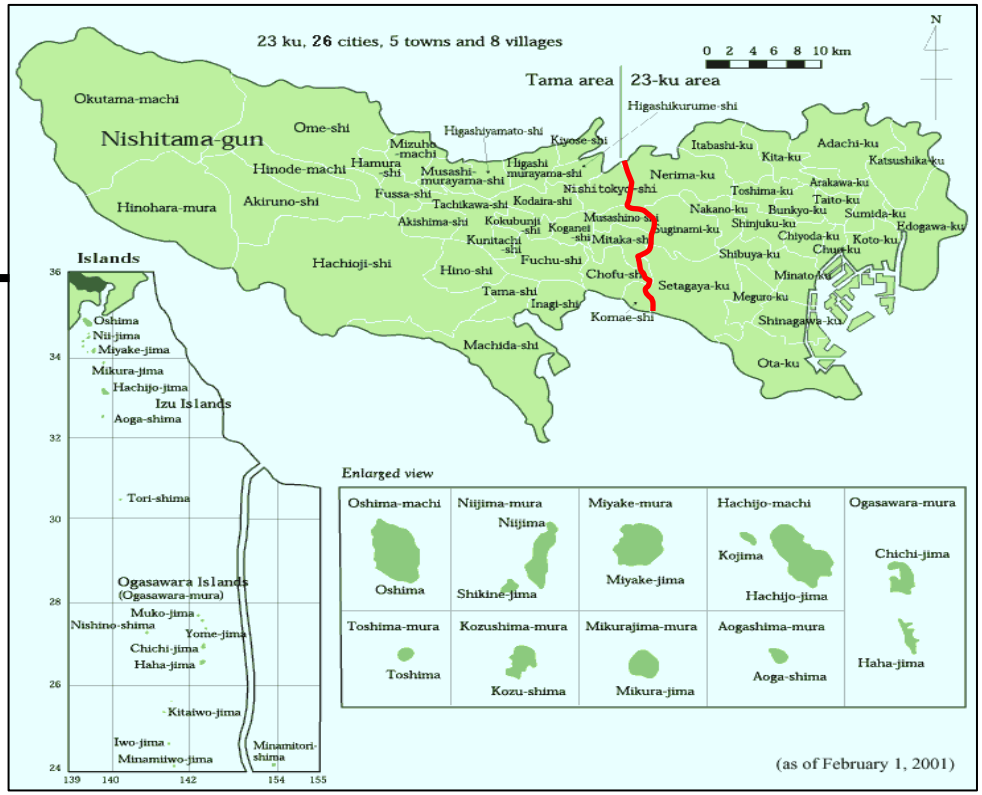
Mosquito-borne diseases in Tokyo

Tokyo's measures to control disease-carrying mosquitoes

Be safe and secure
without mosquitoes!

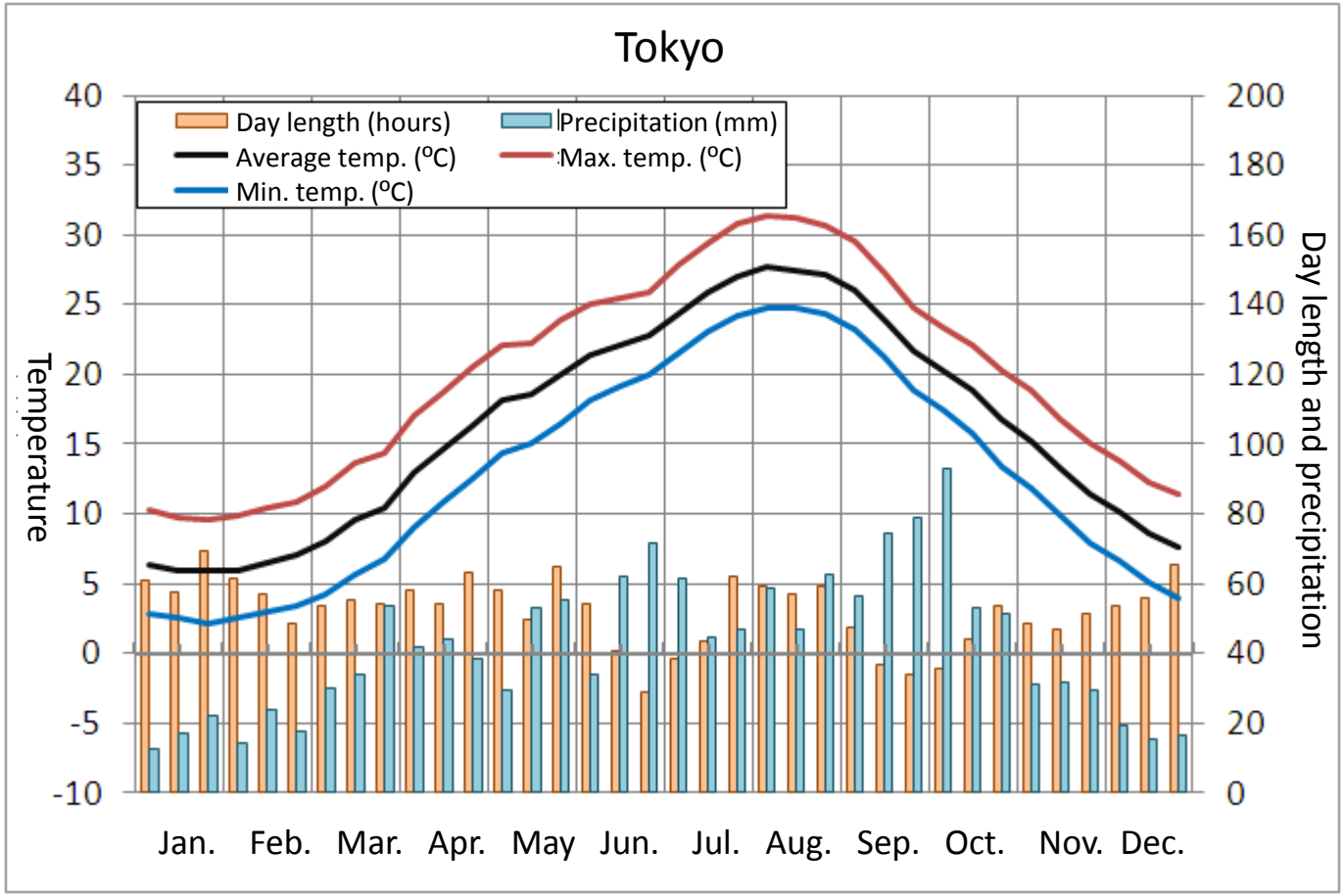
Tokyo overview



Year	Population As of October 1, 2015				Population density	Population change rate 2010-2015	Foreign population
	Total	< 14 y of age (%)	15-64 y of age (%)	≥ 65 y of age (%)	(n/km²)	(%)	
2015	13,515,271	1,518,130 (11.5)	8,734,155 (65.9)	3,005,516 (22.7)	6168.7	2.7	378,564

Source: National Census Oct. 1, 2015

Climate of Tokyo



Source: Tokyo District Meteorological Observatory's web site

Mosquito species that transmit infectious diseases

Aedes albopictus

Culex pipiens

Culex tritaeniorhynchus

	West Nile fever	Dengue fever	Chikungunya fever	Malaria	Zika fever	Japanese encephalitis
Aedes albopictus	●	●	●		●	
Culex pipiens *C. pipiens molestus*	●					
Anopheles	●			●		
C. tritaeniorhynchus	●					●
*Aedes aegypti**	●	●	●		●	

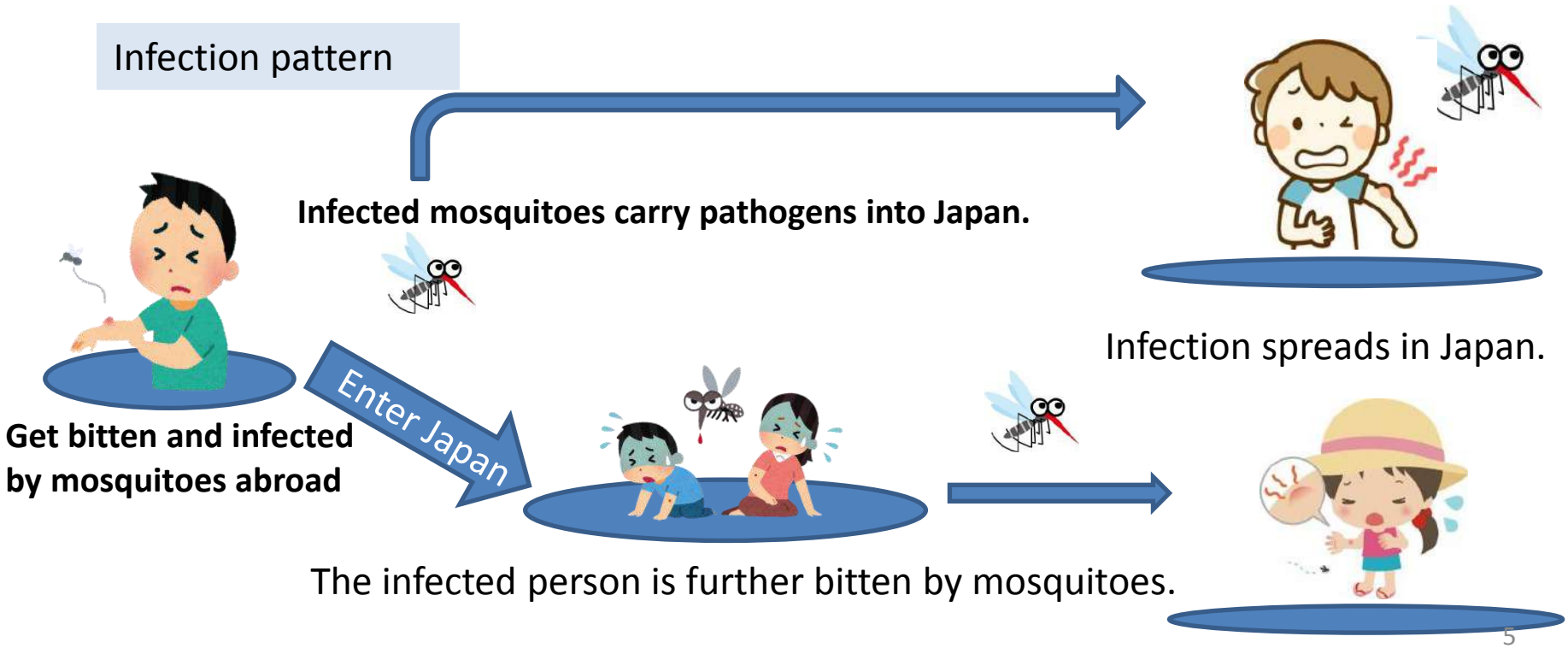
* does not inhabit Japan.

Source: "Survey on mosquitoes in relation to dengue fever" by Environmental Information Division

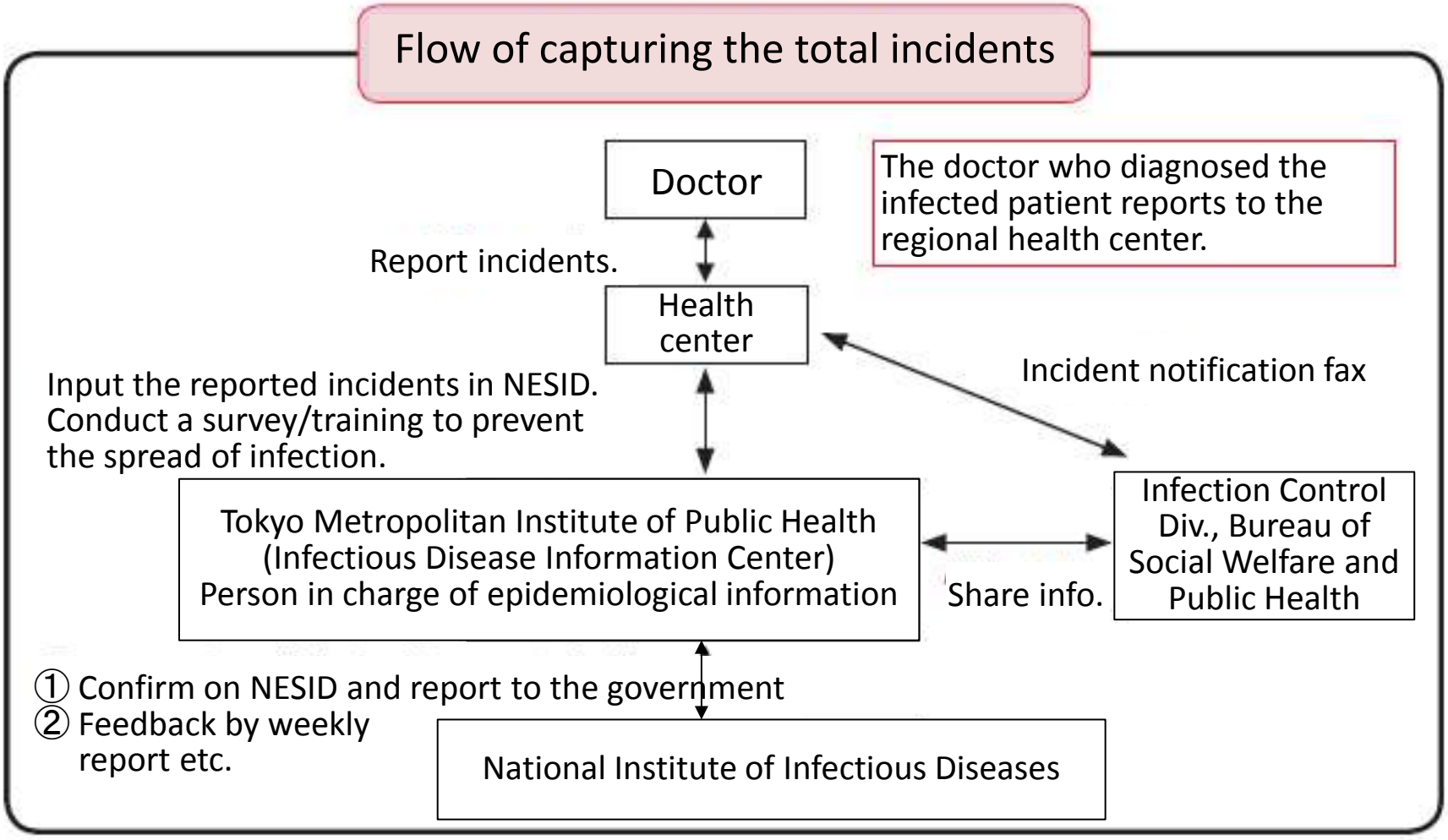
Concern over epidemics of mosquito-borne diseases

- As advances in transportation have allowed infectious pathogens to enter Japan from epidemic areas using people and goods as vehicles, concerns are growing over epidemics of diseases carried by mosquitoes, such as dengue fever and Zika virus infection.

Infection pattern



Flow of reporting mosquito-borne diseases



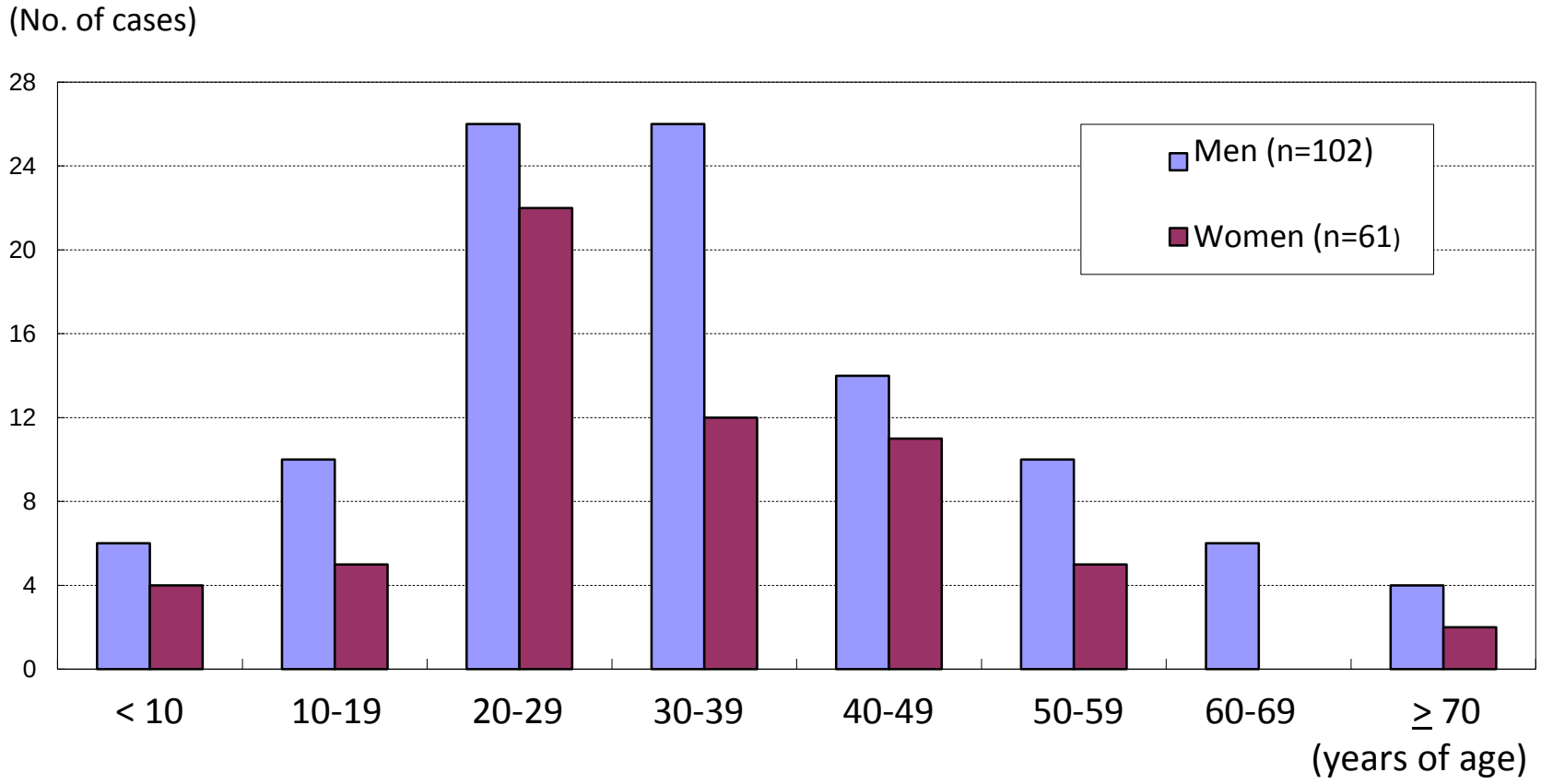
Mosquito-borne disease incidents in Tokyo

Disease	2013	2014	2015	2016	2017
West Nile fever	0	0	0	0	0
Yellow fever	0	0	0	0	0
Zika virus infection	×	×	×	3	0
Western equine encephalitis	0	0	0	0	0
Chikungunya fever	4	5	7	4	3
Dengue fever	66	163*	92	90	65
Eastern equine encephalitis	0	0	0	0	0
Japanese encephalitis	0	0	0	0	0
Venezuelan equine encephalitis	0	0	0	0	0
Hendra virus infection	0	0	0	0	0
Malaria	12	27	16	18	27
Tularemia	0	0	0	0	0

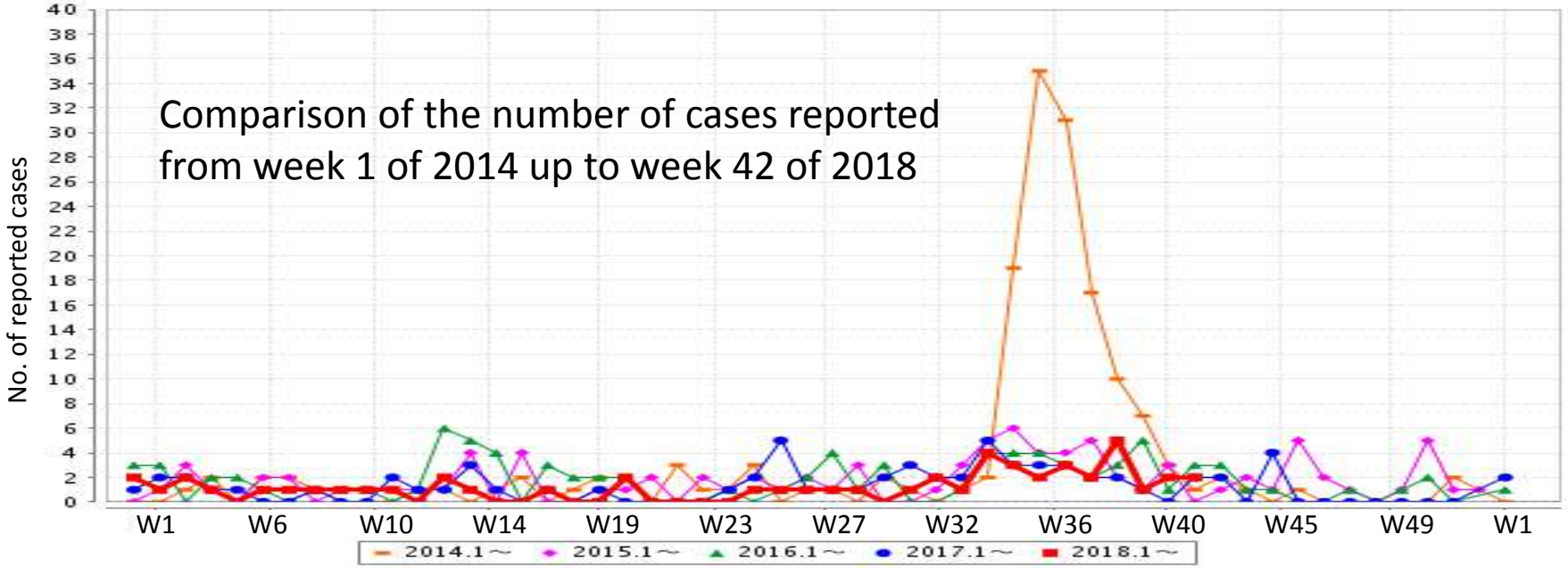
* Including domestically acquired infection

In 2014, a dengue fever outbreak occurred in Tokyo

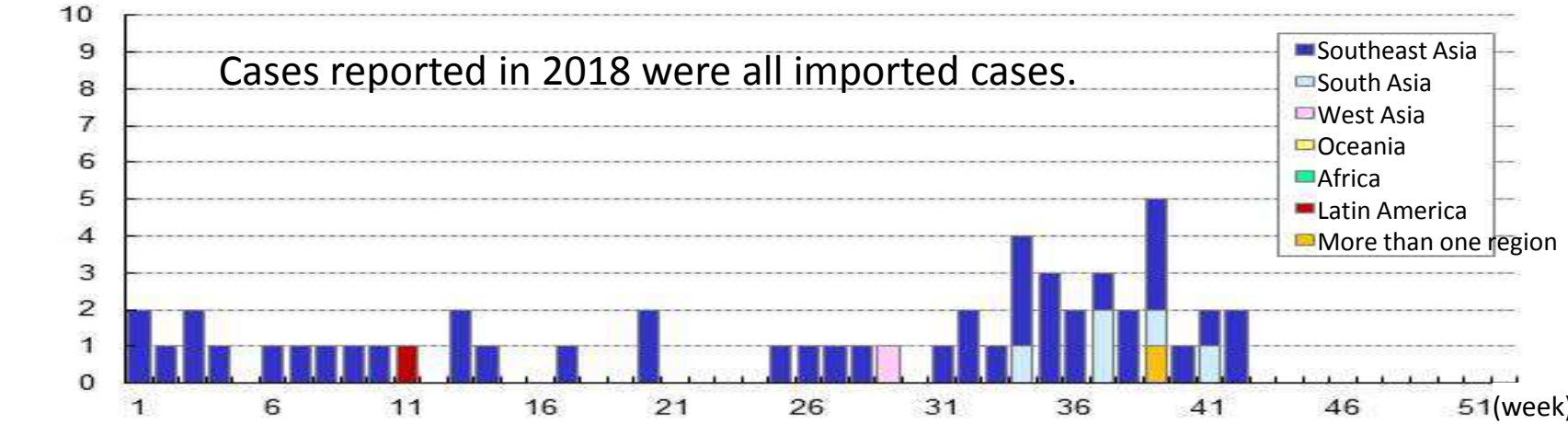
Number of reported dengue fever cases (n=163) by sex and age in 2014



Number of reported dengue fever cases and estimated infected areas

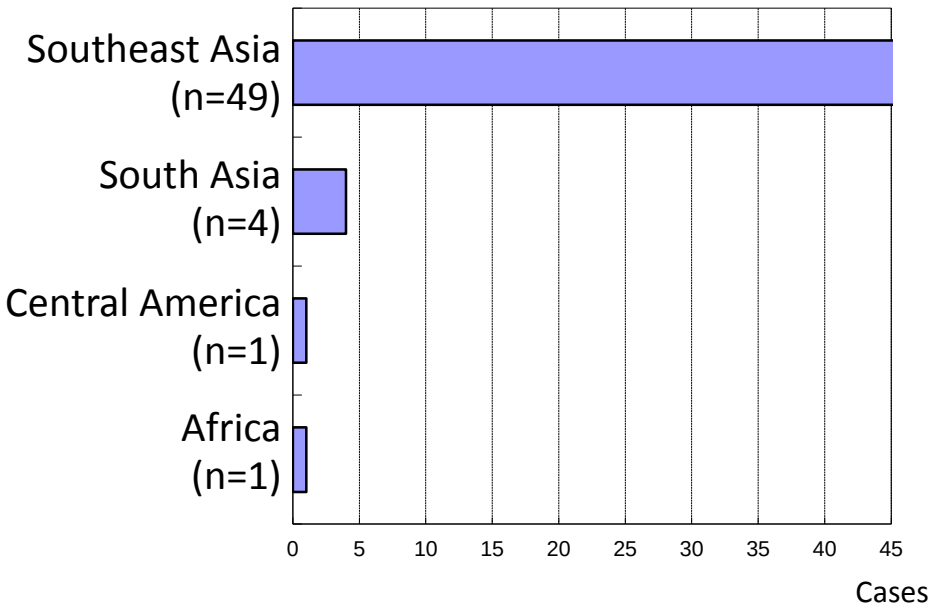


Number of reports per week per estimated infectious area from W1 to W42 (up to Oct. 21) in 2018



Detailed account of the areas estimated to be infected with dengue fever in 2017 (n=55)

Country	No. of cases
Indonesia	18
Thailand	10
Malaysia	7
Philippines	5
India	2
Singapore	2
Malaysia/Singapore	2
Myanmar	2
Cuba/Mexico	1
Sri Lanka	1
Thailand/Indonesia	1
Tanzania	1
Maldives	1
East Timor	1
French Polynesia	1



Serotyping of samples from patients with mosquito-borne diseases

○ Samples from 199 patients received from April to the end of December in 2017 were tested for viruses responsible for mosquito-borne diseases.

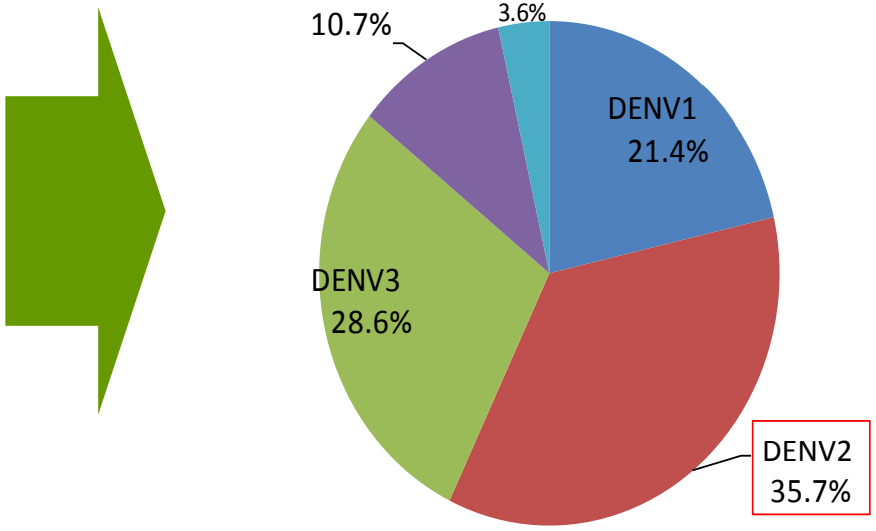
○ 27 cases, which comprised about 23% of the total cases, were found positive for DENV, none of which were domestically acquired.

○ A patient who returned from India was tested positive for chikungunya virus in the sample.

○The most frequent serotype was dengue type 2 (DENV2, 35.7% of the total).

○The full length of the DENV region (about 1.5 kb) was analyzed and compiled into a database.

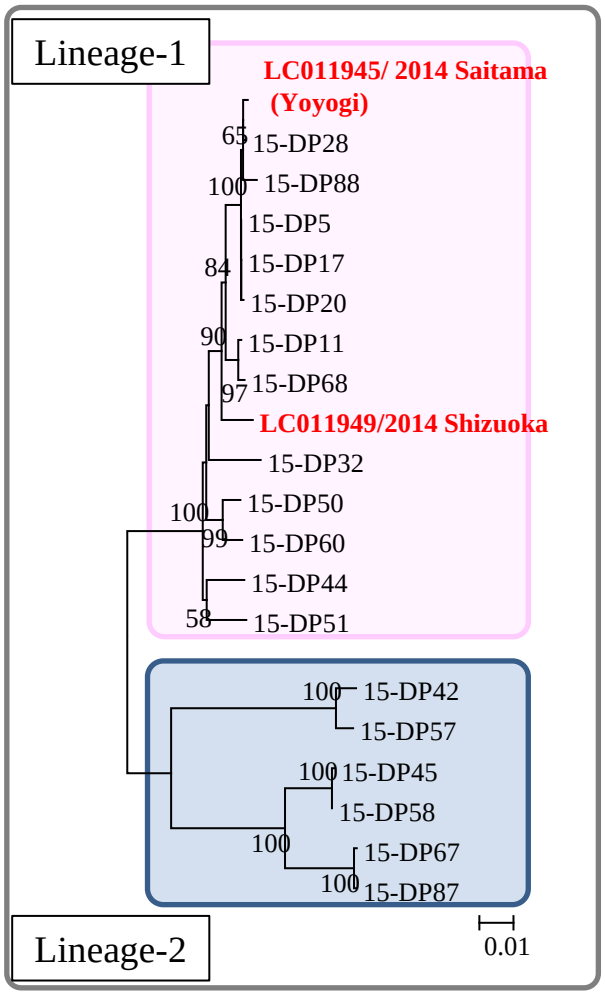
Virus serotype	No. of cases
Total	28
DENV1	6
DENV2	10
DENV3	8
DENV4	3
CHIKV	1

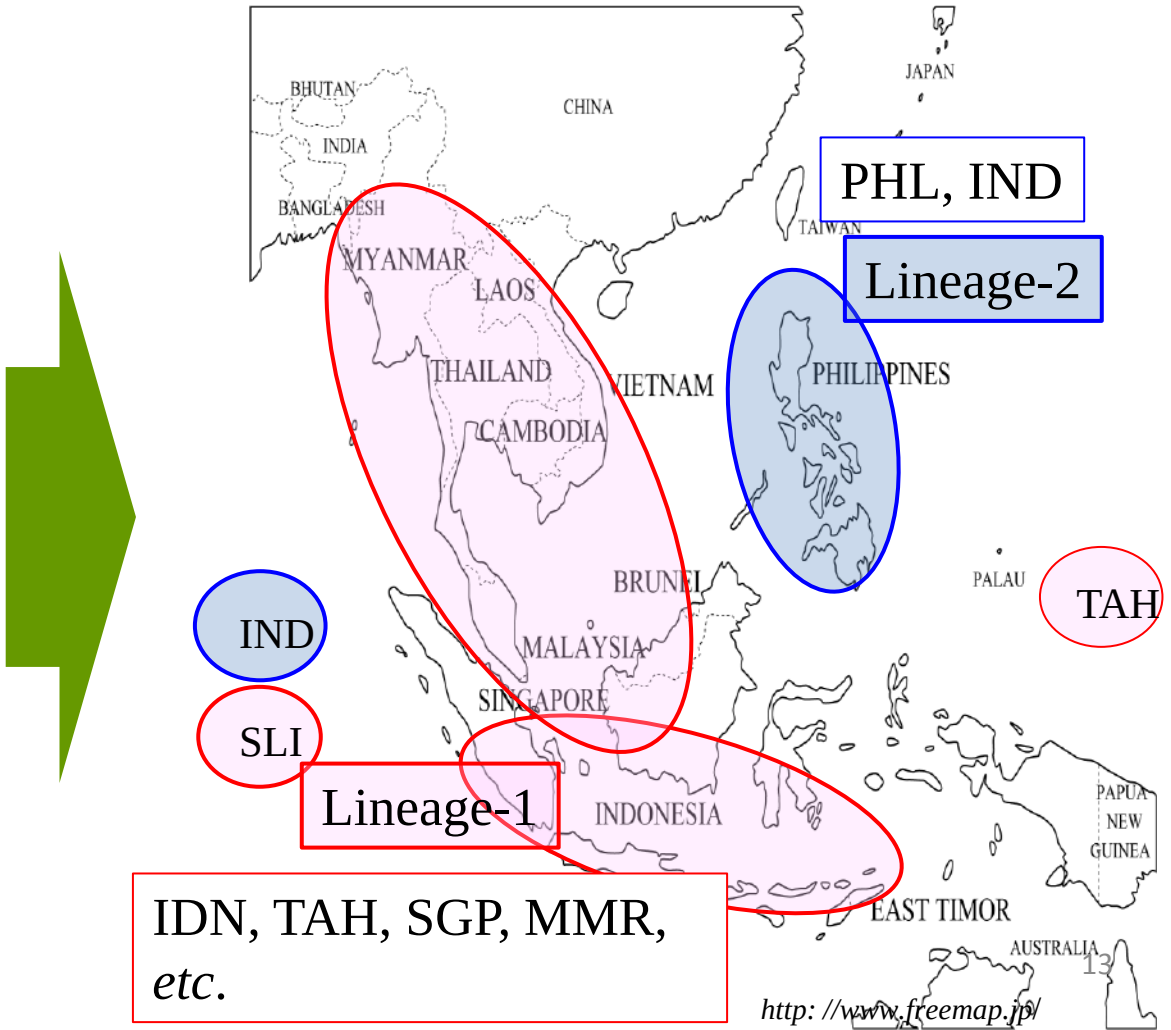


Reference: “Study of viruses of concern for spread in Japan such as dengue virus” by Michiya Hasegawa

Gene analysis of samples from patients with mosquito-borne diseases

- None of the detected DENV1 strains had a base sequence that 100% matched that of Yoyogi strain.
- In the molecular phylogenic tree, the DENV1 strains were divided into 2 lineages (Lineage-1 and -2).
- A relationship was found between the estimated infected areas and each lineage; PHL/IND-derived strains belonged to Lineage-2, and strains derived from other regions to Lineage-1.





Phylogenetic tree analysis of dengue viruses derived from imported cases

(Lineage-1)

D. virus 1 D1/Hu/Saitama/NIID100/2014
16DP41 (Indonesia)
15DP28 (Malaysia)
15DP88 (Singapore)
16DP71 (Indonesia)
15DP5 (Indonesia)
15DP17 (Indonesia)
15DP20 (Thailand)
D. virus 1 D1/SG/05K4480DK1/**2005** poly...
D. virus 1 Fj231/04 polyprotein
D. virus 1 DG14 polyprotein
15DP11 (Malaysia)
D. virus Hb22/CHN/2014 polyprotein
15DP68 (ラオス)
D. virus 1 SGEHI (D1) 1494Y08 polyprotein
D. virus 1 SG (EHI) D1227Y03 polyprotein
D. virus 1 polyprotein
Dengue virus 1 D1/Hu/Shizuoka/NIID181/2014
17DP2 (Philippines)
D. virus 1 DENV-1/TH/BID-V2277/2001 p...
15DP32 (ミャンマー)
Dengue virus 1 DENV-1/VN/BID-V4081/2008
Dengue virus 1 DENV-1/VN/BID-V3907/2008
15-DP51 (カンボジア)
16DP213 (ベトナム)
16DP96 (ベトナム)
17DP44 (タヒチ)
17DP120 (ベトナム)
17DP97 (ベトナム)
Dengue virus 1 DENV-1/VN/BID-V1855/**2007**
Dengue virus 1 DENV-1/VN/BID-V1772/2008
Dengue virus 1 DENV1/Vietnam/10dx-241...
15DP44 (タヒチ)
17DP25
Dengue virus 1 ThD1 0049 01
Dengue virus 1 SDDF1543
Dengue virus 1 DEN1/GZ/OY
Dengue virus 1 GD02/06
15DP60 (ミャンマー)
16DP160 (ミャンマー)
Dengue virus 1 DV1 SL **2009**c
Dengue virus 1 DV1 SL 2009b
Dengue virus 1 BNI-5201
Dengue virus 1 DV1 SL 2009a
Dengue virus 1 SL 2012 GS0289
Dengue virus 1 SL 2012 GS0319
Dengue virus 1 DK87
15DP50 (スリランカ)
Dengue virus 1 SL 2012 GS0308
Dengue virus 1 DV1 SL 2010b
16DP42 (インド)

0.0100

Indonesia
Malaysia
Singapore
Thailand
Philippines
2005-2017

Vietnam
Cambodia
Tahiti
2007-2017

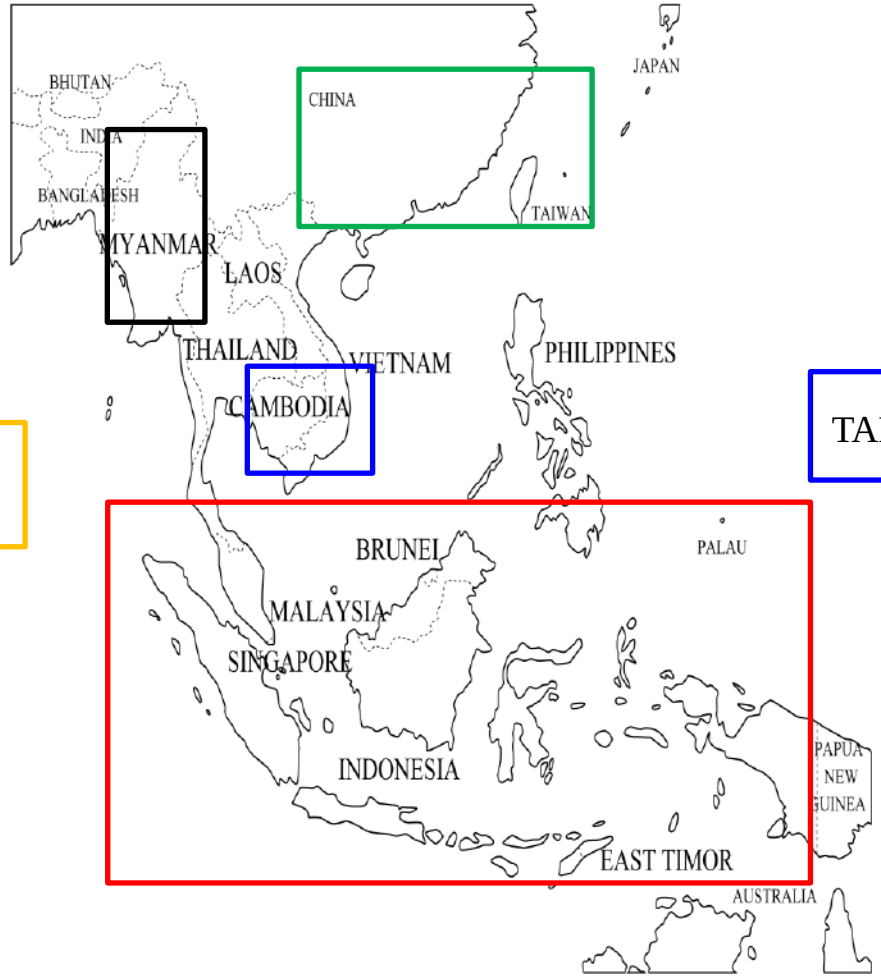
China Taiwan
2006

Myanmar

Sri Lanka
2009-2016

SRL

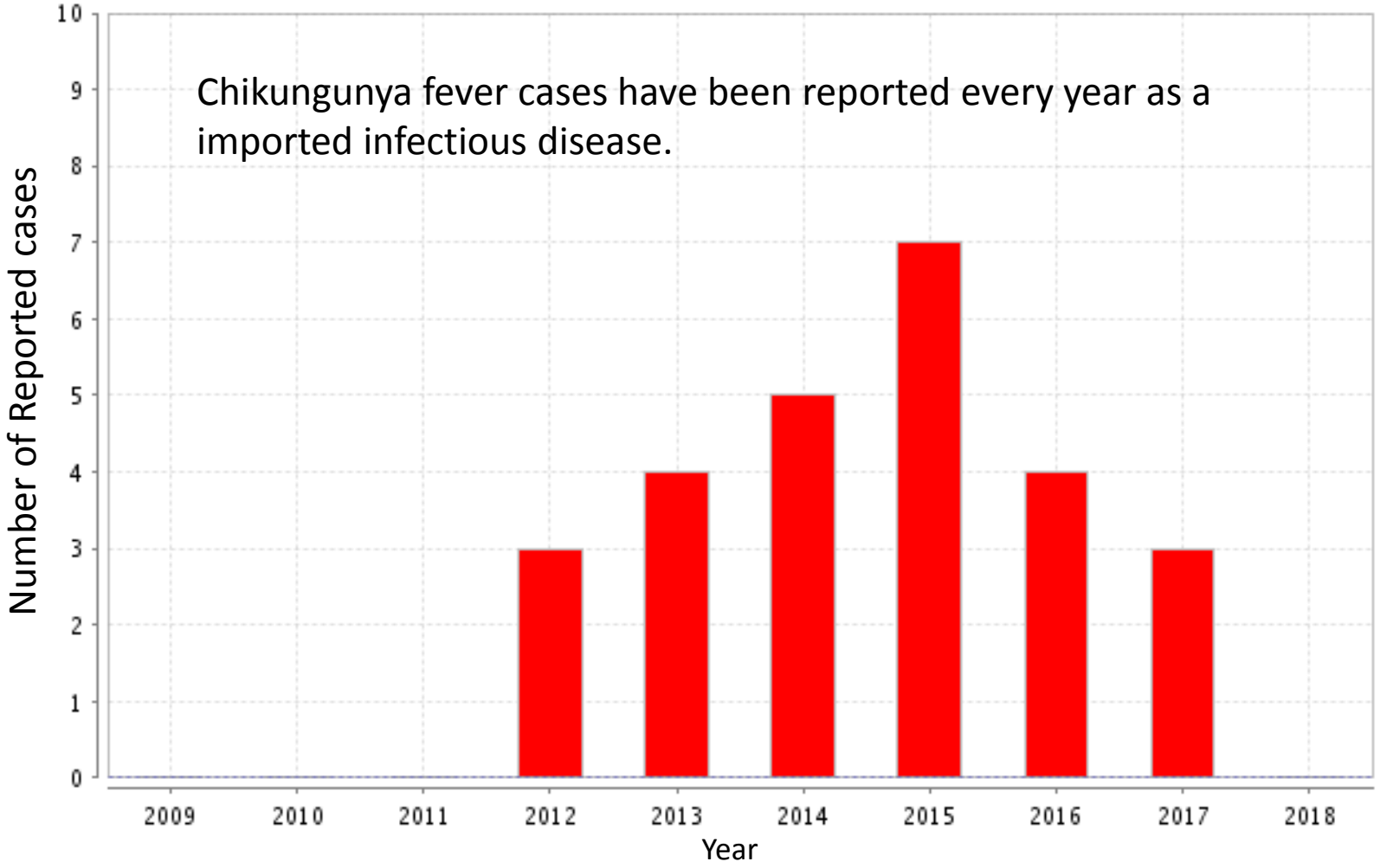
TAH



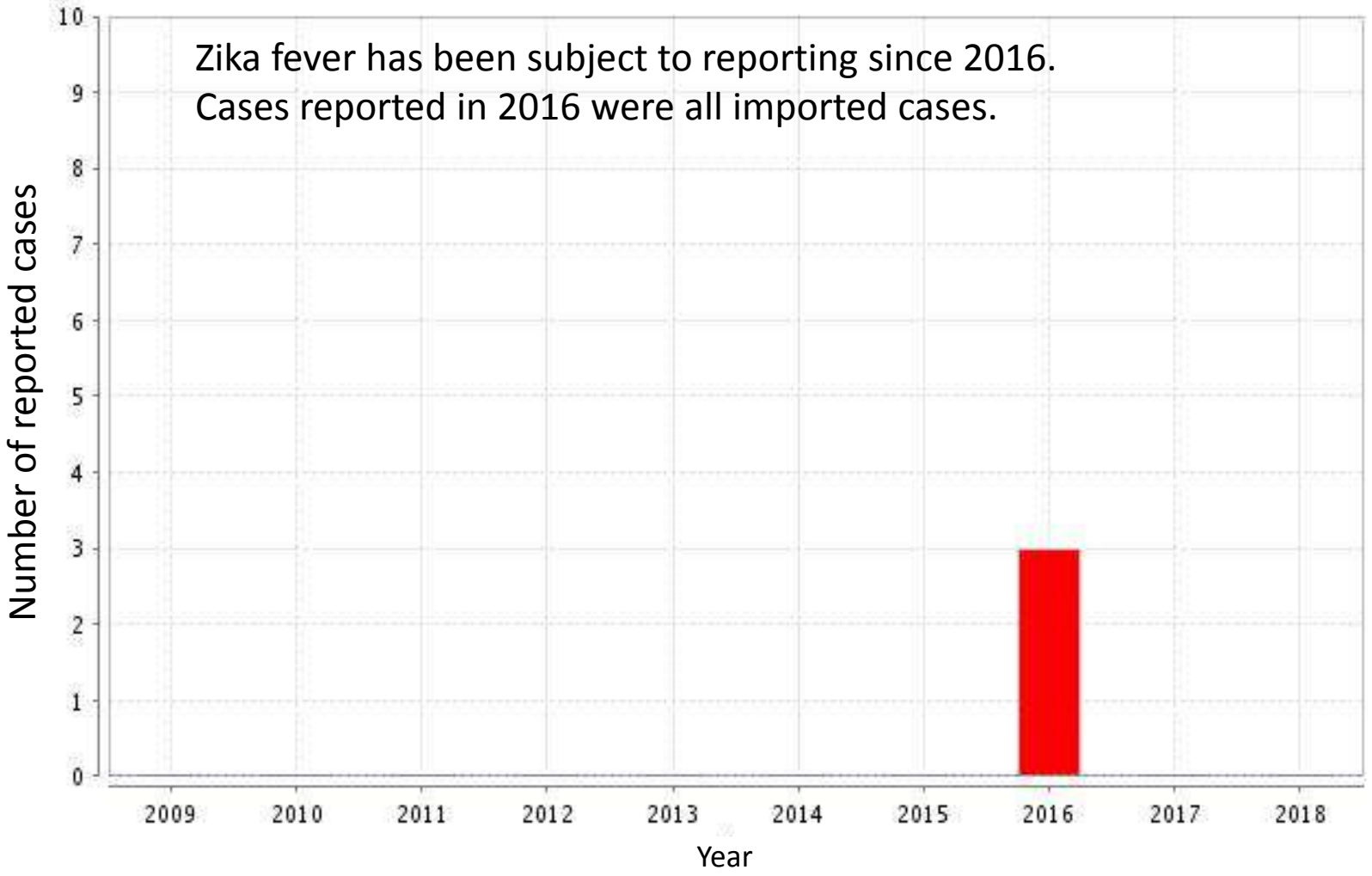
- FY2015 imported cases
- FY2016 imported cases
- FY2017 imported cases

- Dengue virus genotypes are deeply related to regions; viruses endemic to particular regions have been epidemic for nearly a decade.
- Among the types that have been epidemic since 2005 over a wide range of regions, including Indonesia, Malaysia, Singapore, Thailand and Philippines, was the strain that became epidemic in Tokyo in 2014, indicating that the virus came from these regions.

Number of chikungunya fever cases reported from 2012 to 2018 (up to Week 42)



Number of Zika fever cases reported from 2012 to 2018 (up to Week 42)



Tokyo Mosquito-borne Disease Control Measures Conference

- The conference is intended to hear opinions of experts on how to promote measures against mosquito-borne diseases in Tokyo.
- It consists of healthcare professionals and experts of mosquito-borne diseases and delegates from relevant administrative agencies.
- Established in September 2014, the conference investigated incidents of domestically acquired dengue fever in Tokyo in December of the same year, and laid out measures that requires joint forces from the Metropolitan Government, municipalities, related organizations such as health centers, medical institutions and private businesses, as well as from the citizen of Tokyo

Tokyo's action plan for implementing mosquito-borne disease control measures

Issued 2014
Revised 2016

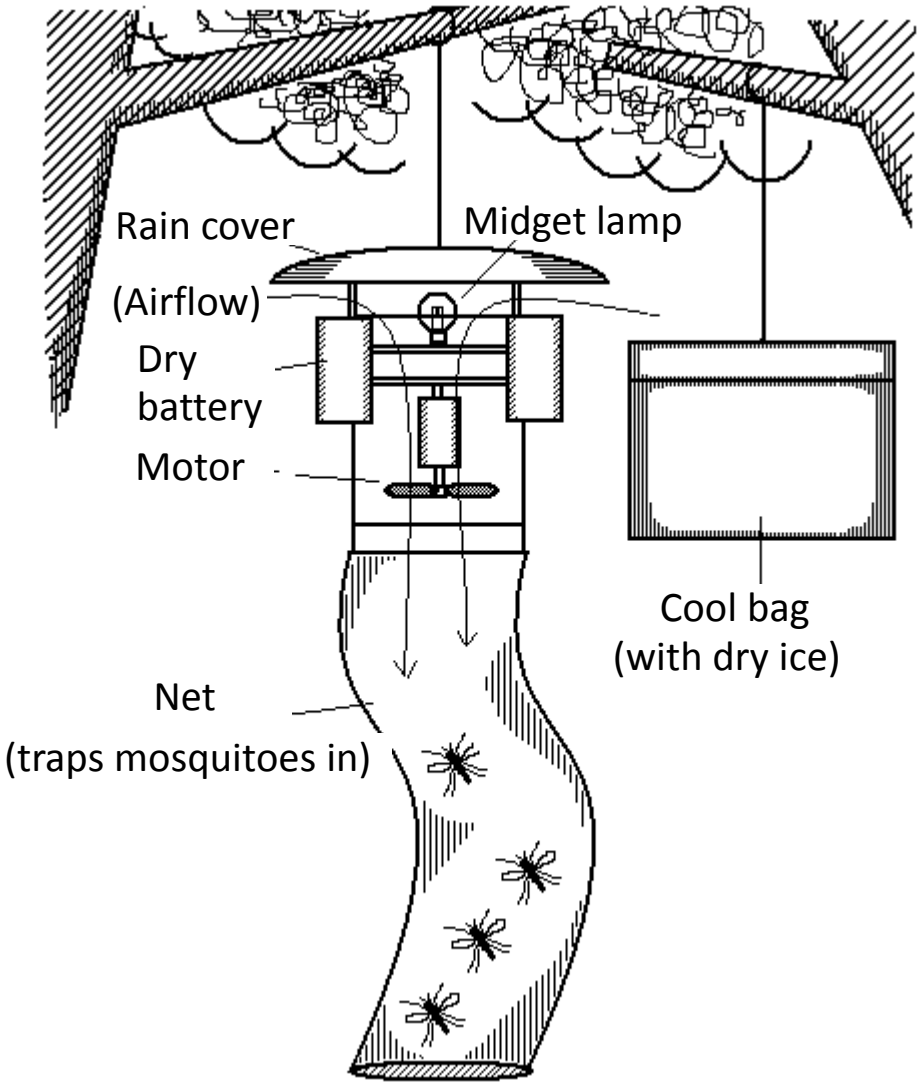
- Basic policies of mosquito-borne disease control measures
  - Implement measures according to the stage of incidents.
  - If the risk is rated high based on a risk assessment, implement measures thoroughly.

Incident stage	Definition	Policies of measures
No patients emerge	No domestically acquired infection cases are found excluding cases imported from abroad.	Reduce the risk of mosquito-borne disease incidents by hindering mosquitoes from emerging as much as possible through government-private partnerships and improve the healthcare system for early detection of emerging patients.
Patients start emerging	An incident of domestically acquired infection occurs in Tokyo.	Call for attention and promptly implement mosquito control measures in the region where incidents are occurring and control the expansion of infection and transmission.
Outbreak	Transmission persists in multiple regions with patients emerging in great numbers.	Provide proper medical care to severe cases.

Mosquito surveillance

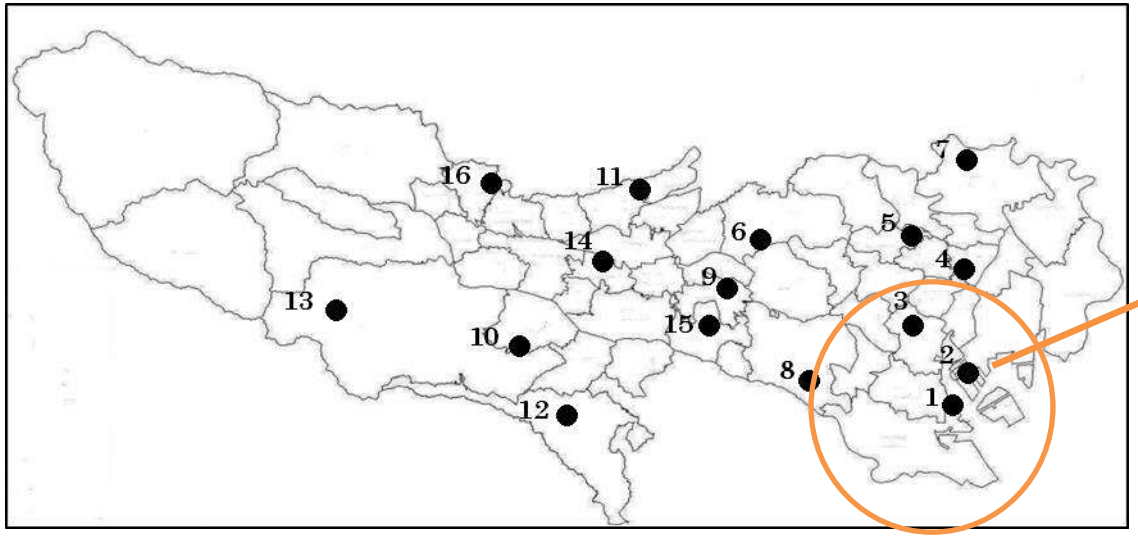
Name	Wide-area surveillance	Focused surveillance
Year of initiation	2004	2015
Objective	Intensify the monitoring of new infectious diseases that can emerge in Tokyo with increasing temperature due to global warming	In response to the incident of dengue fever patients emerging in Japan, intensify the monitoring of mosquitoes that can transmit dengue fever and chikungunya in addition to the conventional measures for controlling mosquito-borne diseases.
Sites of operation	16 parks, cemeteries, etc. (16 sites)	9 Urban parks (50 sites)
Target of collection	Adult mosquitoes	*Aedes albopictus*
Time of operation	June to October	April to November
Method of operation	Use light traps with dry ice.	- Adults: caught by light trap with dry ice from May to October and by human bait method in April and November - Larvae: caught in Parks' discharge basins etc. in April through November
Criteria for selecting the sites of surveillance	Multiple institutions conduct surveillance independently of each other. To avoid redundancy as well as eliminate regional biases and make surveillance more effective, sites were selected in equal number from the special wards and Tama district.	- Human-related conditions Numbers of visitors and events, frequency of foreigners' visits, long hours of stay - Environmental conditions Bushes and shrubbery Untended environment Frequent complaints about mosquitoes

Method of catching mosquitoes (trap)

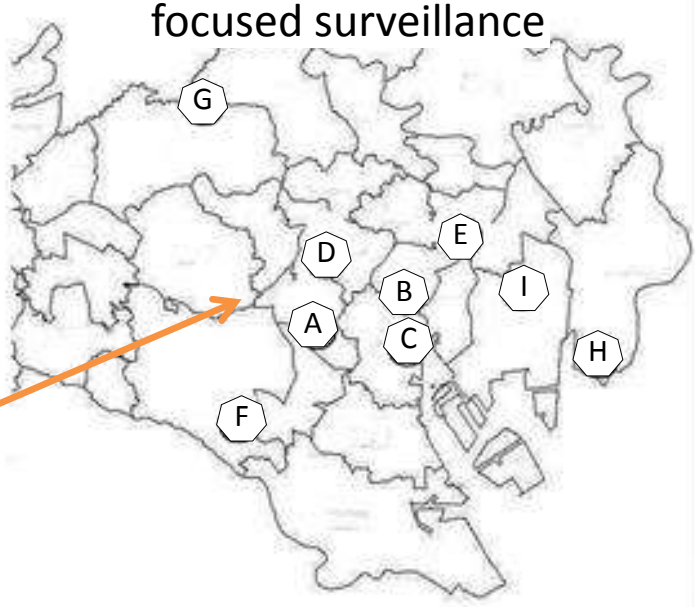


Early detection of disease-carrying mosquito incidents

Facilities for wide-area surveillance



Facilities for focused surveillance



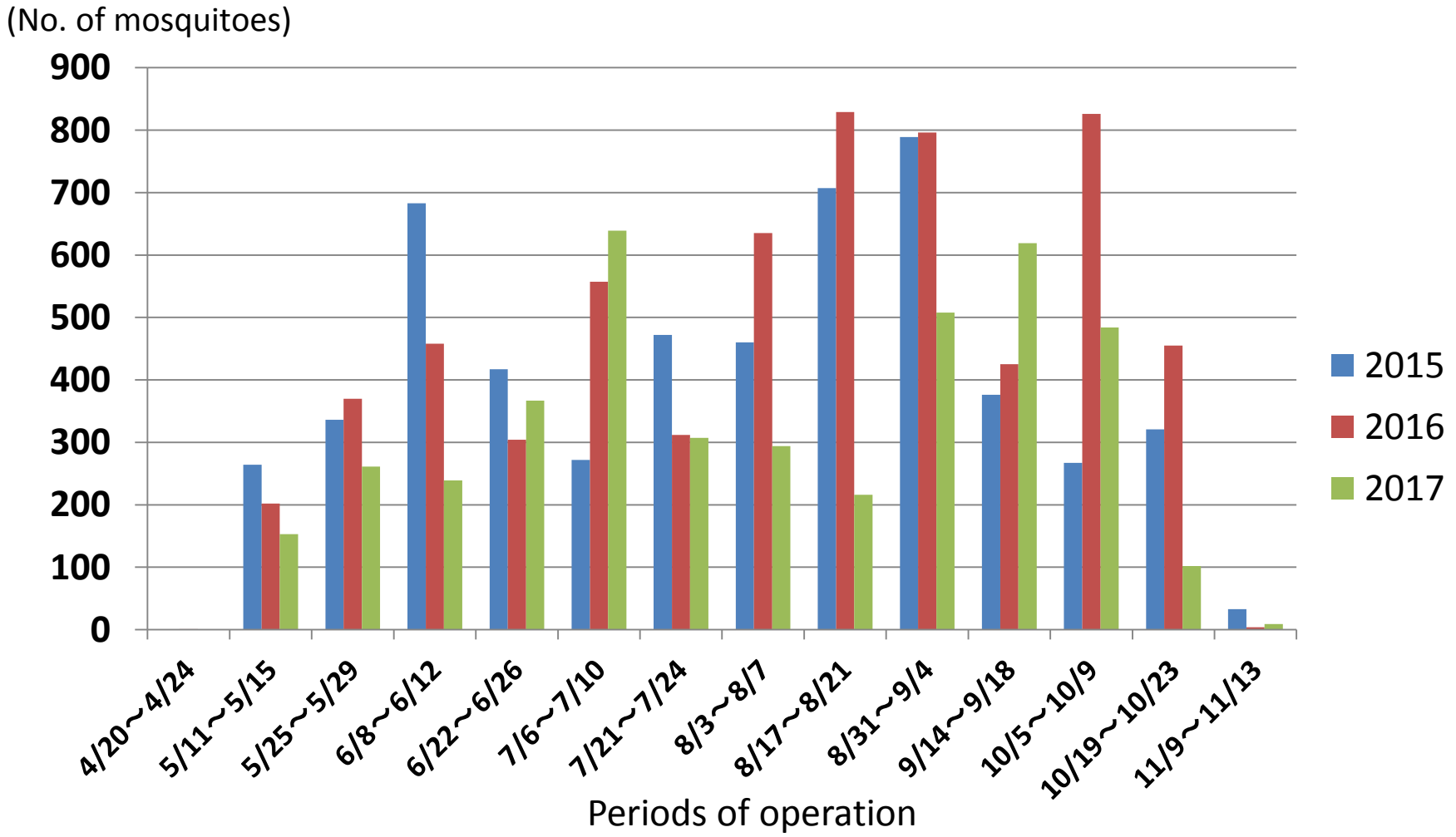
	Facility name		Facility name
1	Oi Central Seaside Park	9	Inokashira Park
2	Odaiba Marine Park	10	Tama Zoological Park
3	Aoyama Cemetery	11	Sayama Park
4	Yanaka Cemetery	12	Oyamada Green Area
5	Somei Cemetery	13	Hachioji Cemetery
6	Shakujii Park	14	Medical Botanical Garden
7	Toneri Park	15	Jindai Botanical Park
8	Kinuta Park	16	Mizuho Nogei High School

	Facility name
A	Yoyogi Park (Districts A and B)
B	Hibiya Park
C	Hamarikyu Gardens
D	Toyama Park
E	Ueno Park
F	Komazawa Olympic Park
G	Hikarigaoka Park
H	Sarue Onshi Park
I	Kasai Rinkai Park

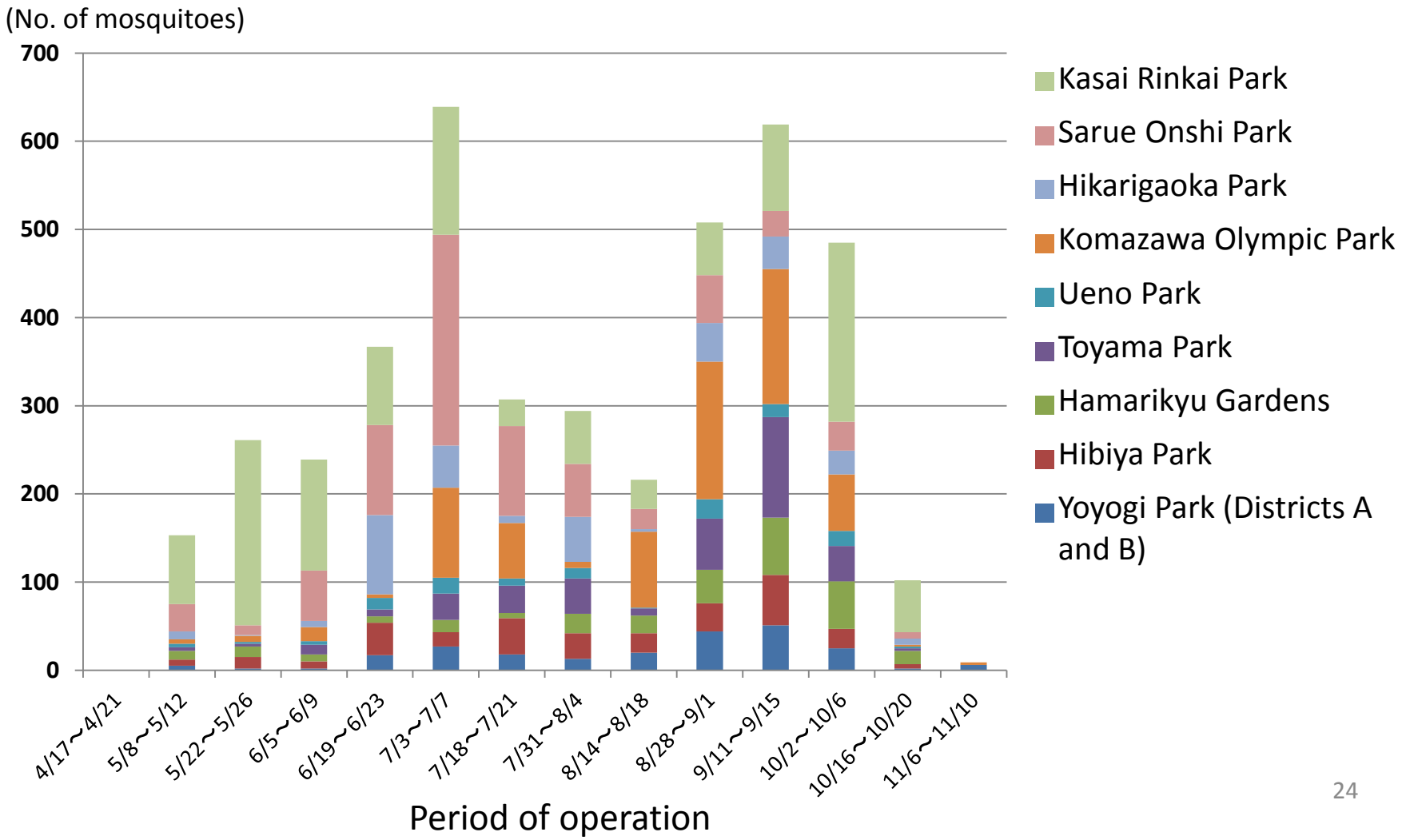
Tests items

	Wide-area surveillance	Focused surveillance
Tests items	- Virus-carrying mosquito monitoring	- Monitoring of virus-carrying mosquitoes - Survey of mosquito incident-densities - Survey of mosquito larvae incidents
Test pathogens	Dengue virus Chikungunya virus Zika virus West Nile virus Plasmodium falciparum	Dengue virus Chikungunya virus Zika virus

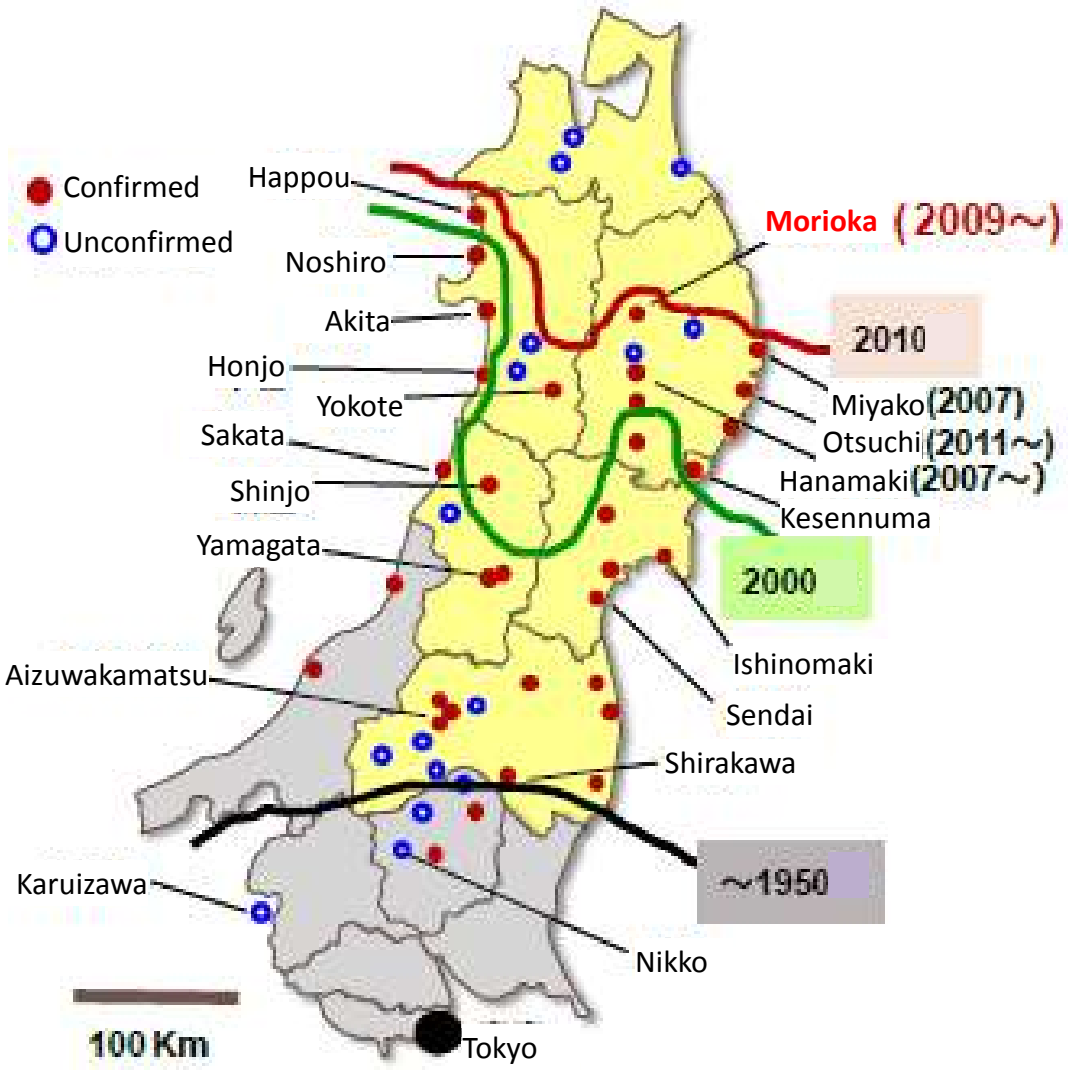
Number of mosquitoes collected in focused surveillance (2015-2017)



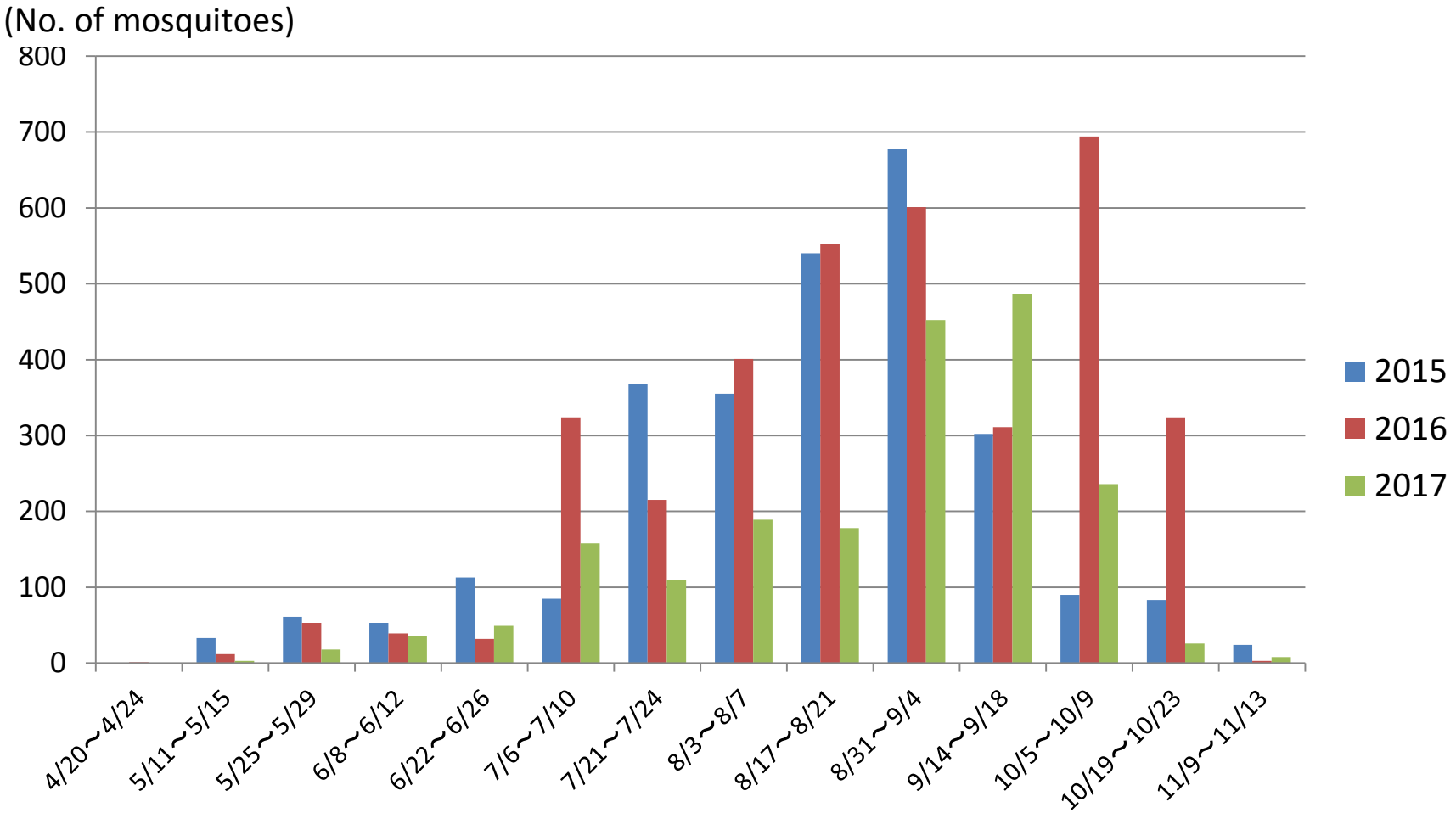
Number of mosquitoes collected per park in focused surveillance in 2017



Distribution of *Aedes albopicti* in Japan



Number of *Culex fasciatus* mosquitoes collected in 2015-2017



Detection of viruses from mosquitoes

The numbers of samples were:
FY2015
7816 adults and 9128 larvae,
FY2016
11161 adults and 3429 larvae, and
FY2017
7383 adults and 1629 larvae.

No mosquito-borne infectious viruses including dengue virus were detected by genetic testing in samples from either adults or larvae.

Viruses (cases) detected by wide-area surveillance in 2017

	West Nile	Dengue	Chikungunya	Zika	Malaria
2017/6/12-6/16	0	0	0	0	0
6/26-6/30	0	0	0	0	0
7/10-7/14	0	0	0	0	0
7/24-7/28	0	0	0	0	0
8/7-8/10	0	0	0	0	0
8/21-8/25	0	0	0	0	0
9/4-9/8	0	0	0	0	0
9/25-9/29	0	0	0	0	0
10/10-10/13	0	0	0	0	0
10/23-10/27	0	0	0	0	0

Viruses detected in the past 3 years

	2015 (No. of positive/total sites)					2016 (No. of positive/total sites)					2017 (No. of positive/total sites)				
	WNV	DNV	CHIKV	ZIKA	P. f	WNV	DNV	CHIKV	ZIKA	P. f	WNV	DNV	CHIKV	ZIKA	P. f
Wide-area surveillance	0/144	0/124	0/124	×	0/0	0/153	0/125	0/125	0/125	0/1	0/148	0/111	0/111	0/111	0/0
(No. of mosquitoes collected)	2419					4989					3184				
Focused surveillance Larvae	×	0/43	×	×	×	×	0/44	0/44	0/44	×	×	0/43	0/43	0/43	×
(No. of mosquitoes collected)	1796					3429					1629				
Focused surveillance Adults	×	0/342	0/274	×	×	×	0/383	0/383	0/383	×	×	0/302	0/302	0/302	×
(No. of mosquitoes collected)	5397					6172					4198				

WNV: West Nile virus
DNV: Dengue virus
CHIKV: Chikungunya virus
ZIKA: Zika virus
PF: Plasmodium falciparum

Feedback of surveillance information on the web site

東京都健康安全研究センター
Tokyo Metropolitan Institute of Public Health

Google サイト内検索

センター紹介 | 行事のご案内 | 刊行物 | 報道発表 | 職員募集 | 交通案内 | 申請窓口案内 サイトマップ

Top - 東京都の感染症媒介蚊対策

東京都の感染症媒介蚊対策

Tokyo's measures to control disease-carrying mosquitoes

Be safe and secure without mosquitoes!

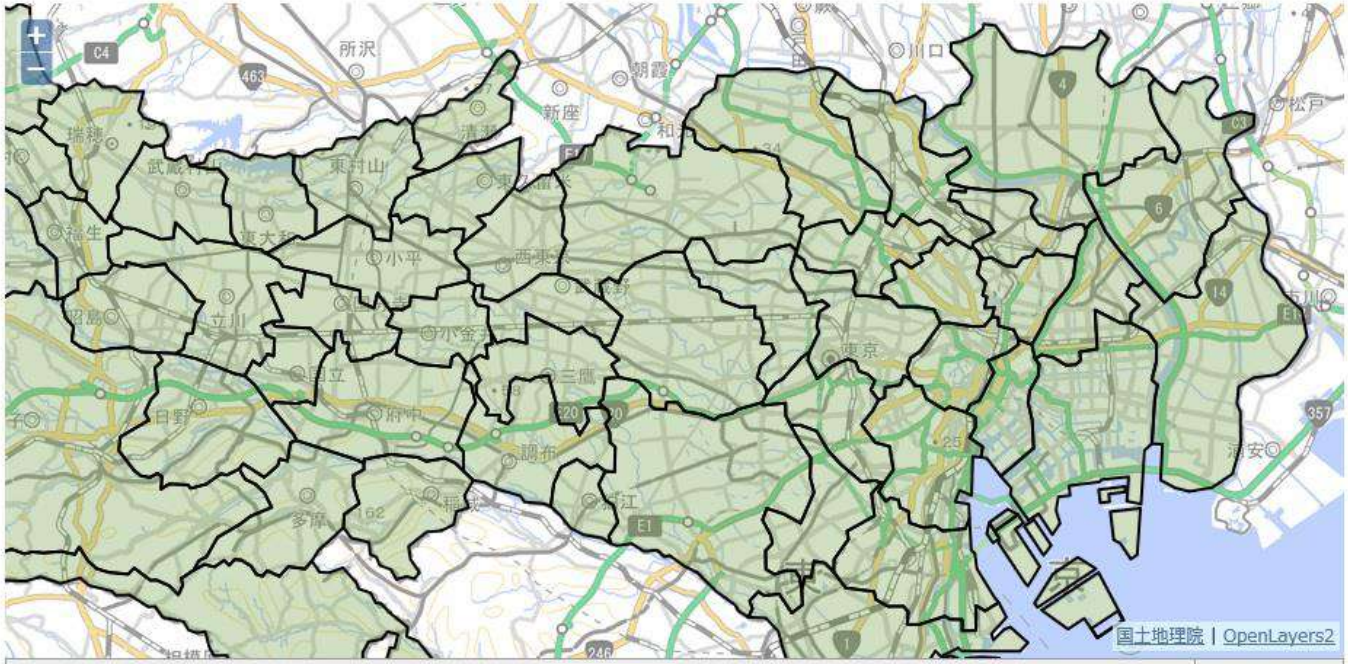
近年、輸送手段の発達等により、感染症流行地域から我が国へ、人や物資等を介した病原体の侵入により、デング熱やジカウイルス感

high-risk sites are shown on the map

選択	疾患名
○	デング熱（0地点）
○	ジカウイルス感染症（0地点）
○	チクングニア熱（0地点）
◉	合計（0地点）

Select “Disease name,” and the high risk sites for the disease will be shown on the map.

なお、「合計」の地点数は実数で記載しているため、各疾患の地点数の合算と合わない場合があります。

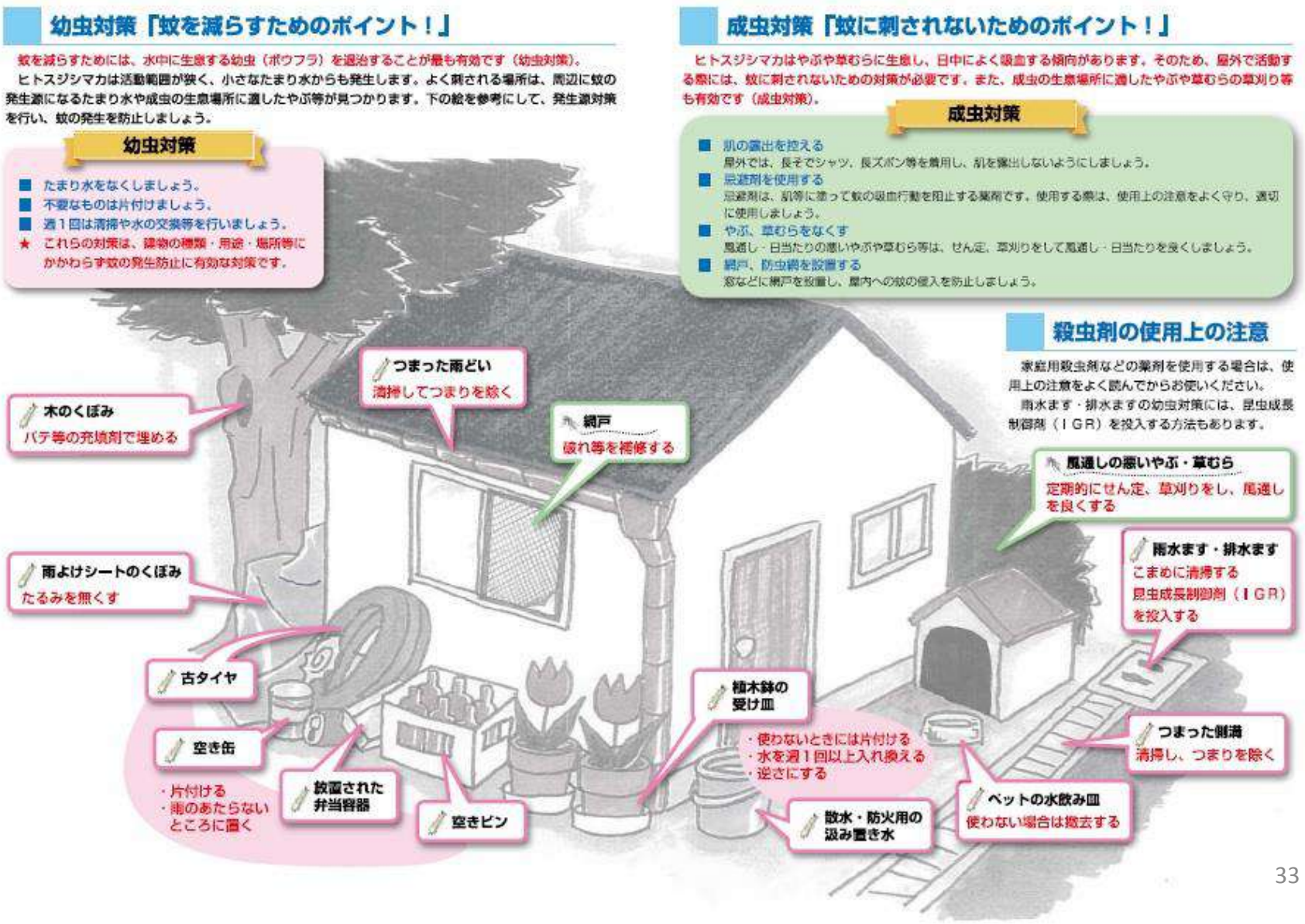


Legends						棒グラフ
棒グラフ	Sites rated “high risk” with multiple patients emerging in and around the facility	黄色の円	Sites rated “high risk” with virus-carrying mosquitoes identified by a survey conducted by facilities	棒グラフ＋黄色の円	Sites rated “high risk” with multiple patients emerging in and around the facility and virus-carrying mosquitoes identified	＋ 大きく － 小さく

Tokyo's measures for controlling mosquito-borne diseases

- Be prepared at all levels in peace time, such as acting to prevent mosquito infestation and improving the system for early diagnosis.
- In the event of domestically acquired infection cases, act proactively to stop the disease spreading.

Mosquito infestation prevention measures

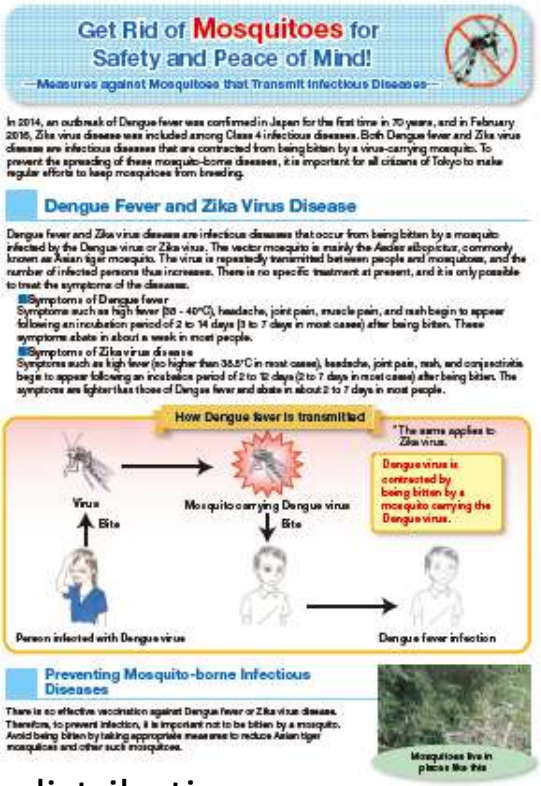


Information service and public relationship

① Posters

② Ad-rapped buses

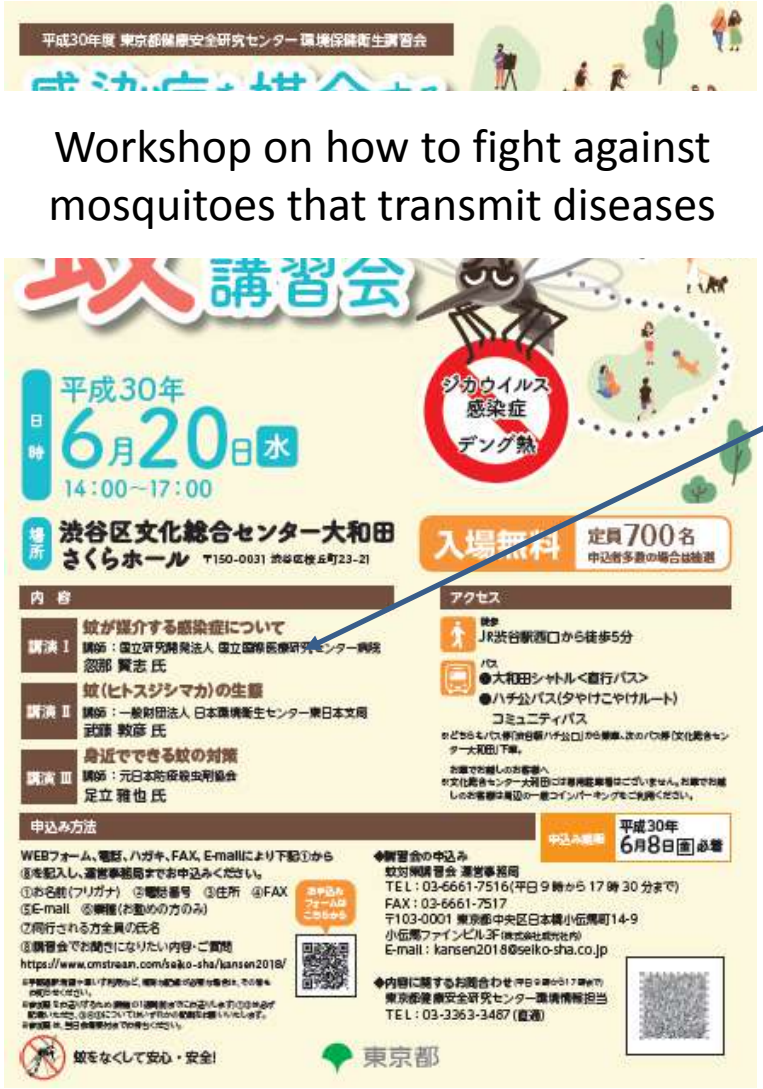
③ Leaflets



④ Panel display

⑤ Motion picture distribution

Upcoming workshop



Workshop on how to fight against mosquitoes that transmit diseases

Lecture contents

1. Infectious diseases transmitted by mosquitoes

   Speaker: Satoshi Kutsuna, Center Hospital of the National Center for Global Health and Medicine (National R&D Agency)

2. Biology of mosquitoes (*Aedes albopictus*)

   Speaker: Atsuhiko Muto, East Japan Branch, Japan Environmental Sanitation Center (General Incorporated Association)

3. Mosquito control measures you can apply in your daily lives

   Speaker: Masaya Adachi, Hygienic Insecticide Industrial Association of Japan

Responses to the emergence of patients

Responses to imported cases (non-domestically acquired infection)

- Acquaint healthcare workers with mosquito-borne diseases and improve the system of testing;
- Conduct surveys of patients who were infected abroad and provide them with appropriate health instructions; and
- Secure samples from persons who were reported to have been infected abroad with dengue fever, chikungunya fever and Zika virus to analyze them for pathogens.

Government-led mosquito-borne disease testing

People who are likely to be infected, even if they have no history of travel abroad, should be tested.

Have you ever traveled to an area of a country with an epidemic of Zika virus infection?
[No → Requirement A; Yes → Requirement B]

[Requirement A] Cases falling under all the following criteria ① through ④:

① got bitten by mosquitoes within about 2 weeks before the onset of symptoms (regardless of whether the bite was in Japan or abroad),
② have sudden fever (38°C or higher),
③ have more than one of the following: (1) rash, (2) nausea/vomiting, (3) joint pain/muscle pain/headache, (4) decreased platelets, (5) decreased white blood cells, (6) positive result for tourniquet test
④ have no health insurance coverage for dengue virus NS1 antigen testing

[Requirement B] (with history of travel to an area of a country with an epidemic of Zika virus infection (*)) Cases falling under all the following criteria ① through ⑤:

① have traveled or stayed in an area of a country with an epidemic of zika virus infection (*) within 2 weeks before the onset of symptoms
② Got bitten by mosquitoes in an area of a country with an epidemic of Zika virus infection
③ have either (1) rash or (2) fever (37°C or higher) or both
④ have more than one of the following: (1) joint pain, (2) arthritis, (3) and conjunctivitis (nonexudative and hyperemic)
⑤ Have the sample collected within 2 weeks before the onset of symptoms.

Viruses separated from patients' serum

	Dengue type 1	Dengue type 2	Dengue type 3	Dengue type 4	Chikungunya	Zika	Total
2015	9	16	5	3	1	0	34
2016	7	10	10	2	0	1	30
2017	1	6	5	2	0	0	14
Total	17	32	20	7	1	1	78

Dengue viruses were separated using VeroE6 cells, and **Zika and chikungunya viruses** using Vero9013 cells.

Health center responses

- During viremia, confirm whether or not the patient has been bitten by mosquitoes in Japan

  → If the place where the patient got bitten was located, inspect the place and exterminate mosquitoes.

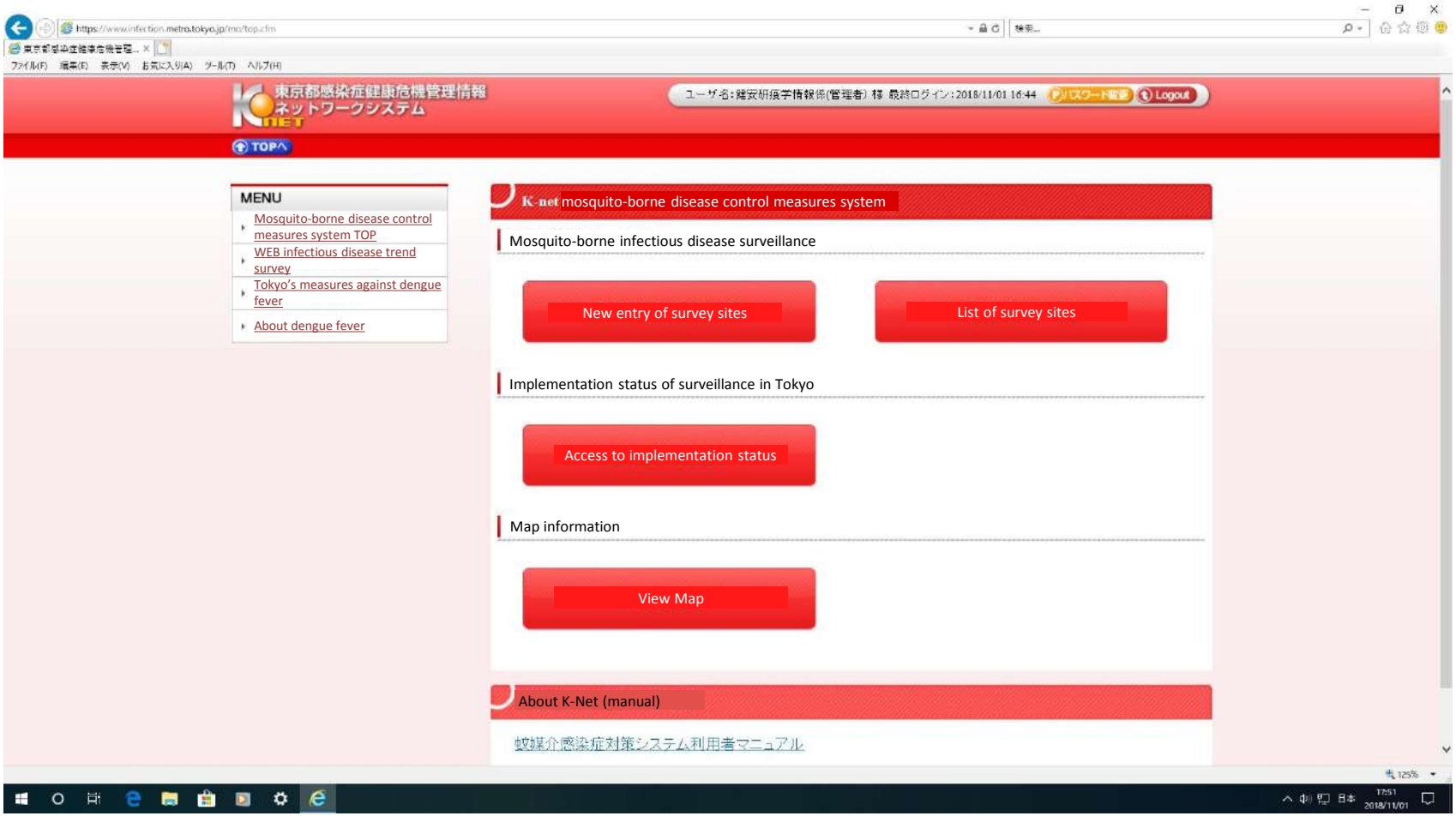
- Provide training of how to prevent patients from getting bitten by mosquitoes

  → Use of repellents, use of mosquito nets and insecticides indoors

- Confirm whether or not a large number of mosquitoes live near where patients are recuperating.

  → Consider extermination if infestation is great.

Information sharing among related organizations



Mass gathering and mosquito-borne diseases

- Chances are high that viruses are brought in from overseas by visitors with history of travel to, or stay in, foreign countries.
- It takes time to identify incidents of such patients.
- The higher the incidence of mosquitoes and the greater the number of park visitors, the higher the risk of infected mosquitoes emerging and infectious diseases spreading.

Preparations for the upcoming Olympics and Paralympics

- 2020 Tokyo Olympics and Paralympics will be held in summer.
- It is necessary to reduce the risk of mosquito-borne diseases including dengue fever.
- Comprehensive measures including mosquito infestation control should be implemented with coordinated efforts from relevant organizations and the citizens of Tokyo.