

### An Indigenous Outbreak of Dengue Fever in Toubiankeng's Orchards, Taiping District, Taichung City, 2018

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#### Abstract

In 2018, an indigenous outbreak of dengue fever (DF) occurred in Taichung City. Among the DF-confirmed cases, 16 cases were related to Toubiankeng's orchards located in Taiping District, Taichung City.

The epidemiologic investigation found that 16 cases had spatial relationships, and the identified causative type 1 dengue viruses shared similar genomic sequences in some cases, thus confirming the DF outbreak. The epidemic origin was likely due to an unknown asymptomatic case who transmitted the disease to inhabitants or farmers in orchards by *Aedes albopictus*.

Because the orchards are located in a mountainous area and the passages are narrow, it was difficult to eliminate the breeding sites and implement chemical control. Therefore, more manpower was needed to control the outbreak.

From October 23 to November 16, 2018, Taiwan Centers for Disease Control and Taichung City Government mobilized 563 person-times to eliminate breeding sites, execute chemical control, and assess the effectiveness of vector control measures. We believe that a complete control plan, including chemical control, reducing adult

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mosquitoes' density, contact tracing, DF testing to find the case early, and restricting public access to the orchards, was the key to controlling this outbreak successfully. In this article, we describe the DF outbreak in orchards and make recommendations to deal with similar situations in the future.

**Keywords:** indigenous, dengue fever, eliminate breeding sites, chemical control, restriction of access

# Investigation and Containment Measures of the Dengue Outbreak in Tainan City, 2019

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## Abstract

In 2019, an indigenous dengue fever outbreak, with 31 confirmed cases, threatened Tainan City. The outbreak included several epidemiologic-related clusters, and cases were distributed throughout the city. In response to this outbreak, a partnership was established between Taiwan Centers for Diseases Control, the Tainan City government, and National Health Research Institute. We set up several platforms, including LINE groups and emergency response sessions, for real-time discussion and decision-making. We also assembled technical staff to conduct the larvae elimination project in the affected districts. As of December 6 (31 days from the onset date of the last case), no new case was discovered. This article described the process of a dengue fever outbreak containment and shared experience for further similar outbreaks.

**Keywords:** Tainan city, indigenous dengue fever, clusters, partnership

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Weekly Data of Notifiable Inases (by week of diagnosis)

Case diagnosis year		Week 24★		Week 1-24			
Classification	Disease Diagnosed	2023	2022	2023		2022	
				Total cases★	Imported cases	Total cases★	Imported cases
Category I	Plague	0	0	0	0	0	0
	Rabies	0	0	0	0	0	0
	SARS	0	0	0	0	0	0
	Smallpox	0	0	0	0	0	0
Category II	Cholera	0	0	0	0	0	0
	Typhoid fever	0	0	2	2	1	0
	Paratyphoid Fever	0	0	4	0	0	0
	Epidemic Typhus Fever	0	0	0	0	0	0
	Shigellosis	2	2	30	9	40	1
	Amoebiasis	3	4	133	58	89	32
	Enterohemorrhagic E.coli Infection	0	0	0	0	0	0
	Anthrax	0	0	0	0	0	0
	Diphtheria	0	0	0	0	0	0
	Meningococcal Meningitis	0	0	1	0	0	0
	Poliomyelitis	0	0	0	0	0	0
	Acute Flaccid Paralysis	3	1	26	0	11	0
	Measles	0	0	1	1	0	0
	Rubella	0	0	0	0	0	0
	Dengue Fever	15	1	63	52	3	3
	West Nile Fever	0	0	0	0	0	0
	Acute Viral Hepatitis type A	4	0	46	2	93	0
	Malaria	0	0	1	1	2	2
	Chikungunya Fever	0	0	5	5	0	0
	Hantavirus syndrome	1	0	4	0	2	0
Zika virus infection	0	0	2	2	0	0	
Mpox	20	-	176	9	-	-	
Category III	Acute Viral Hepatitis type B	3	0	68	4	45	0
	Acute Viral Hepatitis type C	13	6	272	0	203	1
	Acute Viral Hepatitis type D	0	0	0	0	0	0
	Acute Viral Hepatitis type E	0	0	7	2	6	0
	Acute Viral Hepatitis, untyped	0	0	3	1	0	0
	Congenital Syphilis	0	0	0	0	0	0
	Congenital Rubella Syndrome	0	0	0	0	0	0
	Enteroviruses Infection with Severe Complications	0	0	6	0	0	0
	Haemophilus Influenza type b Infection	0	0	0	0	1	0
	Japanese Encephalitis	4	0	6	0	0	0
	Legionnaires' Disease	15	10	139	2	167	1
	Mumps	4	4	124	2	92	0
	Neonatal Tetanus	0	0	0	0	0	0
	Pertussis	0	0	0	0	0	0
Tetanus	0	0	3	0	1	0	
Category IV	Botulism	0	0	0	0	0	0
	Brucellosis	0	0	0	0	0	0
	Complicated Varicella	1	0	23	0	13	0
	Endemic Typhus Fever	1	0	7	0	5	0
	Herpesvirus B Infection	0	0	0	0	0	0
	Influenza Case with Severe Complications	32	0	271	3	0	0
	Invasive Pneumococcal Disease	4	10	150	1	92	0
	Leptospirosis	1	0	21	0	15	0
	Listeriosis	3	4	99	1	64	0
	Lyme Disease	0	0	0	0	1	1
	Melioidosis	0	0	7	0	1	0
	Q Fever	0	0	2	0	2	0
	Scrub Typhus	9	9	54	0	75	0
	Toxoplasmosis	1	0	15	2	12	0
	Tularemia	0	0	0	0	0	0
Severe Fever with Thrombocytopenia Syndrome	0	0	0	0	0	0	
Severe Pneumonia with Novel Pathogens	3,470	402,884	1,382,541	18,119	3,277,343	11,412	
Category V	Ebola Virus Disease	0	0	0	0	0	0
	Lassa Fever	0	0	0	0	0	0
	Marburg Hemorrhagic Fever	0	0	0	0	0	0
	Middle East Respiratory Syndrome Coronavirus Infections	0	0	0	0	0	0
	Novel Influenza A Virus Infections	0	0	1	0	0	0
	Rift Valley Fever	0	0	0	0	0	0
Yellow Fever	0	0	0	0	0	0	

1. ★The weekly and cumulative total numbers include indigenous and imported cases of notifiable infectious diseases.  
 2. MDR-TB, Tuberculosis, Syphilis, Gonorrhoea, HIV Infection, AIDS, Hansen's Disease and Creutzfeldt-Jakob Disease are excluded from the table.  
 3. Numbers of mumps and tetanus cases are summed up by the week of report.  
 4. "Mpox" has been listed as a Notifiable Infectious Disease since June 23, 2022.  
 5. "Severe Pneumonia with Novel Pathogens": The case definition has been revised to include patients who have both a positive test for SARS-CoV-2 and associated complications since March 20, 2023. Additionally, it has been modified from Category V to Category IV since May 1, 2023.

## Suspected Clusters

- Fifty-six clusters related to Upper respiratory tract infection (37), Diarrhea (8), Enterovirus (5), TB (3), Varicella (2) and Fever of unknown origin (1) were reported during week 24.

## Imported Infectious Diseases

- There were 11 imported cases from at least 10 countries / areas during week 24.
  - Severe Pneumonia with Novel Pathogens:** 4 cases from Vietnam, Italy, Austria and Japan.
  - Dengue Fever:** 4 cases from Laos, Malaysia, Thailand and Maldives.
  - Mpox:** 1 case from Cambodia.
  - Shigellosis:** 1 case from Indonesia.
  - Amoebiasis:** 1 case from Indonesia.
- During week 1-24, there were 18,278 imported cases of notifiable diseases. The top three were Severe Pneumonia with Novel Pathogens (18,119), Amoebiasis (58) and Dengue Fever (52).
- During week 1-24, imported cases of notifiable diseases were from at least 46 countries/areas. The top three were China (3,159), Japan (717) and Korea (182).

## Summary of Epidemic

- **Severe Pneumonia with Novel Pathogens:** The epidemic is in a plateau phase and may slightly increase.
- **Mpox:** The risk of epidemic transmission remains.
- **Enterovirus:** The epidemic is in a plateau phase and slightly decreases.
- **Japanese Encephalitis:** In the midst of the epidemic season, the number of new cases is expected to rise in all counties.
- **Dengue Fever:** A local cluster has been detected in Tainan City. Recent rainfall in multiple counties has led to the accumulation of water in containers and an increase in vector breeding. Therefore, the risk of epidemic transmission is increasing.
- **Influenza:** The epidemic reaches a plateau phase and is similar to previous weeks.

**Weekly Data of Notifiable Inases (by week of diagnosis)**

Case diagnosis year		Week 25★		Week 1-25			
Classification	Disease Diagnosed	2023	2022	2023		2022	
				Total cases★	Imported cases	Total cases★	Imported cases
Category I	Plague	0	0	0	0	0	0
	Rabies	0	0	0	0	0	0
	SARS	0	0	0	0	0	0
	Smallpox	0	0	0	0	0	0
Category II	Cholera	0	0	0	0	0	0
	Typhoid fever	0	0	2	2	1	0
	Paratyphoid Fever	0	0	4	0	0	0
	Epidemic Typhus Fever	0	0	0	0	0	0
	Shigellosis	1	0	31	9	40	1
	Amoebiasis	5	2	138	59	91	33
	Enterohemorrhagic E.coli Infection	0	0	0	0	0	0
	Anthrax	0	0	0	0	0	0
	Diphtheria	0	0	0	0	0	0
	Meningococcal Meningitis	0	0	1	0	0	0
	Poliomyelitis	0	0	0	0	0	0
	Acute Flaccid Paralysis	3	2	29	0	13	0
	Measles	0	0	1	1	0	0
	Rubella	0	0	0	0	0	0
	Dengue Fever	47	1	110	56	4	4
	West Nile Fever	0	0	0	0	0	0
	Acute Viral Hepatitis type A	0	2	46	2	95	0
	Malaria	0	0	1	1	2	2
	Chikungunya Fever	0	0	5	5	0	0
	Hantavirus syndrome	0	0	4	0	2	0
Zika virus infection	0	0	2	2	0	0	
Mpox	15	0	191	9	0	0	
Category III	Acute Viral Hepatitis type B	1	1	69	4	46	0
	Acute Viral Hepatitis type C	9	10	281	0	213	1
	Acute Viral Hepatitis type D	0	0	0	0	0	0
	Acute Viral Hepatitis type E	0	1	7	2	7	0
	Acute Viral Hepatitis, untyped	0	0	3	1	0	0
	Congenital Syphilis	0	0	0	0	0	0
	Congenital Rubella Syndrome	0	0	0	0	0	0
	Enteroviruses Infection with Severe Complications	1	0	7	0	0	0
	Haemophilus Influenza type b Infection	0	0	0	0	1	0
	Japanese Encephalitis	0	3	6	0	3	0
	Legionnaires' Disease	5	12	144	2	179	1
	Mumps	8	8	132	2	100	0
	Neonatal Tetanus	0	0	0	0	0	0
	Pertussis	0	0	0	0	0	0
Tetanus	0	1	3	0	2	0	
Category IV	Botulism	0	0	0	0	0	0
	Brucellosis	0	0	0	0	0	0
	Complicated Varicella	0	2	23	0	15	0
	Endemic Typhus Fever	1	0	8	0	5	0
	Herpesvirus B Infection	0	0	0	0	0	0
	Influenza Case with Severe Complications	23	0	294	3	0	0
	Invasive Pneumococcal Disease	3	3	153	1	95	0
	Leptospirosis	2	2	23	0	17	0
	Listeriosis	1	4	100	1	68	0
	Lyme Disease	0	0	0	0	1	1
	Melioidosis	0	0	7	0	1	0
	Q Fever	0	0	2	0	2	0
	Scrub Typhus	3	1	57	0	76	0
	Toxoplasmosis	2	0	17	2	12	0
	Tularemia	0	0	0	0	0	0
Severe Fever with Thrombocytopenia Syndrome	0	1	0	0	1	0	
Severe Pneumonia with Novel Pathogens	1,617	318,310	1,384,157	18,118	3,595,653	11,880	
Category V	Ebola Virus Disease	0	0	0	0	0	0
	Lassa Fever	0	0	0	0	0	0
	Marburg Hemorrhagic Fever	0	0	0	0	0	0
	Middle East Respiratory Syndrome Coronavirus Infections	0	0	0	0	0	0
	Novel Influenza A Virus Infections	0	0	1	0	0	0
	Rift Valley Fever	0	0	0	0	0	0
Yellow Fever	0	0	0	0	0	0	

1. ★The weekly and cumulative total numbers include indigenous and imported cases of notifiable infectious diseases.  
2. MDR-TB, Tuberculosis, Syphilis, Gonorrhoea, HIV Infection, AIDS, Hansen's Disease and Creutzfeldt-Jakob Disease are excluded from the table.  
3. Numbers of mumps and tetanus cases are summed up by the week of report.  
4. "Mpox" has been listed as a Notifiable Infectious Disease since June 23, 2022.  
5. "Severe Pneumonia with Novel Pathogens": The case definition has been revised to include patients who have both a positive test for SARS-CoV-2 and associated complications since March 20, 2023. Additionally, it has been modified from Category V to Category IV since May 1, 2023.

## Suspected Clusters

- Forty-four clusters related to Upper respiratory tract infection (37), Diarrhea (4), TB (2) and Varicella (1) were reported during week 25.

## Imported Infectious Diseases

- There were 5 imported cases from at least 2 countries / areas during week 25.
  - Dengue Fever:** 4 cases from the Philippines (3) and Thailand (1).
  - Amoebiasis:** 1 case from the Philippines.
- During week 1-25, there were 18,282 imported cases of notifiable diseases. The top three were Severe Pneumonia with Novel Pathogens (18,118), Amoebiasis (59) and Dengue Fever (56).
- During week 1-25, imported cases of notifiable diseases were from at least 46 countries/areas. The top three were China (3,159), Japan (717) and Korea (182).

## Summary of Epidemic

- **Severe Pneumonia with Novel Pathogens:** The epidemic is in a plateau phase and may slightly increase.
- **Mpox:** The risk of epidemic transmission remains.
- **Enterovirus:** It is in an epidemic period and may slightly decrease.
- **Japanese Encephalitis:** In the midst of the epidemic season, the number of new cases is expected to rise in all counties.
- **Dengue Fever:** The number of cases within the cluster in Tainan City is still increasing. The vector indices in some counties are high, indicating an elevated risk of epidemic transmission.
- **Influenza:** The epidemic is in a plateau phase, and the number of severe cases may increase.

### Weekly Data of Notifiable Inases (by week of diagnosis)

Case diagnosis year		Week 26★		Week 1-26			
Classification	Disease Diagnosed	2023	2022	2023		2022	
				Total cases★	Imported cases	Total cases★	Imported cases
Category I	Plague	0	0	0	0	0	0
	Rabies	0	0	0	0	0	0
	SARS	0	0	0	0	0	0
	Smallpox	0	0	0	0	0	0
Category II	Cholera	0	0	0	0	0	0
	Typhoid fever	0	0	2	2	1	0
	Paratyphoid Fever	1	0	5	0	0	0
	Epidemic Typhus Fever	0	0	0	0	0	0
	Shigellosis	1	3	32	10	43	1
	Amoebiasis	1	8	139	59	99	37
	Enterohemorrhagic E.coli Infection	0	0	0	0	0	0
	Anthrax	0	0	0	0	0	0
	Diphtheria	0	0	0	0	0	0
	Meningococcal Meningitis	0	0	1	0	0	0
	Poliomyelitis	0	0	0	0	0	0
	Acute Flaccid Paralysis	1	1	30	0	14	0
	Measles	0	0	1	1	0	0
	Rubella	0	0	0	0	0	0
	Dengue Fever	104	1	214	56	5	5
	West Nile Fever	0	0	0	0	0	0
	Acute Viral Hepatitis type A	4	5	50	2	100	1
	Malaria	0	0	1	1	2	2
	Chikungunya Fever	0	0	5	5	0	0
	Hantavirus syndrome	0	0	4	0	2	0
Zika virus infection	0	0	2	2	0	0	
Mpox	16	0	207	10	1	1	
Category III	Acute Viral Hepatitis type B	5	1	74	4	47	0
	Acute Viral Hepatitis type C	9	8	290	0	221	1
	Acute Viral Hepatitis type D	0	0	0	0	0	0
	Acute Viral Hepatitis type E	0	0	7	2	7	0
	Acute Viral Hepatitis, untyped	0	0	3	1	0	0
	Congenital Syphilis	0	0	0	0	0	0
	Congenital Rubella Syndrome	0	0	0	0	0	0
	Enteroviruses Infection with Severe Complications	0	0	7	0	0	0
	Haemophilus Influenza type b Infection	0	0	0	0	1	0
	Japanese Encephalitis	1	1	7	0	4	0
	Legionnaires' Disease	9	5	153	4	184	1
	Mumps	8	3	140	3	103	0
	Neonatal Tetanus	0	0	0	0	0	0
	Pertussis	0	0	0	0	0	0
Tetanus	0	0	3	0	2	0	
Category IV	Botulism	0	0	0	0	0	0
	Brucellosis	0	0	0	0	0	0
	Complicated Varicella	1	0	24	0	15	0
	Endemic Typhus Fever	1	0	9	0	5	0
	Herpesvirus B Infection	0	0	0	0	0	0
	Influenza Case with Severe Complications	28	0	322	4	0	0
	Invasive Pneumococcal Disease	3	4	156	1	99	0
	Leptospirosis	2	2	25	0	19	0
	Listeriosis	7	2	107	1	70	0
	Lyme Disease	0	0	0	0	1	1
	Melioidosis	1	0	8	0	1	0
	Q Fever	0	0	2	0	2	0
	Scrub Typhus	9	5	66	0	81	0
	Toxoplasmosis	0	0	17	2	12	0
	Tularemia	0	0	0	0	0	0
Severe Fever with Thrombocytopenia Syndrome	0	0	0	0	1	0	
Severe Pneumonia with Novel Pathogens	1,513	257,342	1,385,670	18,118	3,852,995	12,510	
Category V	Ebola Virus Disease	0	0	0	0	0	0
	Lassa Fever	0	0	0	0	0	0
	Marburg Hemorrhagic Fever	0	0	0	0	0	0
	Middle East Respiratory Syndrome Coronavirus Infections	0	0	0	0	0	0
	Novel Influenza A Virus Infections	0	0	1	0	0	0
	Rift Valley Fever	0	0	0	0	0	0
Yellow Fever	0	0	0	0	0	0	

1. ★The weekly and cumulative total numbers include indigenous and imported cases of notifiable infectious diseases.  
2. MDR-TB, Tuberculosis, Syphilis, Gonorrhoea, HIV Infection, AIDS, Hansen's Disease and Creutzfeldt-Jakob Disease are excluded from the table.  
3. Numbers of mumps and tetanus cases are summed up by the week of report.  
4. "Mpox" has been listed as a Notifiable Infectious Disease since June 23, 2022.  
5. "Severe Pneumonia with Novel Pathogens": The case definition has been revised to include patients who have both a positive test for SARS-CoV-2 and associated complications since March 20, 2023. Additionally, it has been modified from Category V to Category IV since May 1, 2023.



## Suspected Clusters

- Twenty clusters related to Upper respiratory tract infection (10), TB (4), Enterovirus (3), Diarrhea (2) and Varicella (1) were reported during week 26.

## Imported Infectious Diseases

- There were 6 imported cases from at least 5 countries / areas during week 26.
  - Legionnaires' Disease:** 2 cases from Vietnam and Thailand.
  - Shigellosis:** 1 case from USA.
  - Influenza Case with Severe Complications:** 1 case from Korea.
  - Mumps:** 1 case from China.
  - Mpox:** 1 case from Vietnam.
- During week 1-26, there were 18,288 imported cases of notifiable diseases. The top three were Severe Pneumonia with Novel Pathogens (18,118), Amoebiasis (59) and Dengue Fever (56).
- During week 1-26, imported cases of notifiable diseases were from at least 46 countries/areas. The top three were China (3,160), Japan (717) and Korea (183).

## Summary of Epidemic

- **Severe Pneumonia with Novel Pathogens:** The epidemic is in a plateau phase.
- **Mpox:** The risk of epidemic transmission remains.
- **Enterovirus:** The epidemic is slightly decreasing.
- **Japanese Encephalitis:** In the midst of the epidemic season, the risk of new cases is expected to be detected in all counties.
- **Dengue Fever:** The clusters in Tainan City and Yunlin County continue to show an increase in cases, and the vector indices in some counties are high, indicating an elevated risk of epidemic transmission.
- **Influenza:** The epidemic is in a plateau phase.

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