

Arboviral Surveillance and Response Capacity Survey 2021

Section I: Respondent details

1. Country

Singapore

2. Respondent/person to be contacted for clarification, if needed (last name, first name, e-mail address)

3. Professional title and affiliation

4. Date (dd/mm/yyyy)

2/7/2021

Section II: Arboviral disease surveillance system

5. Which arboviruses have circulated in your country at any time since the year 2000? This refers only to arboviruses with autochthonous i.e., local mosquito-borne transmission.

Chikungunya	Yes
Dengue	Yes
Yellow fever	Not selected
Zika	Yes

6. Do you have any written arbovirus surveillance and control plan(s) and/or guideline(s) for your country?

Yes, we have arbovirus-specific plans(s) or guidelines(s)

6b. For which of the following arboviruses do you have written surveillance and control plans for your country? Please choose all that apply.

Chikungunya	Yes
Dengue	Yes
Yellow fever	Yes
Zika	Yes

6c. Please upload surveillance and control plan(s) or protocol(s), or guideline(s)

0 file(s) submitted

7. Is there a specific national programme for arboviral diseases surveillance or is it integrated in another programme? Please select the appropriate answer:

Specific programme

7b. Please specify the programme into which arboviral diseases is integrated

8. For which level of the health structure are individual and aggregated data available? (Select all relevant levels)

	Individual level	Aggregated
Primary health care level	Yes	Yes
District level	Not selected	Not selected
Regional level	Not selected	Not selected
National level	Yes	Yes

9. What are the tools used for recording case data for surveillance purposes? Select all that apply

National	Mixed methods
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10. Which training has been provided to the staff working on arboviral disease surveillance data?

One-time basic training on data capture and analysis (MS Excel, MS Access, EpiInfo) and/or geographic information systems (GIS)	Not selected
Repeated/continuing basic training on data capture, analysis, and/or GIS	Yes
One-time advanced training on statistical software for data analysis (e.g. STATA, R, SAS, Tableau, etc)) and GIS	Not selected
Repeated/continuing training on advance statistical software for data analysis (eg STATA, R, SAS, etc) and GIS	Yes
No training	Not selected

11. Is reporting mandatory for any arboviral disease cases in your country?

Yes

11b. For which of the following arboviral disease cases is reporting mandatory in your country?

Chikungunya	Mandatory reporting of all suspect cases
Dengue	Mandatory reporting of all suspect cases
Yellow fever	Mandatory reporting of all suspect cases
Zika (non-congenital)	Mandatory reporting of all suspect cases
Zika (congenital)	Mandatory reporting of all suspect cases
Other	Mandatory reporting of all suspect cases

11c. For which other arboviral diseases is reporting mandatory?

1	Japanese encephalitis	All suspect cases
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11d. Please upload document(s) containing surveillance case definitions used for reporting of arboviral diseases

0 file(s) submitted

12. In the last 2 years, did your country conduct national epidemiological surveillance for human cases of arboviral disease?

Yes

12b. How frequently are surveillance data reported to the national level?

Ongoing

12c. What type of national epidemiological surveillance was conducted?

Primarily passive

For reference, here are the relevant definitions:

Active surveillance is defined as having dedicated systems and staff that routinely and with effort survey for cases of disease or detection of vectors and associated pathogens by the public health department.

Passive surveillance is defined as having a reporting system where physicians, laboratories, mosquito control districts, academic institutions or others routinely report cases of disease or detection of vectors and associated pathogens to the public health department.

12d. If available, please upload the most recent report(s) on arboviral surveillance in humans

0 file(s) submitted

13. Does your country provide regular training sessions for healthcare workers on notification of *Aedes*-borne arboviral diseases?

No

14. What do the arboviral disease surveillance staff perceive as factors contributing to the a) success and b) barriers/challenges to arboviral disease surveillance in humans?

Success: a) Consistent and reliable notification of arbovirus disease cases from medical practitioners and laboratories to the Health Ministry b) Readily available and affordable access to arbovirus diagnostics at primary healthcare facilities c) Extensive coordination and collaboration among human, environmental and animal health agencies involved in arbovirus surveillance, using the “One Health” approach Challenge: a) Integration of various disease reporting mechanisms in a centralised system would strengthen the capacity for comprehensive surveillance data analyses and sharing of information across One Health agencies

Section III: Arbovirus laboratory capacity

15. Is arbovirus diagnostic laboratory testing performed for confirmation of suspected cases in your country? (Please select the applicable option during outbreak periods and during non-outbreak periods, respectively)

Outbreak periods	All suspect cases tested
Non-outbreak periods	All suspect cases tested

15b. On average, for what percentage of suspected arboviral disease cases your country is laboratory confirmatory testing performed? Please indicate for outbreak and non-outbreak periods, respectively

Non-outbreak (routine) percentage in a year	96
During outbreaks percentage per identified cluster	96

16. In the last two years, were the positive cases of arboviruses confirmed by a national reference laboratory?

Yes, but only for some arboviral infections. Please specify them:

All arboviral infections except dengue

16b. If your country does not have capacity to type and serotype arboviruses, do you send samples for typing to other countries?

Yes. Please specify where:

For PCR negative but high suspicion, blood samples will be sent to regional reference lab

17. Overall, what arboviral testing capacity(ies) is(are) available in your country? Please check all applicable boxes

	Antigen testing	IgM antibody testing	IgG antibody testing	Neutralizing antibody testing	Virus isolation	RT-PCR or other nucleic acid amplification test	Viral gene/genome Sequencing
Chikungunya		Yes	Yes	Yes	Yes	Yes	Yes
Dengue	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yellow fever				Yes	Yes	Yes	Yes
Zika				Yes	Yes	Yes	Yes
Other		Yes	Yes	Yes	Yes	Yes	Yes

18. Which additional resources are most needed for your country to perform adequate testing for arboviral diseases? Please describe what would be needed for each checked resource in the adjacent comment field

Other capacity needs: Well evaluated pan-flavivirus PCR protocol, reference materials and EQA

19. Do you perform virological surveillance on humans, ie, tracking of prevailing genotypes/serotypes? Please select all that apply

Yes, using virus isolation: NA

Yes, using RT-PCR: NA

Yes, using other acid nucleic tests. Please specify: Sequencing, Whole-Genome Sequencing (WGS) and Genotyping based on partial genome sequencing

Yes, using serological testing. Please specify: via four-yearly serosurveys

19b. Which samples do you use for virological surveillance?

Samples from suspected arboviral diseases routinely notified	Yes
Samples routinely collected from patients with fever of unknown origin	Not selected
Other	(a) Samples collected from patients with hepatorenal syndrome and encephalitis of unknown origin under the Severe Illness and Death from Possibly Infectious Causes (SIDPIC) programme; (b) Serosurvey samples collected from healthy blood donors

19c. For which viruses do you perform virological surveillance? (check all that apply)

Chikungunya virus	Yes
Dengue viruses	Yes
Yellow fever virus	Yes
Zika virus	Yes
Other	Flaviviruses

19d. Does your country provide regular training sessions for healthcare workers on arboviruses virological surveillance?

No

20. What do the arboviral diagnostic laboratory staff perceive as factors contributing to the a) success and b) barriers/challenges with respect to laboratory testing for arboviral infections?

Nil

Section IV: Management of arboviral disease cases

21. Does your country have clinical guidelines for healthcare workers on diagnosis and clinical management of cases and severe cases of *Aedes*-borne arboviral diseases?

Yes

21b. Please upload the clinical guideline(s) for arboviral disease management

1 file(s) submitted

22. Are severe cases of arboviral diseases managed in a special area (part of the hospital, isolation beds)?

No. If so, where are patients with severe disease treated? Please specify in comments field.

23. How many hospital beds are available per 100,000 population?

238

24. Does your country provide regular training sessions for healthcare workers on clinical diagnosis and management of *Aedes*-borne arboviral diseases?

Yes, specific training is provided. If so, please specify:

NA

25. What do the arboviral disease surveillance/clinical staff perceive as factors contributing to the a) success and b) barriers/challenges with respect to case management?

Successes • Reminders and updates on guidelines for dengue management are provided to medical practitioners in a timely manner, ahead of and during epidemic periods • Review of dengue hospital referral and admission criteria was conducted to focus healthcare resources on the management of severe dengue cases • Implementation of dengue education programmes focusing on primary care management of dengue patients

Section V: Routine vector surveillance and control

26. Is there a disease programme, agency, or service in charge of arbovirus vector surveillance in your country?

Yes. If so, please specify in the comment field.

National Environment Agency (NEA)

27. Which institution/department is in charge of reporting entomologic surveillance data to the national ministry of health/health department? (Check all that apply)

State/provincial health agencies	Not selected
Other national agency	Yes
City/country health departments	Not selected
Local mosquito control districts or similar organisations	Not selected
Universities or academic institutions	Not selected
Private companies	Not selected
Other	National Environment Agency

28. For the last 2 years, did your country conduct entomologic surveillance for arboviral infections in mosquito vectors?

No

28b. Please upload the most recent national vector surveillance report

28c. Did the entomologic surveillance entail country wide programmes or was it restricted to specific locations?

28d. How many sentinel surveillance sites do you have?

28e. How often was the surveillance conducted? Please choose one of the following:

29. Do you conduct adult mosquito surveillance?

Yes

30. Do you conduct larval/pupal mosquito surveillance?

Yes

31. Are trapped mosquitoes identified to species?

Yes

32. Does your country either calculate minimum infection rates (MIR) for any *Aedes*-borne arboviruses with your mosquito data or receive such data from other agencies? Please choose only one of the following:

Yes, the MIR are estimated by another institution. If so, please specify:

Saw Swee Hock School of Public Health, National University of Singapore

33. Which laboratories performed testing for arboviruses on mosquito pools collected in your country in the last two years? (check all that apply)

National public health laboratory	Not selected
State/provincial/regional public health laboratory	Not selected
Local health department laboratory	Not selected
University or academic institution	Not selected
Local MCD (if different from county health dep't)	Not selected
Mosquito surveillance done, but no testing done on mosquito pools	Not selected
Not applicable (no mosquito surveillance done)	Not selected
Other	NEA Environmental Health Institute

34. Is there a record of *Aedes aegypti* or *Aedes albopictus* being found in your country in the past 5 years? Please choose only one of the following

Yes, both *Aedes aegypti* and *Aedes albopictus*

34b. Please describe the potential public health threat from *Aedes aegypti* in your country

Aedes aegypti populations are abundant and arbovirus(es) is (are) circulating

34c. Please describe the potential public health threat from *Aedes albopictus* in your country

Aedes albopictus populations are abundant and arbovirus(es) is (are) circulating

35. Over the past two years, did your country use any of the following vector control methods in local jurisdictions (either using government staff and resources, or subcontracting to a different entity to do so)? Please select all that apply

Adulticiding (insecticide application against adult mosquitoes)	Yes
Larviciding	Yes
Insect growth regulators (eg , pyriproxyfen)	Yes
Wolbachia method	Yes
Sterile insect release	Not selected
None	Not selected

35b. Would your country have conducted or financially supported adulticiding/larviciding or source reduction activities in the last two years if sufficient funding were available?

35c. Which adulticides and/or larvicides (brand and product name) were used?

Pirimiphos methly (Actellic EC50) Temephos (Abate) Bti (WG and briquette form)

36. Does your country provide regular training sessions for staff in charge of vector control and vector surveillance?

Yes, for both

37. For the last two years, did your country have a plan for mosquito-borne disease control that includes a threshold (eg, level of vector mosquito abundance or minimum infection rate) that would result in a recommendation for mosquito adulticiding/other mosquito reduction measures?)

Yes, have a threshold that requires concurrent human cases

37b. Which indicator(s) is(are) used as threshold(s)?

38. Overall, are data on any of the following arboviral outbreak risk factors routinely collected and analysed? (Select all that apply)

House Index	Yes
Breteau Index	Yes
Container Index	Not selected
Temperatures	Yes
Rainfall	Yes
Migration of a non-immune population	Not selected
None	Not selected
Other	Gravitrapp Aedes aegypti Index

39. Is there a surveillance system in place for monitoring *Aedes* resistance to the insecticide(s) used?

Yes

40. What do the vector surveillance staff perceive as factors contributing to the a) success and b) barriers/challenges with respect to vector surveillance and control in the country?

Success: Source reduction strategy is effective in mitigating transmission and effective coordination among stakeholders to tackle dengue

Challenge: The year-round warm and humid climate, and the increased urbanisation of the country provides a conducive environment for the breeding of the *Aedes* mosquitoes, pose challenges in keeping the *Aedes* mosquito population low.

NOTE: Adhoc screenings are conducted in selected dengue cluster areas to support and guide vector control operations

Section VI: Animal surveillance

41. During the last 2 years, did your country conduct national epidemiological surveillance for arboviral disease in animals (eg, epizootic surveillance for yellow fever in endemic areas)?

Yes

41b. How often was the animal surveillance conducted?

Ongoing

41c. What type of surveillance was conducted in animals?

Primarily passive

41d. Please upload a report on the animal surveillance

0 file(s) submitted

42. Does your country (or local jurisdictions within the country) perform sentinel animal surveillance or epizootic surveillance, eg, for yellow fever in nonhuman primates in endemic regions?

No

42b. For which viruses is sentinel surveillance conducted and in which animal species?

42c. Please upload the most recent report(s) on sentinel animal surveillance

Section VII: Community sensitization and participation

43. Does your country have a community outreach program that also covers arboviral diseases?

Yes

43b. What entity(ies) is(are) in charge of the outreach program in your country?

Ministry of Health and National Environment Agency

43c. What is the geographical coverage of the outreach program in your country?

Countrywide

43d. Is the community outreach/social mobilization program sufficiently funded to cover staff time, prevention and outreach activities as needed?

Yes

43e. Which resources would help ensure adequate capacity?

Educational materials for the public	Yes
Educational and reference materials for providers	Not selected
Educational and reference materials for local health departments	Not selected
Additional staff	Yes
Staff training	Yes

44. Did your national arboviral disease program issue notifications to the public about local transmission risk and/or possible vector-control activities (eg larviciding, adulticiding, community mobilization and participation, etc) as a prevention message for arboviral diseases within last 2 years? (Check all that apply)

	During outbreaks	During non-outbreak periods
Issued by national public health agency	Yes	Yes
Issued by state/local health agencies	Not selected	Not selected
No risk in the past two years	Not selected	Not selected
No notifications even though risk was present	Not selected	Not selected

44b. Which means does your program use for community sensitization, mobilization and acceptance of interventions in your country? (Check all that apply)

Press releases to electronic and printed media	Yes
Public service announcements on television or radio	Yes
Passive distribution of informational brochures	Yes
Active distribution of informational brochures	Yes
Town, community, or neighborhood meetings	Yes
Posting information on the home page of your agency's website	Yes
Social media outlets (Facebook, Twitter, etc)	Yes
Door-to-door outreach in selected locations	Yes
Participation in community clean-ups	Yes
Modification of messages for all local languages	Yes

45. Does your country provide regular training sessions for staff in charge of community sensitization, mobilisation and acceptance of interventions dedicated to control arboviral diseases?

Yes. If yes, please describe in comments field:

New staff will attend structured training modules developed by the Singapore Environment Institute on vector control, which covers dengue prevention. The modules are also available online to facilitate e-learning.

46. What do the community outreach staff perceive as factors contributing to the a) success and b) barriers/challenges with respect to community participation

Factors contributing to success: a) The variety of communication platforms adopted can reach a wide audience to address public concerns; b) The national agencies have well-established links with community organizations for rapid information dissemination. Barriers: Increased complacency of the population to endemic diseases e.g. dengue, due to over sensitisation and alert fatigue

Section VIII: Preparedness for arboviral outbreaks/epidemics

47. Is there either a surveillance and outbreak response committee in your country, or a steering committee for that purpose?

Yes

48. Does your country have a contingency plan to organize healthcare services during an outbreak (including outbreaks of arboviral diseases)?

Yes

48b. Please upload the contingency plan

0 file(s) submitted

49. Are there defined or established criteria for declaring an outbreak of arboviral disease outbreak in your country?

Yes. If so, in the comments field, please briefly describe the criteria or reference the document in which those are sta

- a) [For endemic diseases] Rise in incidence in humans above defined statistical thresholds
- b) [for emerging arboviruses] single detected case

50. Do you have established collaborations with national/regional research institutions / international agencies that are planned to be activated in case of arboviral outbreak?

Yes. If so, please specify institutions/agencies in the comments field:

Saw Swee Hock School of Public Health, National University of Singapore Duke-NUS Medical School National Centre for Infectious Diseases

51. What vector control interventions are deployed in case of an emergency?

Intensified search and destroy efforts in outbreak area to remove breeding sources, conduct larviciding and adulticiding where appropriate. Community mobilisation for public and stakeholders to do their part to remove potential breeding sources in and around their premises and take protective measures including application of repellent, wearing long sleeved clothing and application of insecticide where appropriate.

52. For the last 2 years, which of the following government levels had an emergency fund or a specified emergency funding mechanism for arbovirus outbreak response?

National level	Yes
State/local level	Not selected
None	Not selected

53. Does your country provide regular training sessions for staff/committee in charge of preparedness for arboviral outbreaks/epidemics?

Yes

54. What do the arboviral disease surveillance staff perceive as factors contributing to the a) success and b) barriers/challenges with respect to preparedness of arboviral diseases epidemics in your country?

Factors contributing to success: a) High awareness of arbovirus disease and prevention measures among the population b) Preparedness plans are in place for arboviral disease epidemics c) Whole-of-government approach is used for preparedness to disease epidemics, and tested through exercises and actual events (e.g. Zika epidemic in 2016). All exercises and events are evaluated through after-action reviews to improve our response. d) Continuous surveillance and monitoring of international and local arboviral outbreaks feed into national risk assessments and preparedness for epidemics Barriers/Challenges: a) Automation of information collection and management between national agencies

Section IX: Arboviral disease surveillance data

55. Please provide total number of cases and deaths for the following arboviral diseases from 2015 to 2020 (if available).

	Dengue	Chikungunya	Yellow fever	Zika
2015 Cases	11294	42	0	0
2015 Deaths	6	0	0	0
2016 Cases	13085	36	0	458
2016 Deaths	12	0	0	0
2017 Cases	2767	29	0	67
2017 Deaths	2	0	0	0
2018 Cases	3283	15	0	1
2018 Deaths	6	0	0	0
2019 Cases	15998	58	0	12
2019 Deaths	20	0	0	0
2020 Cases	35315	12	0	5
2020 Deaths	32	0	0	0

(NA = Not Available)

55b. Were cases of other mosquito-borne arboviruses, not listed in the previous question, reported in your country from 2015-2020?

Yes

55c. Please select any of the following other mosquito-borne viruses that have been reported in your country from 2015-2020

Japanese encephalitis	Yes
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55d. Please provide total number of cases and deaths due to each of the following other arboviruses that you selected from 2015-2020

	Japanese encephalitis
2015 Cases	1
2015 Deaths	0
2016 Cases	0
2016 Deaths	0
2017 Cases	0
2017 Deaths	0
2018 Cases	0
2018 Deaths	0
2019 Cases	0
2019 Deaths	0
2020 Cases	0
2020 Deaths	0

56. Please provide the number of cases of locally acquired, mosquito-borne *Aedes*-borne arbovirus infections by case classification for 2020 and, if not available, for 2019

	Suspect cases	Probable cases	Confirmed cases	Deaths
Chikungunya	0	NA	2	0
Dengue	1464	NA	35274	32
Yellow Fever	0	NA	0	0
Zika	0	NA	5	0

57. Do arbovirus surveillance staff have any perceived reasons for increasing trends in arboviral disease incidence? Check all answers that apply.

Climate change (as evidenced by changes in meteorological data)	Not selected
Construction activities	Not selected
Population migration (within the country or between countries)	Yes
Increased availability of peri-domestic water-bearing containers suitable for mosquito egg deposition	Yes

Section X: Surveillance staffing

58. During 2019 (prior to the Covid-19 pandemic), indicate below the number of arbovirus surveillance staff at the national level.

	Number of personnel
Epidemiologists	26.0
Laboratorians	2.5
Entomologists/ vector control specialists	500.0
Support staff (administration; logistics; other)	0.1

59. Indicate below how many total staff persons are needed at the national level in your country to achieve full epidemiology and laboratory capacity* to conduct arbovirus surveillance.

	Number of personnel
Epidemiologists	26.0
Laboratorians	4.5
Entomologists/vector control specialists	500.0
Support staff (administration; logistics; other)	0.5

60. Optional comments to explain responses to questions 58 and 59 above

The arbovirus surveillance system incorporates diagnosis and lab-confirmation at primary care, followed by notification of cases to the Health Ministry and the National Parks Board (for animals) for consolidation, analysis and sense-making. The number of clinicians in healthcare facilities, and laboratory staff in clinical laboratories is not known and not included in the above data. The Entomologists / vector control specialists who carry out Arboviral disease related vector surveillance and control, also carry out surveillance and control for other vectors including rats, fleas, flies and cockroaches. The number excludes personnel working in the pest control industry and in other institutions.

61. The national health authority/ministry of health has access to expertise in clinical management of arboviruses (Check all that apply)

Within the ministry of health (eg, public health medical officers, clinicians in state hospitals)	Yes
Through other national agency with regulatory authority	Not selected
Through academic institution(s)	Not selected
Private hospitals	Not selected
Does not have access	Not selected

62. The national health authority/ministry of health has access to expertise in arbovirus epidemiology (Check all that apply)

Within the ministry of health	Yes
Through other national agency with regulatory authority	Yes
Through academic institution(s)	Yes
Does not have access	Not selected

63. The national health authority/ministry of health has access to expertise in arbovirus laboratory diagnosis (Check all that apply)

Within the ministry of health (e.g., public health laboratory scientists)	Yes
Through other national agency with regulatory authority	Yes
Through academic institution(s)	Yes
Does not have access	Not selected

64. The national health authority/ministry of health has access to expertise in entomology (Check all that apply)

Within the ministry of health	Not selected
Through other national agency with regulatory authority	Yes
Through academic institution(s)	Not selected
Does not have access	Not selected

65. Optional comments to explain responses to any of Questions 61-64

The national laboratory responsible for animal health is the Centre for Animal & Veterinary Sciences under the National Parks Board, which has diagnostic capabilities for certain arboviral diseases.

Section XI: Survey conclusion

66. If you have any further comments to add regarding arbovirus surveillance and control in your country, including whether arboviruses other than *Aedes*-borne arboviruses are of higher priority, please do so in the text field below

Nil