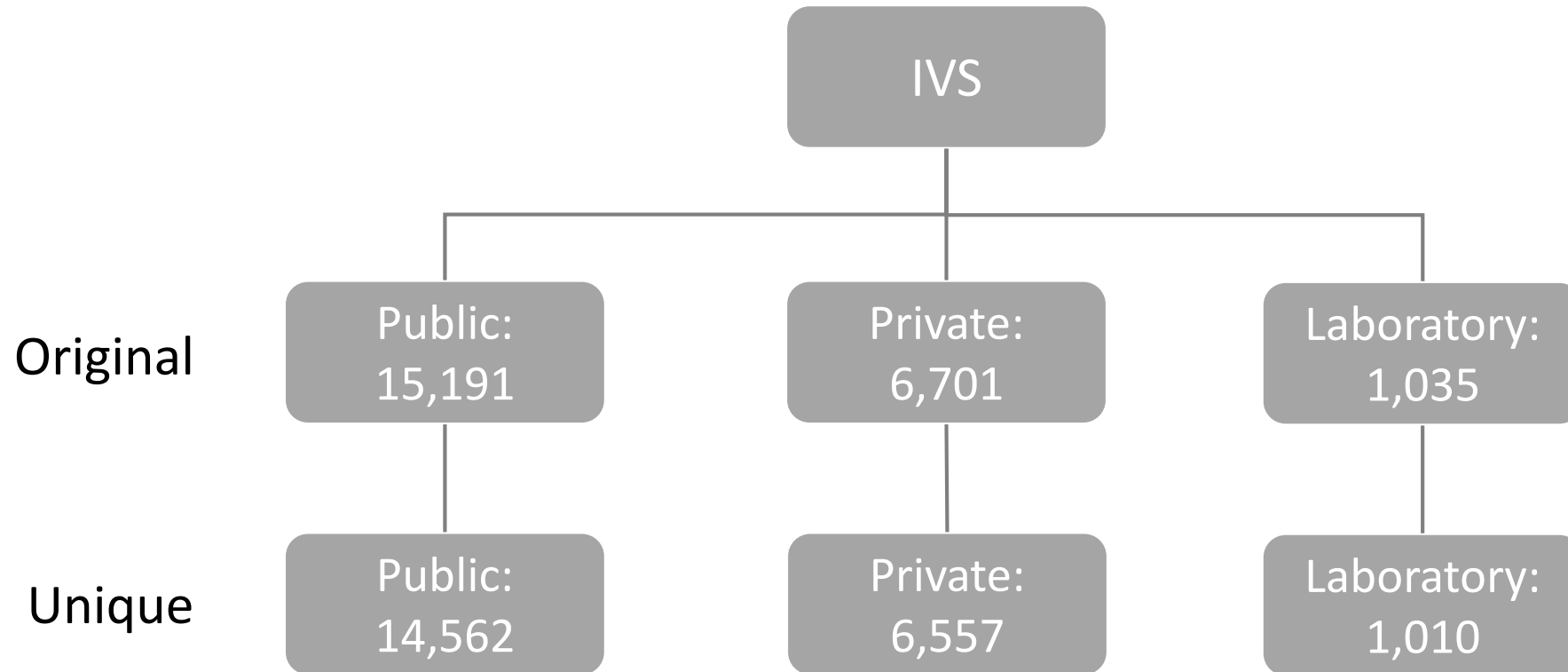
Deduplication of NTP data
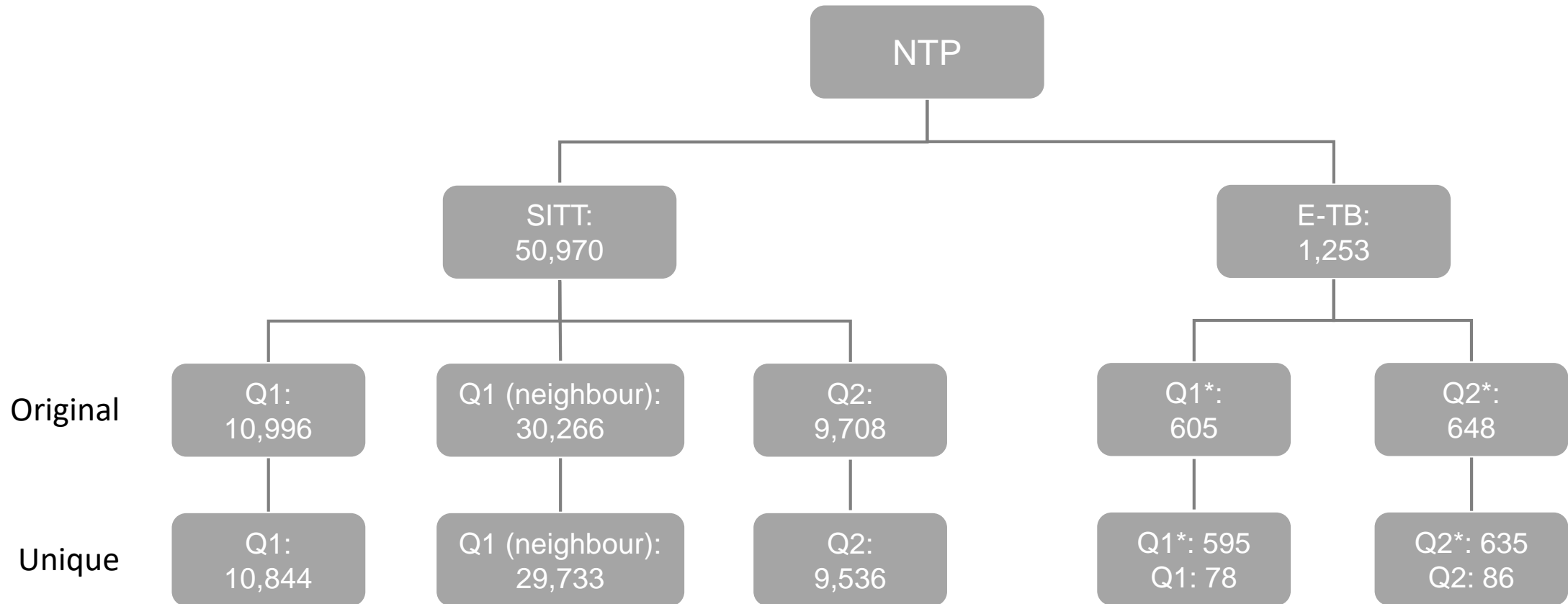
* Total Indonesia

Mapping of health facilities

Health facility mapping

Enumerated, eligible[1], and participated[2] health facilities by type

[1] At least one TB patient diagnosed or treated during the last three months

[2] Informed consent provided

PHC
- Enumerated: 727
- Eligible: 722
- Participated: 722

Public Hospital
- Enumerated: 55
- Eligible: 48
- Participated: 48

Private Hospital
- Enumerated: 156
- Eligible: 116
- Participated: 116

Clinics/BP4
- Enumerated: 1,522
- Eligible: 420
- Participated: 417

PPs
- Enumerated: 1,653
- Eligible: 339
- Participated: 337

Laboratory
- Enumerated: 94
- Eligible: 42
- Participated: 41

Legend: Enumerated, Eligible, Participated

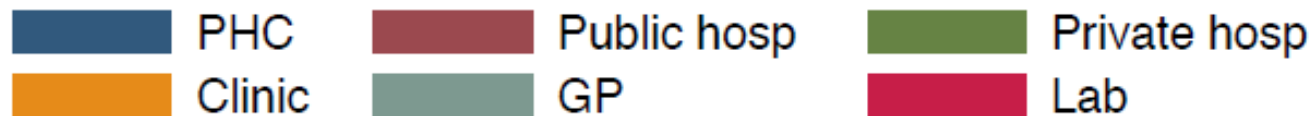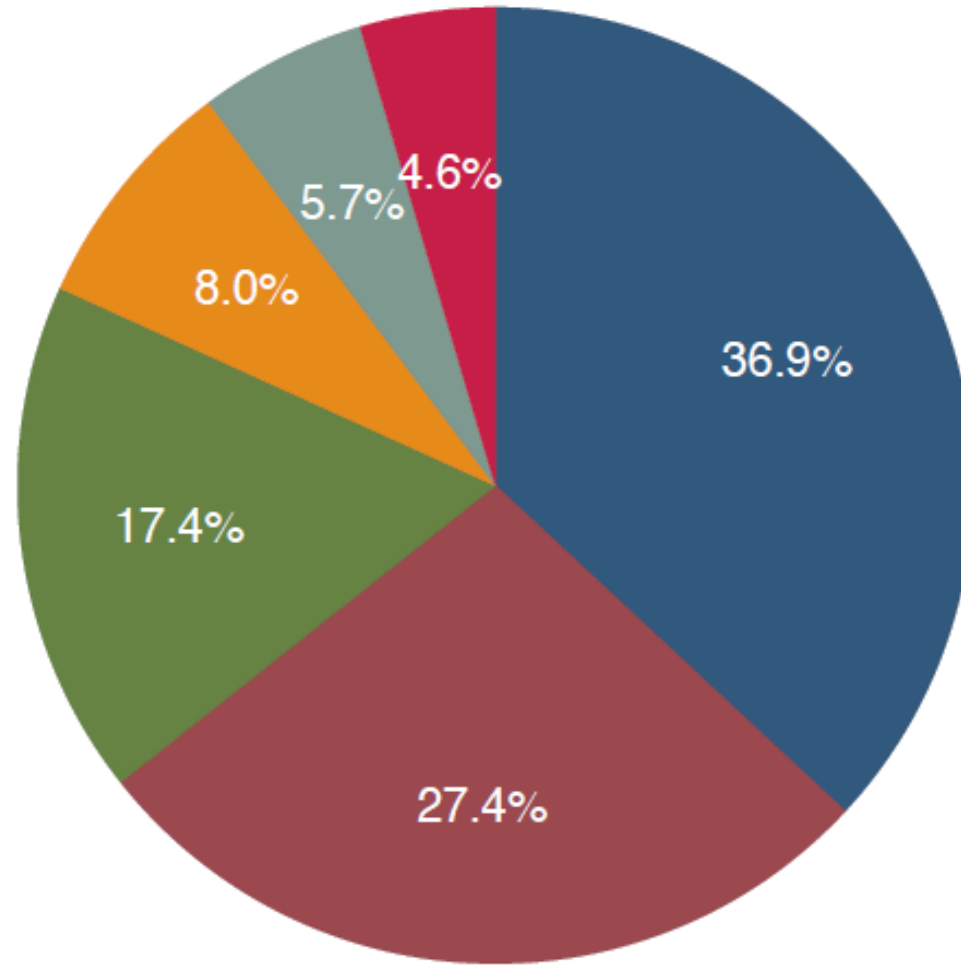# Results of analyses from IVS cases

Targeted study period Q1 2017

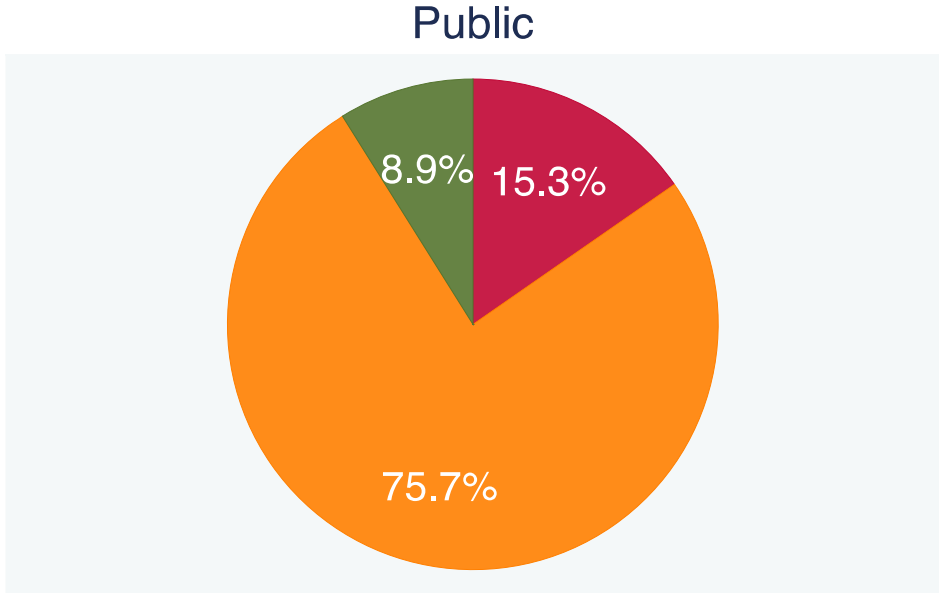# Distribution of IVS cases by health facility

Source	n
Total unique IVS cases	21,320
Non-Lab Public[1]	14,562
Non-Lab Private[2]	6,557
Laboratory[3]	1,010

[1] Puskesmas (PHC), hospitals, clinics
[2] Hospitals, clinics, GPs
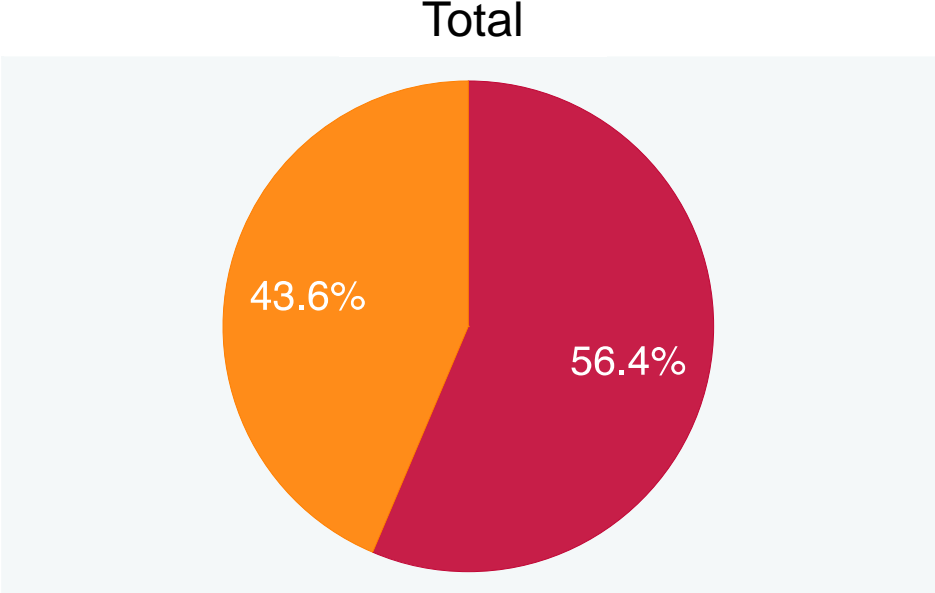[3] Public and private
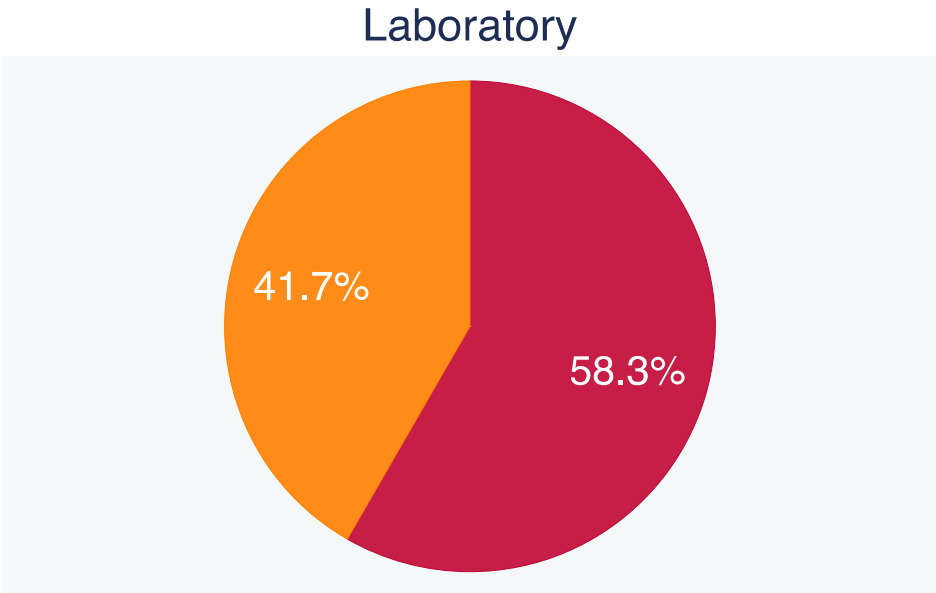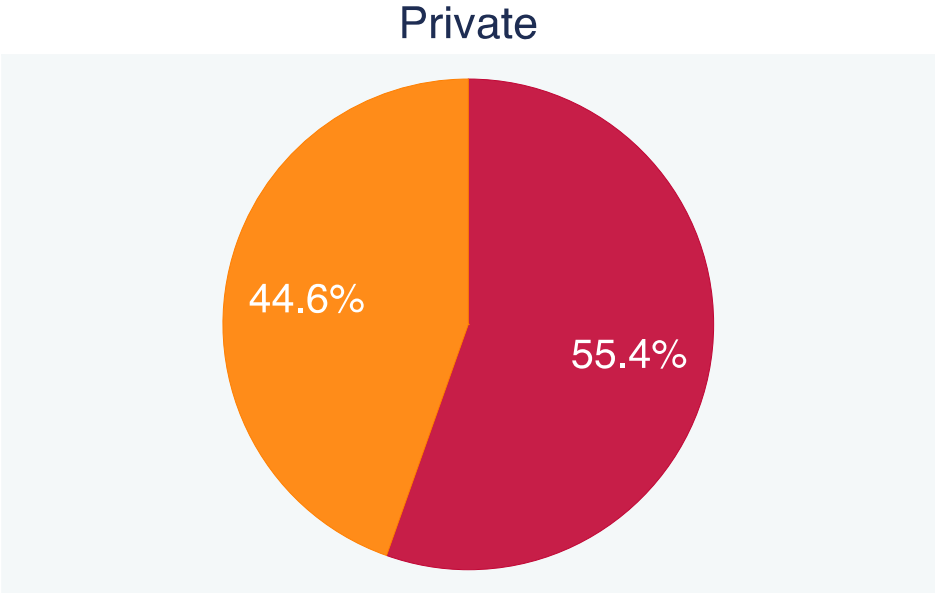

Legend:
- PHC
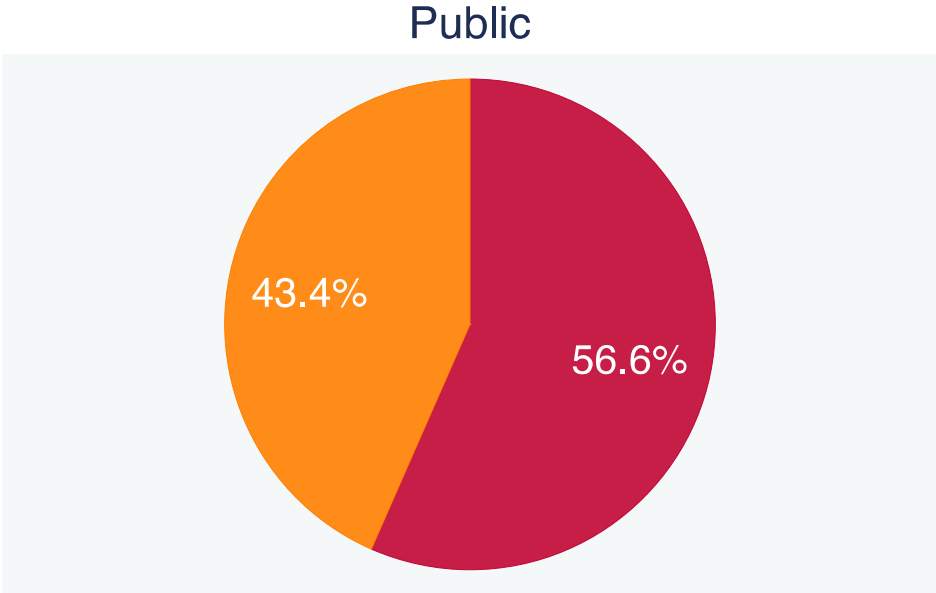- Public hosp
- Private hosp
- Clinic
- GP
- Lab
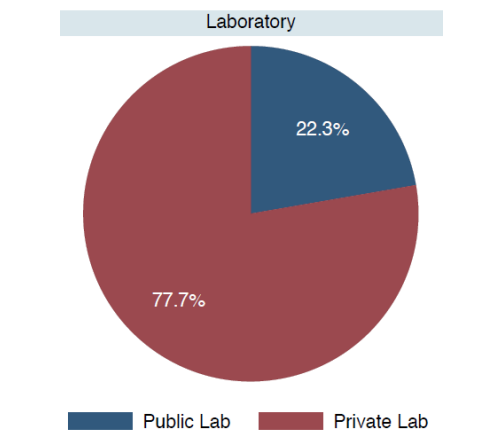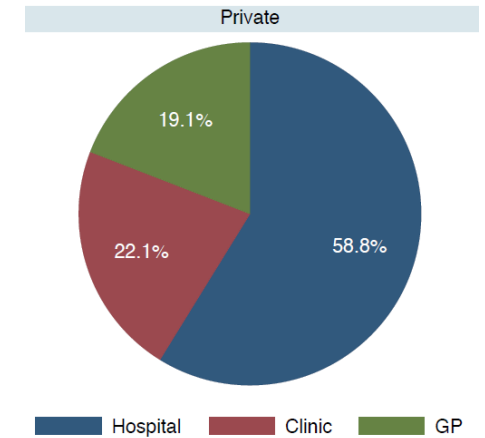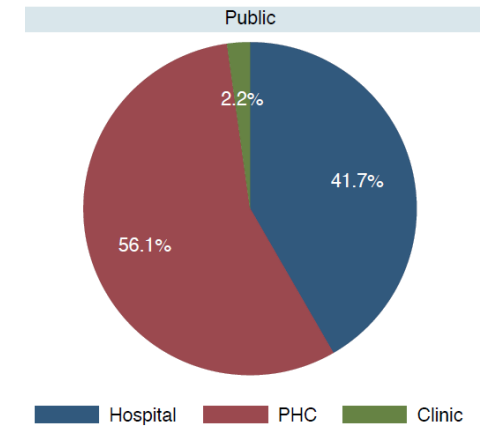
Distribution of IVS cases by age group
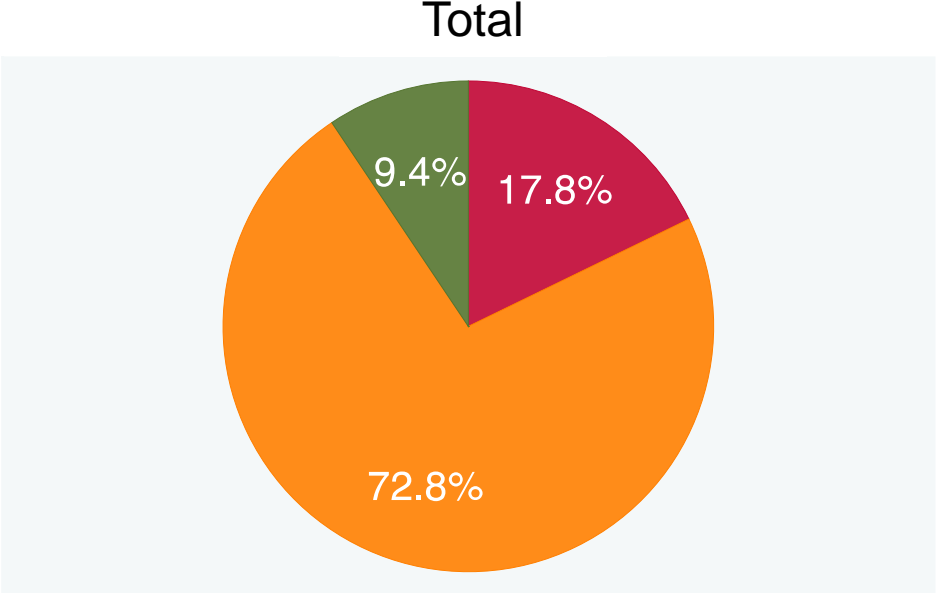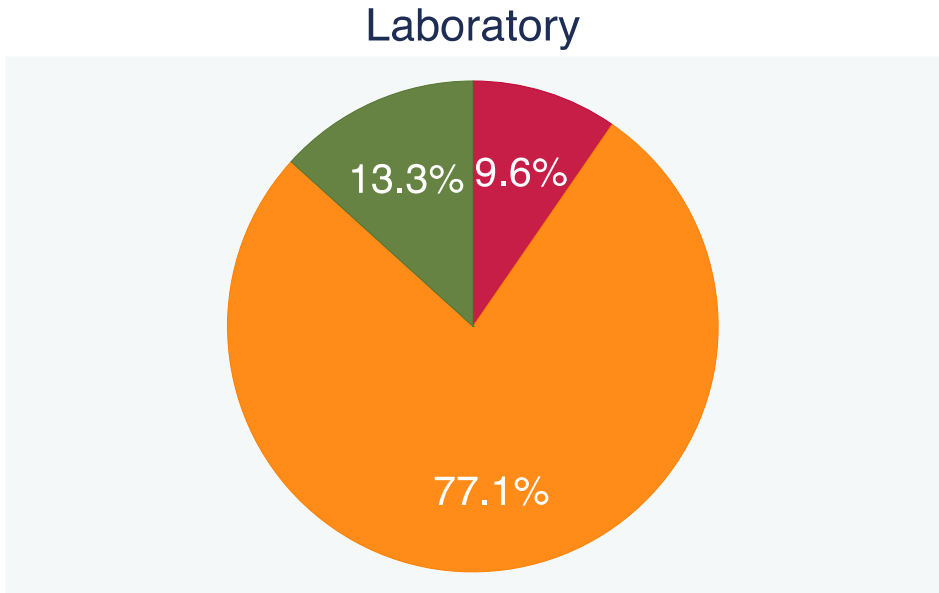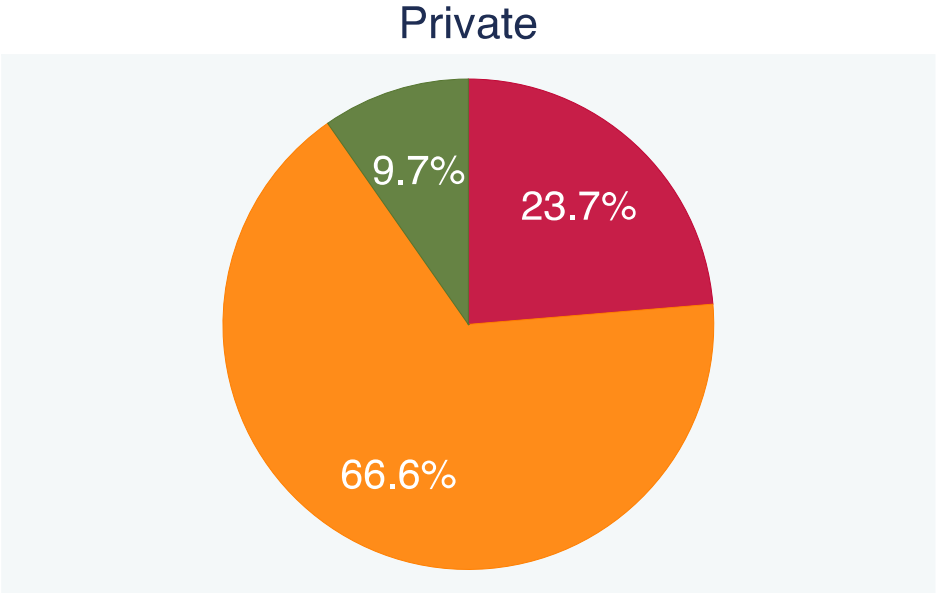
Distribution of IVS cases by gender

Distribution of IVS cases by region
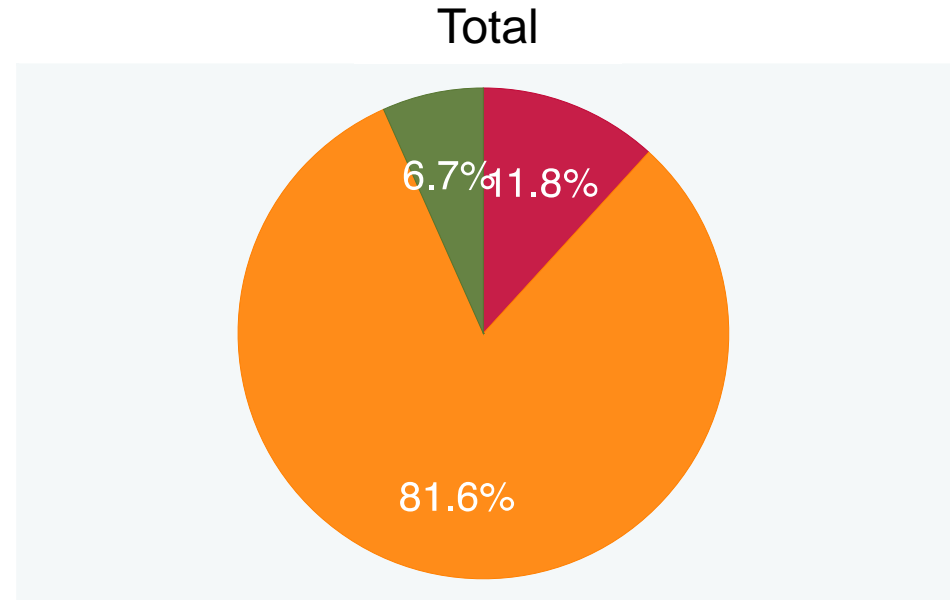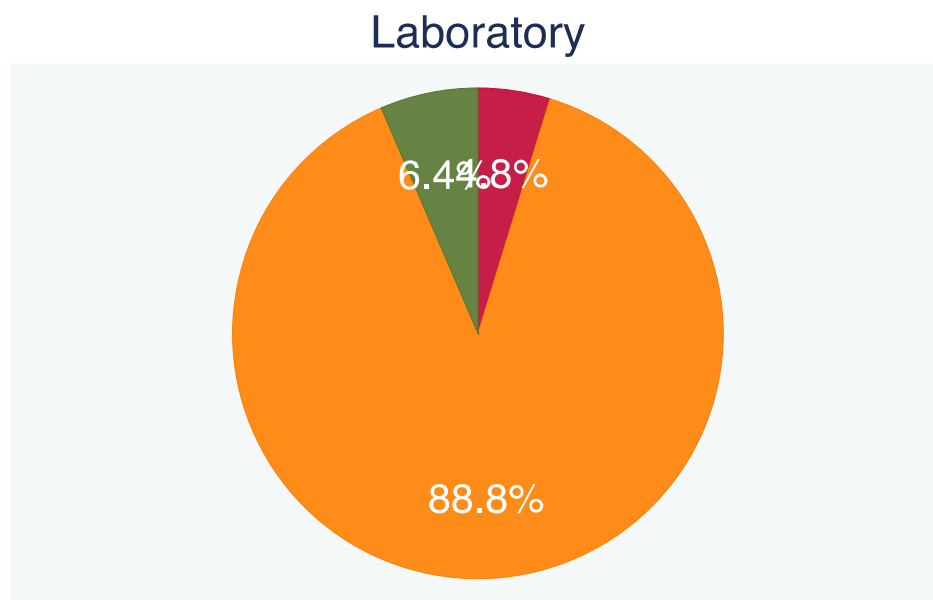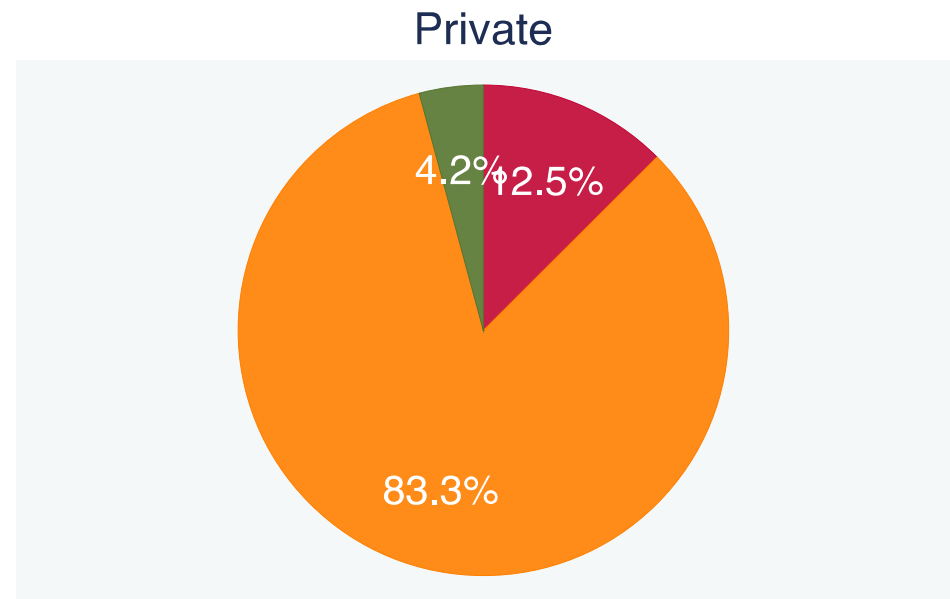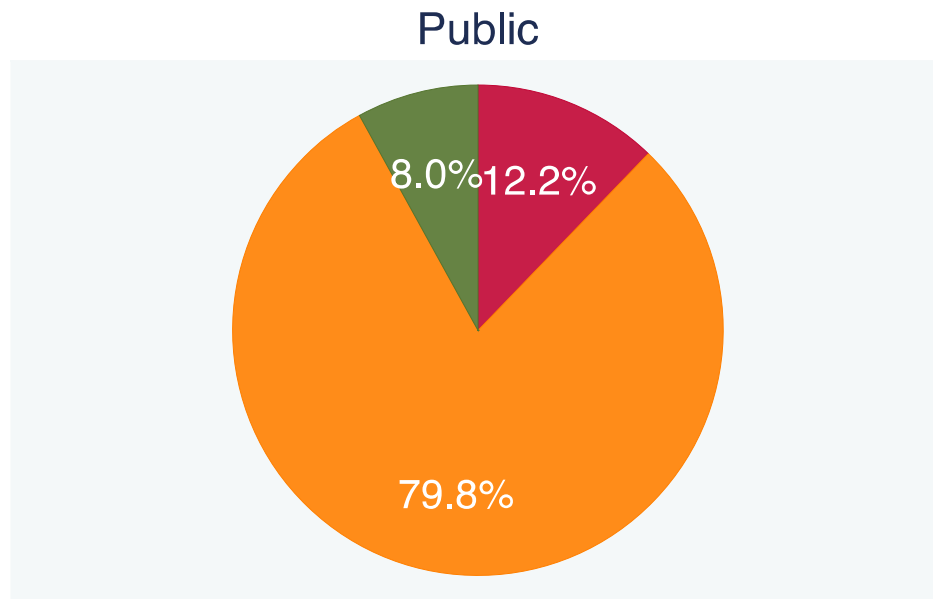
Distribution of cases by case type in each age group

| 0-14 | 15-64 | 65+ |

0-14: 2.5%, 97.5%

15-64: 43.0%, 57.0%

65+: 32.9%, 67.1%

Clinically diagnosed   Bacteriologically Confirmed
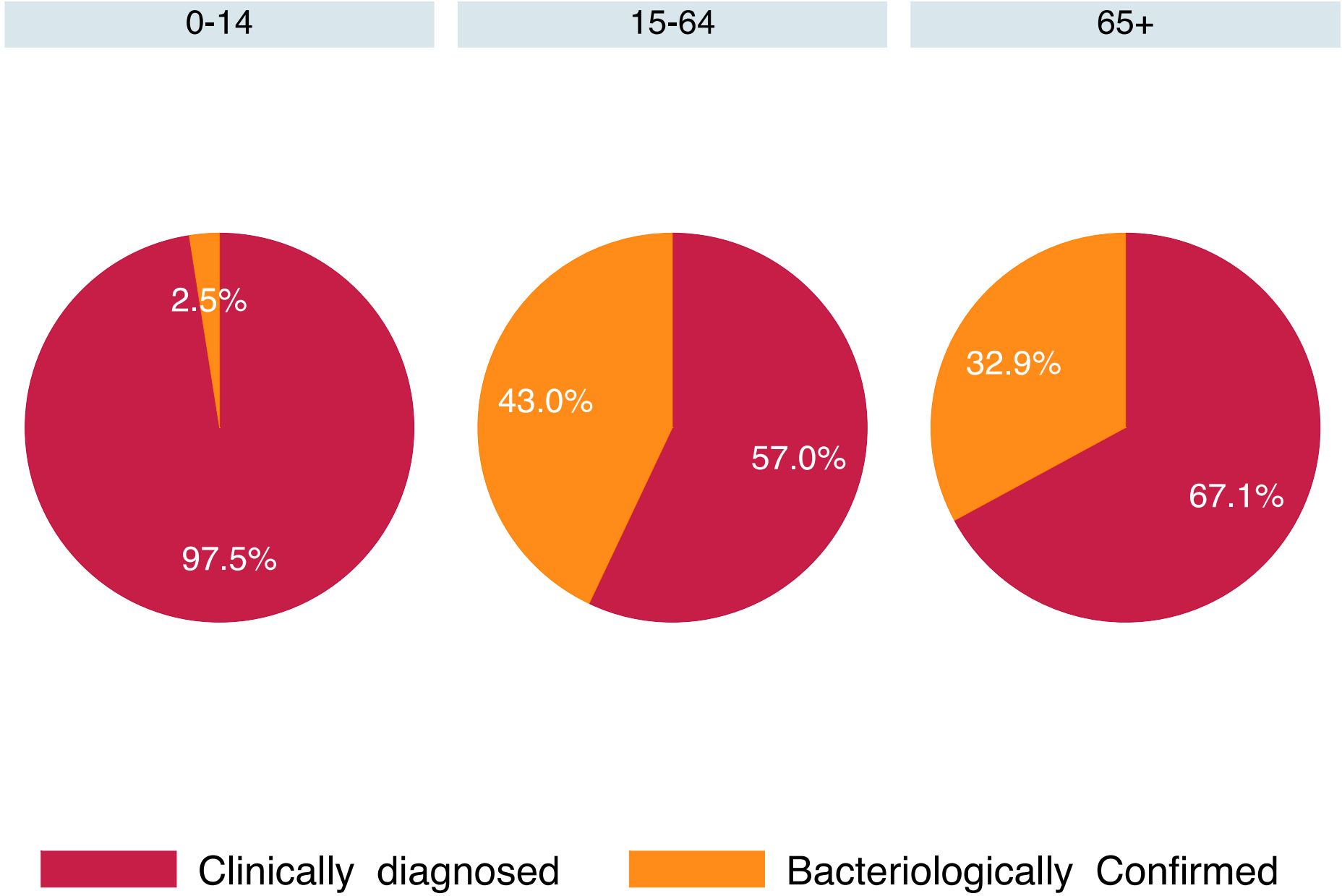
Distribution of cases by case type in each region
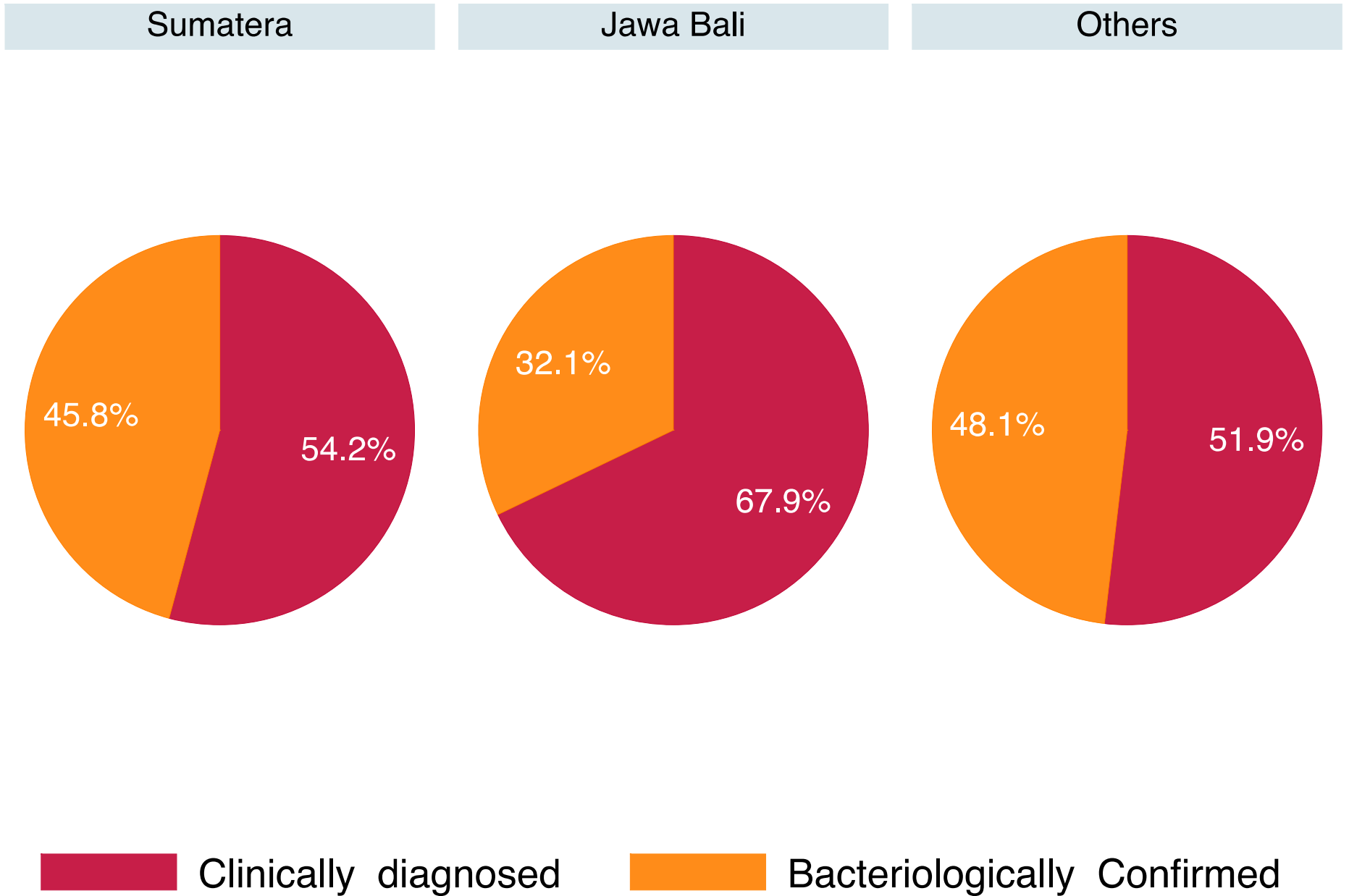
Adherence to national guidelines of TB treatment by region and total

Sumatera
FDC 59.8%
RHZE 33.9%

Jawa Bali
FDC 88.4%
RHZE 8.1%

Others
FDC 73.3%
RHZE 22.2%
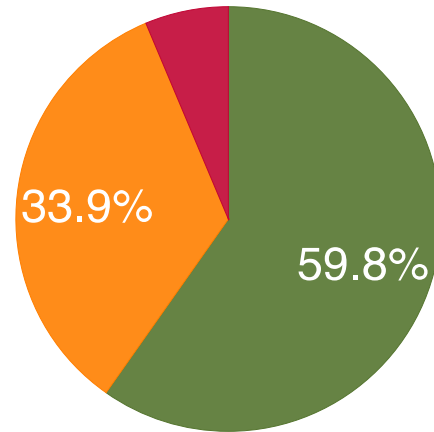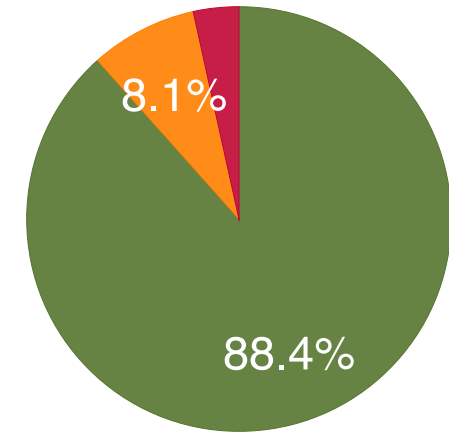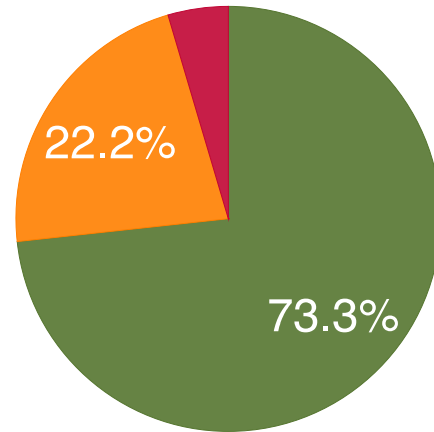
Total
FDC 83.6%
RHZE 12.5%
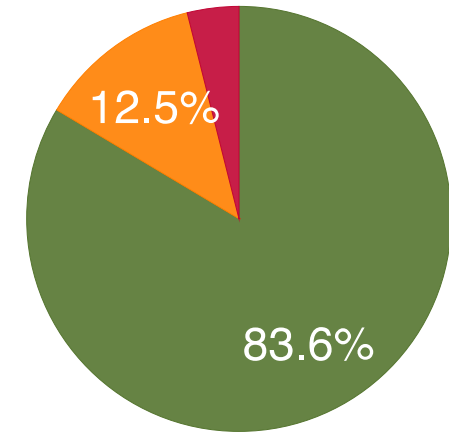
FDC   RHZE   Others

Adherence to national guidelines of TB treatment by DOTS/ Non DOTS

Non DOTS

10.7%
17.9%
71.4%

DOTS

3.4%
12.1%
84.5%

FDC RHZE Others
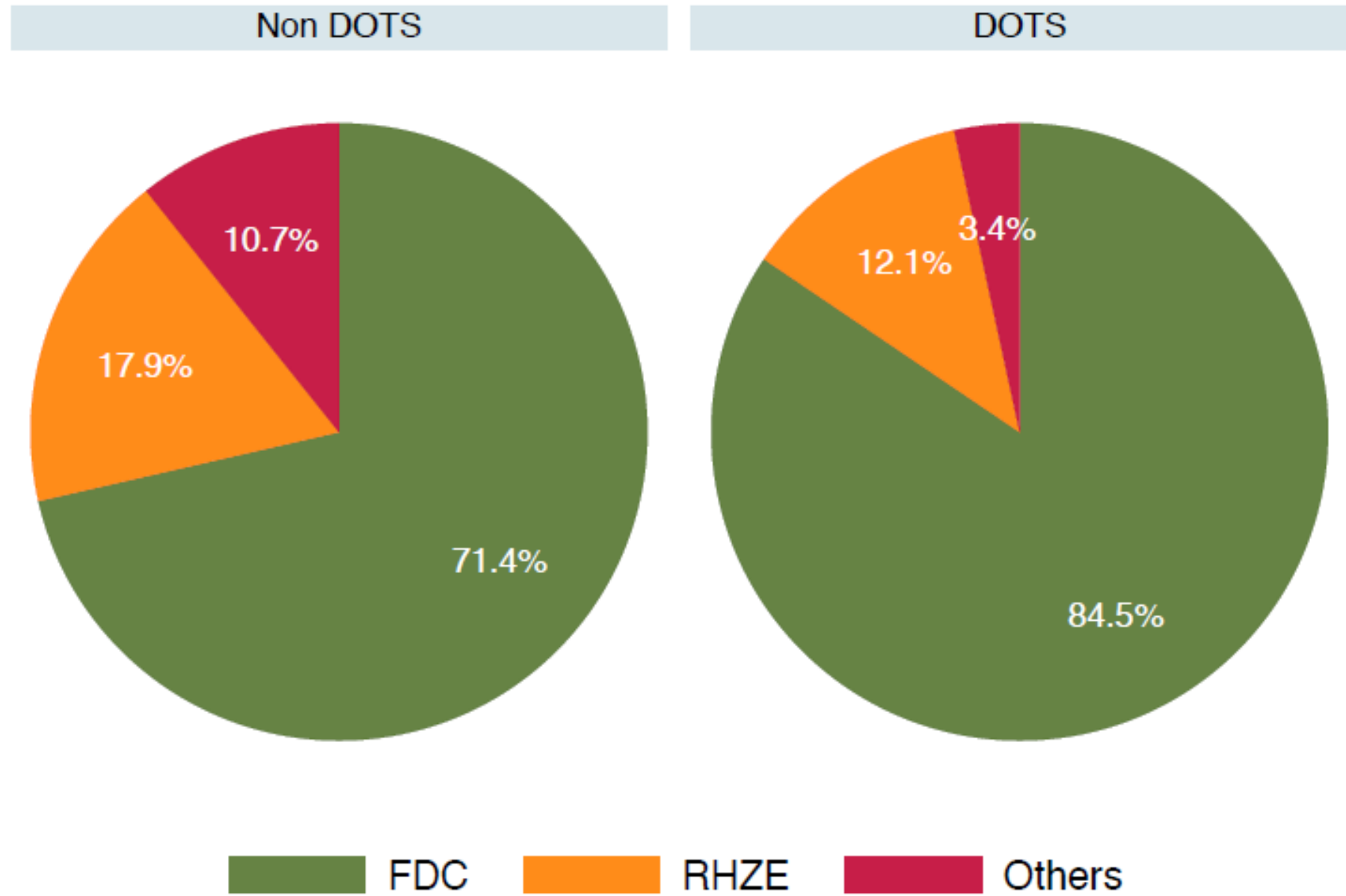
IVS and NTP databases matching results

Selected districts and their neighbouring* for matching buffer

Selected/Neighbour
- Not selected district
- Neighbouring district
- Selected district
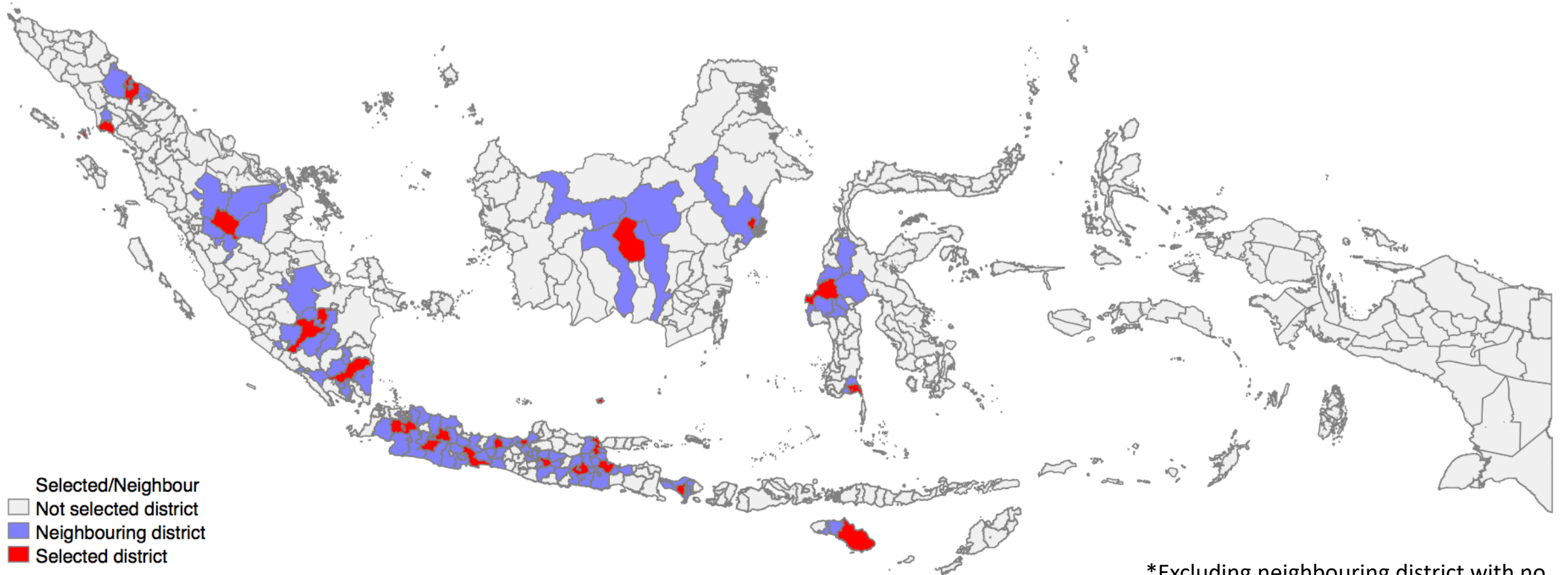
*Excluding neighbouring district with no geographical access to study districts (e.g. mountain separating 2 district)

Matching results of 4 data sources

Source	n
NTP (Unique)	13,211
IVS (Unique)	21,320
IVS: Non-Lab Public[1]	14,562
IVS: Non-Lab Private[2]	6,557
IVS: Laboratory[3]	1,010
NTP-IVS (Unique)	22,681

[1] Puskesmas (PHC), hospitals, clinics
[2] Hospitals, clinics, GPs
[3] Public and private

Not shown in the Venn Diagram:
NTP & Lab (not in Public and Private) = 129
NTP & Private & Lab (not in Public) = 3
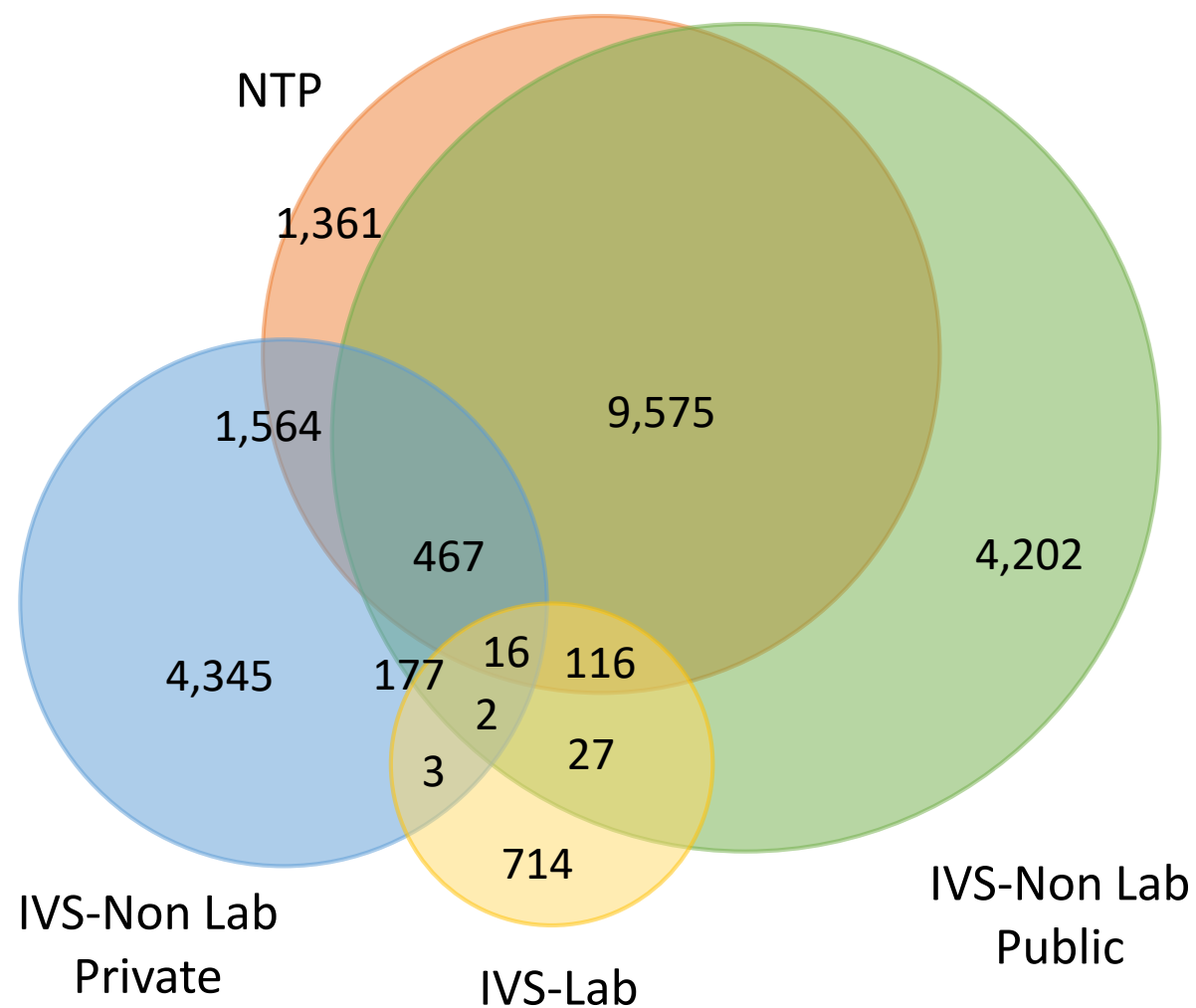
Under-reporting

(Weighted, stratified, clustered accounted for)

Total and by facility type

	Best estimate (95% CI)
Total	41% (36% - 46%)
Facility type	
Puskesmas	15% (11% - 20%)
Non-puskesmas	71% (61% - 79%)
Hospital	62% (52% - 72%)
Other (Clinics, GPs, Lab)	96% (92% - 98%)

By case type and by site of disease

	Best estimate (95% CI)
Case type	
Bacteriologically confirmed	21% (16% - 26%)
Clinically diagnosed	55% (49% - 61%)
Site of disease	
Pulmonary	38% (33% - 44%)
Extra-pulmonary	58% (49% - 66%)

By age group and by sex

	Best estimate (95% CI)
Age group	
<15	54% (44% - 64%)
>=15	39% (34% - 44%)
Sex	
Male	41% (36% - 47%)
Female	41% (36% - 46%)

By geographical area

	Best estimate (95% CI)
Geographical area	
Sumatera	40% (24% - 59%)
Bali/Java	42% (18% - 47%)
Other	39% (28% - 51%)

Risk factors for TB under-reporting
(Logistic regression, weighted, stratified & clustered accounted for)

Risk factors	Crude OR (95% CI)	Adjusted OR (95% CI)
Clinic. vs bact. (ref)	4.8 (3.4 - 6.8)	4.5 (3.1 - 6.5)
Extra pulm. vs Pulm. (ref)	2.2 (1.5 - 3.3)	1.4 (0.9 - 2.2)
Child vs adult (ref)	1.8 (1.3 - 2.6)	1.0 (0.7 - 1.5)
Male vs female (ref)	1.0 (0.9 - 1.1)	1.1 (1.0 - 1.2)

Capture-recapture*

(To estimate undetected TB cases and extrapolate to total TB incidence)

*Additional analysis not originally part of protocol

Estimate of undetected cases

Source	n
NTP (Unique)	13,211
IVS (Unique)	21,320
IVS: Public[1]	14,747
IVS: Private[2]	7,323
NTP-IVS (Unique)	22,681

[1] Puskesmas (PHC), hospitals, clinics, labs
[2] Hospitals, clinics, GPs, labs
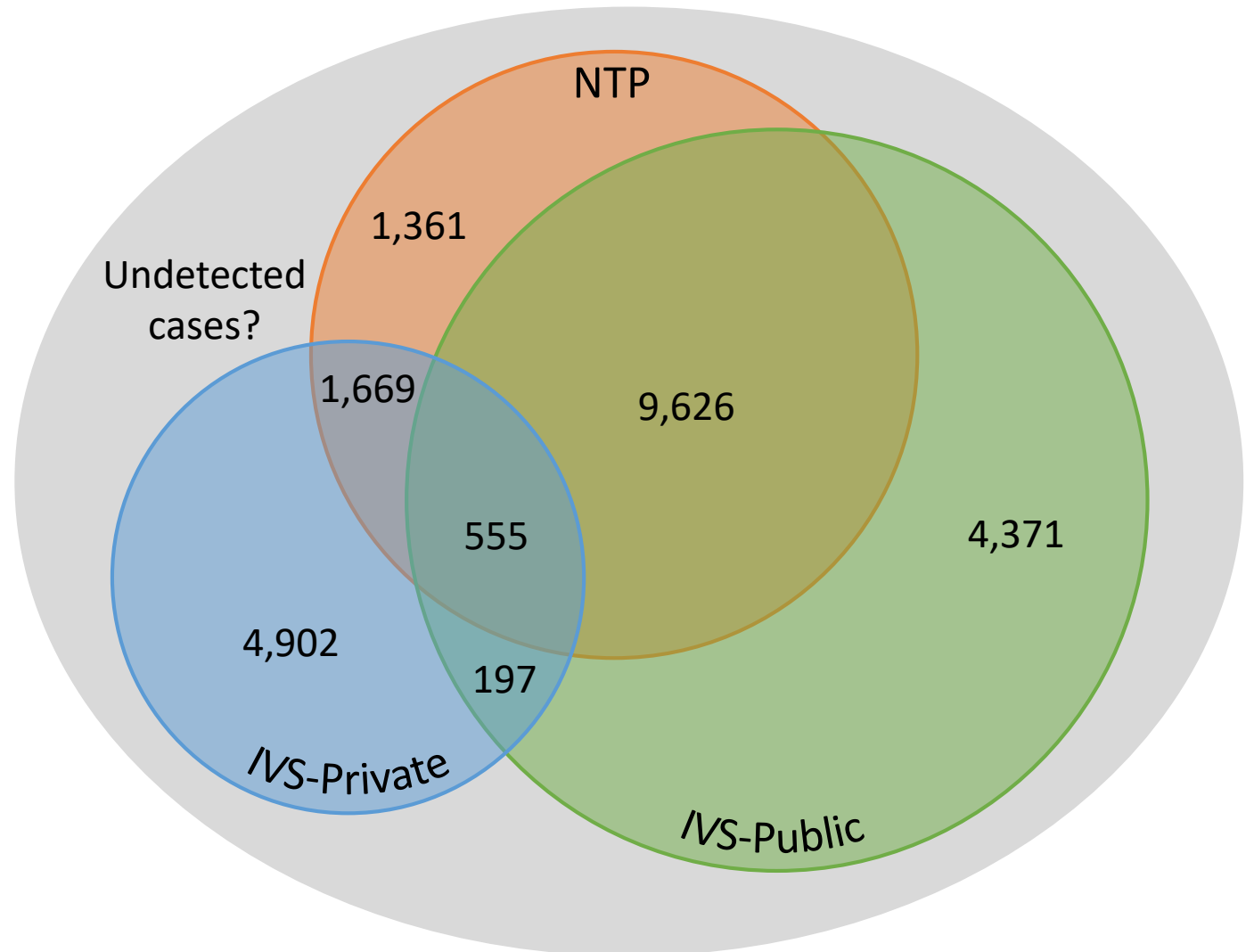
Capture-recapture using Poisson Model

Model	Variables
Model 1	ntp + public + private + ntp*public + ntp*private + public*private + ntp*public*private
Model 2	ntp + public + private + public*private
Model 3	ntp + public + private + ntp*public
Model 4	ntp + public + private + ntp*private
Model 5	ntp + public + private

Estimates and Akaike Information Criterion (AIC) for optimal model selection

Model	b_0*	SE(b_0)	95% CI	AIC
Model 1	5,113.7	478.3	4,257.2 - 6,142.6	79.2
Model 2	1,087.7	33.1	1,024.7 - 1,154.4	3,670.6
Model 3	31,096.6	812.2	29,544.8 - 32,729.9	4,124.0
Model 4	3,340.8	71.0	3,204.6 - 3,482.8	12,732.3
Model 5	4,927.1	88.0	4,757.5 - 5,102.7	14,211.3

*Estimate of total undetected cases in 23 selected districts

Capture-recapture to estimate the number of undetected cases

Estimate the number of undetected cases

5,114 (95% CI: 4,257-6,143)

Proportion of undetected cases

= 5,114/(5,114+22,681)
= 18.4%
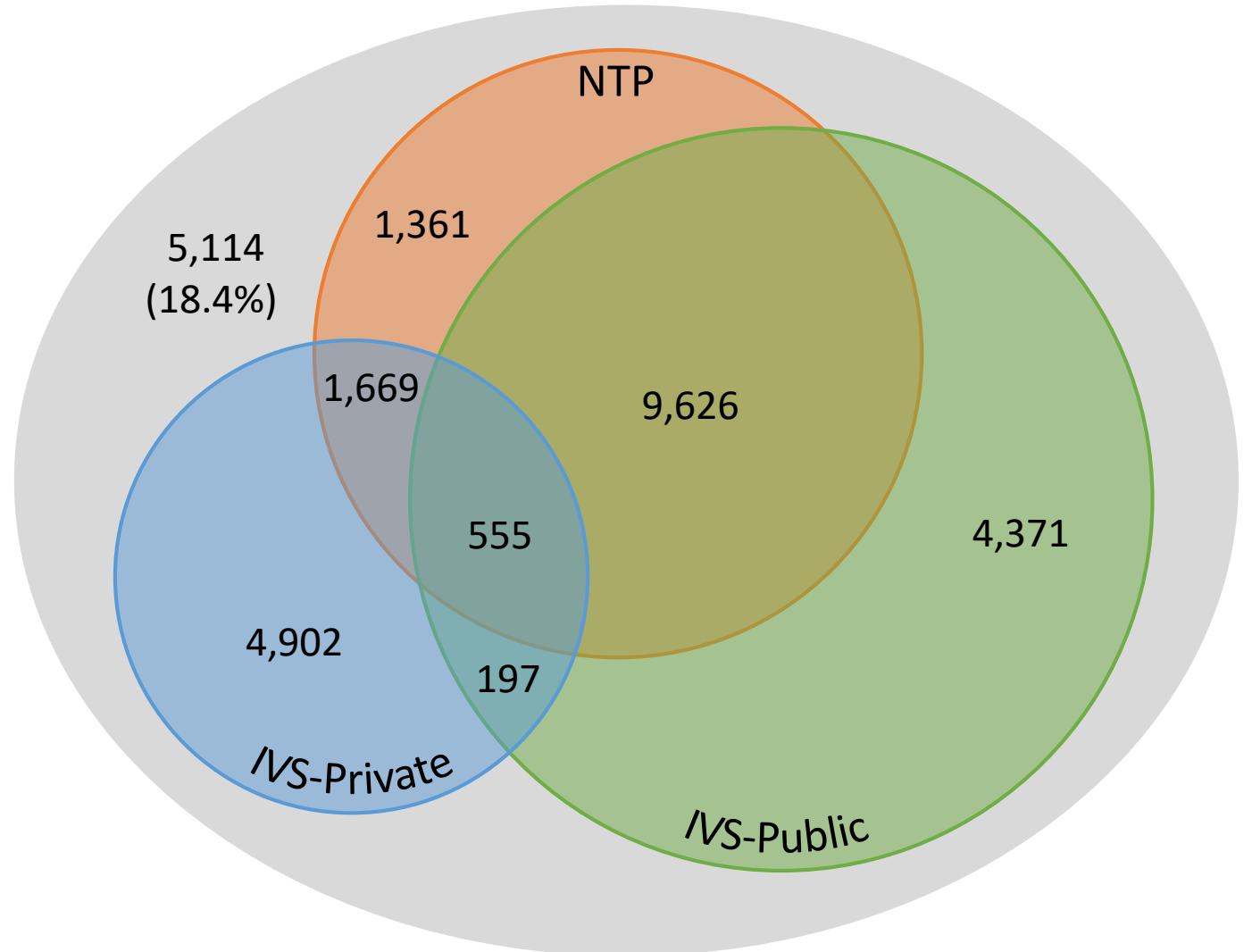
National estimate of TB incidence

$$\hat{I} = \frac{n/(1-u)}{1-d}$$

- n is number of notified cases in 2017
- u is proportion of under reporting, u = 0.4128 (uncertainty, se = 0.0241)
- d is proportion of undetected cases, d = 0.1837, (uncertainty, se = 0.0279)

Summary of key results

- 1.681 health facilities from 23 districts participated in the study
- 21.320 TB cases were found in Q1 2017 from the study
    - 68% of cases in public facilities (56% PHC, 42% hospitals, 2% clinics)
    - 28% of cases in private facilities (59% hospitals, 22% clinics, 19%GPs)
    - 4% labs (22% public, 78% private)
- Overall under-reporting 41% (15% PHC, 62% hospital, 96% lab/GPs/clinics)
    - Clinically diagnosed, extra pulmonary and children are more likely to be under-reported
- Nationally more than 84% of TB cases are prescribed with treatment that adheres to national guidelines (regional differences exist)
- Half of incident TB cases are detected and reported to NTP and from the remaining "missing" cases 2/3 are detected but not reported and 1/3 not detected

Key lessons learned

- Exhaustive mapping of all health facilities that diagnose and treat TB must be kept up to date in every district
  - What is the best mechanism to ensure this?
- Participation of eligible health facilities was extremely high 99.6%
  - Successful model of engagement with different type of health facilities could be rolled out to the rest of the country
- Record linkage exercises to be routinely implemented
  - Deduplication of NTP databases
 - Matching with other sources of TB cases (SIRS, SIHA, BPJS, SRS)

Limitations

- Data collection could not be conducted in 6 health facilities from 2 districts due to difficult geographical access

- 1.361 TB cases that appear in SITT/eTB manager were not captured by IVS enumerators

- 3 labs from 3 districts refused to participate

- Probabilistic record linkage is not fail-proof (sensitivity analyses were conducted to investigate potential bias of results – not found to be the case)

- We did not include pharmacies in the sampling frame of the study

Acknowledgements

- NIHRD
- NTP
- TB Expert Committee
- District field teams
- Provincial and district health offices
- Medical associations (national and district)
- Hospital associations (national and district)
- Pusdatin
- WHO
- Technical partners
- Funding partners (Global Fund, TB Alliance)

Sensitivity analyses

Sensitivity analysis for NTP cases not found in IVS databases

IVS

NTP

1,361

11,850 + 1,361
= 13,211

9,470 – 1,361
= 8,109
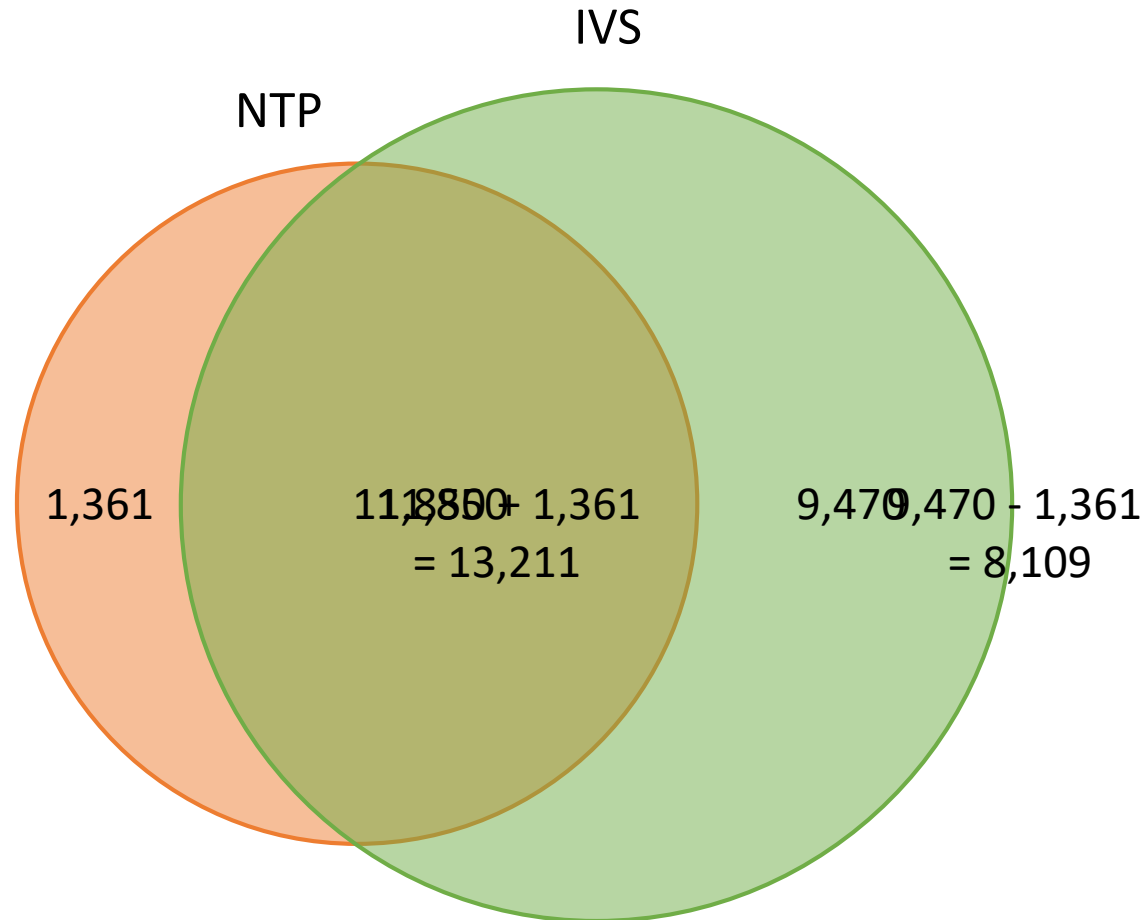
Crude under-reporting

41.7%

Assuming no unmatched NTP records, crude under-reporting

38.0%

Sensitivity analysis for laboratory data

	Match	Unique	Total
Bact. (+)	165	53	218
Bact. (-)	131	661	792
Total	296	714	1,010

Assumption	Est.	SE	95% CI
Assuming 131+661 are false-negative (FN)	41%	2%	36% - 46%
Assuming 131 are FN and 661 are truly-negative (TN)	39%	3%	33% - 44%
Assuming 131+661 are TN	39%	3%	33% - 44%