

# CDC

## 2019 Annual Report

Taiwan Centers for Disease Control





# 2018 Events organized by Taiwan CDC from January to December

## January 1



Hepatitis A vaccine was included in the scope of routine vaccinations for Children. Children born after 2017 and aged 12 months and above are eligible for vaccination.

## January 23

Taiwan CDC organized a book launch for "Power of Perseverance – 120 years of Quarantine in Taiwan (1896~2016)" - a history of Taiwan's quarantine policies and implementation over the past 120 years.

## March 23



To commemorate World Tuberculosis Day, Taiwan CDC organized a press conference titled "END TB". Shih-Chung Chen, Minister of Health and Welfare, tuberculosis experts, legislators, and representatives from different sectors signed for eliminating tuberculosis.

## April 11

Taiwan CDC and Acer Inc. jointly organized a press conference to launch the "Flu Forecasting Station", a website integrating artificial intelligence and big data analytics, offering the public and healthcare providers easy access to influenza activity.



## April 23 to 26



Taiwan CDC, AIT, and the Ministry of Foreign Affairs jointly organized the International Workshop on Laboratory Diagnosis for Enterovirus with a total of 31 public health officials and laboratory professionals coming from 15 countries to participate in the training.

## May 3 to 4



Taiwan CDC successfully secured APEC funding to organize the APEC Conference on Severe Dengue Prevention and Strategies for Reducing Disease Burden. A total of 88 public health and medical professionals from 10 APEC member economies participated in the conference.

## June 11 to July 6



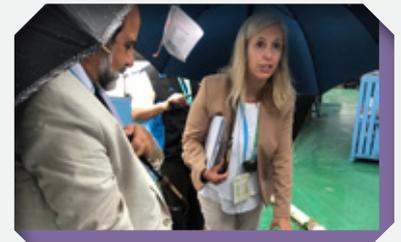
Taiwan CDC hosted the 2018 Tuberculosis Control and Prevention Workshop under the New Southbound Policy. The Quang Ninh Department of Health of Vietnam sent a total of 26 officials involved in policy-making and experts in the areas of public health, clinical medicine, and laboratory diagnosis to Taiwan to participate in the workshop.

## July 30 to August 3

A delegation consisting of officials from the Ministry of Health of Indonesia, tuberculosis experts from USAID, and World Bank consultants visited Taiwan CDC to learn Taiwan's experience in health financing and provider payment mechanisms.

## August 27 to 30

Taiwan CDC invited IHR2005 experts from the European Union to Taoyuan International Airport and Port of Kaohsiung to conduct an external evaluation for the IHR core capacity and sustainable development at designated points of entry. An evaluation is carried out once every five years. Both of the ports were applauded by the experts.



## August 31

Taiwan CDC established the New Southbound Health Center to provide travelers between Taiwan and New South Bound countries with education on preventing communicable diseases, consultations, and transition care services.

## September 1

Taiwan CDC expanded the scope of government-funded vaccination scheme by increasing subsidies for vaccinations. Children now can receive a total of 20 routine vaccines for free before going to elementary school. People aged 75 and above now can also receive pneumococcal vaccines without paying extra diagnostic fees.



## September 3 to 4



Taiwan CDC and Japan NIID jointly organized the 15<sup>th</sup> Taiwan-Japan symposium in Taiwan. 20 Japanese experts and 81 Taiwanese participants shared their experiences in the prevention and control of imported infectious disease, biosafety and biosecurity, and discussed the results of collaborative projects.

## September 19

Taiwan CDC launched Line @ chatbot -Disease Control Butler 2.0. With natural language processing technologies, users are able to access consultations on vaccination as well as comprehensive and accurate information on measures aimed at disease prevention more rapidly.

## September 20 to 21



Taiwan CDC successfully secured APEC funding for the APEC Conference on Strategies Against the Evolving Threats from Antimicrobial Resistance (AMR): From Awareness to Concrete Action. A total of 143 experts on public health and medicine from 15 APEC member economies participated in the event.

## September 28

Taiwan CDC and the National Health Research Institutes jointly organized the International Conference on the Anniversary of Enterovirus A71 Epidemic of 1998 in Taiwan to share Taiwan's experiences in preventing and controlling enterovirus epidemics with experts and disease prevention professionals from the U.S., Japan, and countries covered by the New Southbound Policy.

## September 23 to October 6

Taiwan CDC visited Vietnam for the Taiwan-Vietnam TB Control Collaborative Project to carry out practical exchanges in the areas of public health, clinical medicine and laboratory diagnosis. It also facilitated the signing of the MOU between Taipei Municipal Wanfang Hospital and Quang Ninh Provincial Tuberculosis Hospital and the establishment of the office dedicated to tuberculosis prevention and control.

## October 15



Government-funded influenza vaccines were made available.

## October 20

The National Immunization Horse Stable was unveiled to stabilize the supply of anti-snake venom serums and ensure the safety of people in Taiwan.



## October 22

Taiwan CDC organized the 2018 New Southbound: Indonesia-Taiwan Dengue Workshop with a total of 15 dengue fever prevention professionals from Indonesia participating in the training to study a wide variety of prevention strategies, including surveillance technologies, laboratory techniques, and community-based prevention.

## November 16

Taiwan CDC organized the International Collaboration on Global Health Security in South-East Asia, bringing together a total of 144 participants to discuss the latest updates on the Joint External Evaluation that had been promoted by the WHO and cooperation between Taiwan and countries covered by the New Southbound Policy as well as the biomedical industry.

## November 30



To commemorate 2018 World AIDS Day with the theme of "Live life positively-know your HIV status" and encourage people to screen for AIDS, Taiwan CDC hosted a campaign titled "Beat AIDS and be Healthy Together".





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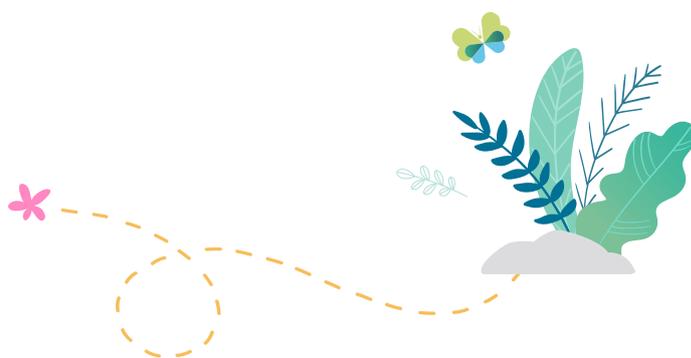
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## Message from the Director - General

Thank you for reading the 2019 Annual Report of the Taiwan Centers for Disease Control (Taiwan CDC)! The 2019 Annual Report presents a comprehensive portrait of our major policies and disease prevention achievements over the past year, which can also serve as a reference for our counterparts and the international community.

Tuberculosis remains one of the top 10 causes of death worldwide. Moreover, MDR-TB is a significant public health issue. In order to effectively control and prevent the spread of tuberculosis, MDR-TB was mandated to be reported to Taiwan CDC since 2006 with the implementation of DOTS-plus service. The Taiwan Multidrug-resistant TB Consortium (TMTC) was established in 2007 and Taiwan CDC is committed to improving the quality of DR-TB laboratory, introducing global novel TB medications and regimens, and establishing a consortium for MDR-TB care to ensure high quality of care for patients and improvement of TB case management. After ten years of efforts, the number of managed MDR-TB cases has been decreasing at an annual rate of 9%. The number of new cases every year only accounts for 1% of the total tuberculosis cases - a number lower than the global average of 3.5%. The treatment success rate also increased significantly from 59% in 2007 to 74% in 2016 with continued monitoring for 24 months. A chapter in this report is dedicated to relevant strategies and achievements of prevention.

Communicable diseases do not respect national borders. To strengthen international cooperation on preventing communicable diseases, Taiwan CDC and the US jointly organized the International Workshop on Laboratory Diagnosis for Enterovirus in 2018 under the Global Cooperation Training Framework (GCTF). Additionally, to share Taiwan's technologies for and experiences in preventing diseases with countries in Asia Pacific and increase Taiwan's international visibility, Taiwan CDC successfully secured funding for organizing the "APEC Conference on Severe Dengue Prevention and Strategies for Reducing Disease Burden" and the "APEC Conference on Strategies Against the Evolving Threat from Antimicrobial Resistance." Scholars, health officials, medical professionals from Asia Pacific and Southeast Asia were invited to the events to establish channels for cooperation and exchanges and increase regional capabilities for preventing communicable diseases.



Vaccination plays a vital role in preventing communicable diseases and ensuring the health of the public. In 2018, Taiwan CDC continued to promote vaccination. In addition, it collaborated with the Pujar Charity Foundation and received a donation of 4 million doses of hepatitis A vaccine. Since then, hepatitis A vaccine has been included in the scope of routine vaccination program for children, protecting more people and reducing the threat posed by hepatitis A to the public.

With more frequent international exchanges, preventing and controlling communicable diseases have become even more challenging. To help other countries better understand measures used to control and prevent communicable diseases in Taiwan, this Annual Report presents the situations for dengue fever, enterovirus, influenza, and AIDS as well as strategies for preventing and controlling these major communicable diseases. Through this Annual Report, Taiwan CDC hopes to share Taiwan's achievements and experiences in disease prevention and control in 2018 with the international community and continues to contribute to the shared goal of global health security.



Jih-Haw Chou, D.D.S., M.P.H.  
Director-General  
Taiwan Centers for Disease Control





衛生福利部疾病管制署  
Taiwan Centers for Disease Control



About  
Taiwan CDC

## About Taiwan CDC

In 1999, the Taiwan Centers for Disease Control (Taiwan CDC) was established under the Organization Law of the Centers for Disease Control. The mission of Taiwan CDC is to protect people from the threats of communicable diseases. Taiwan CDC strives to accomplish its mission by:

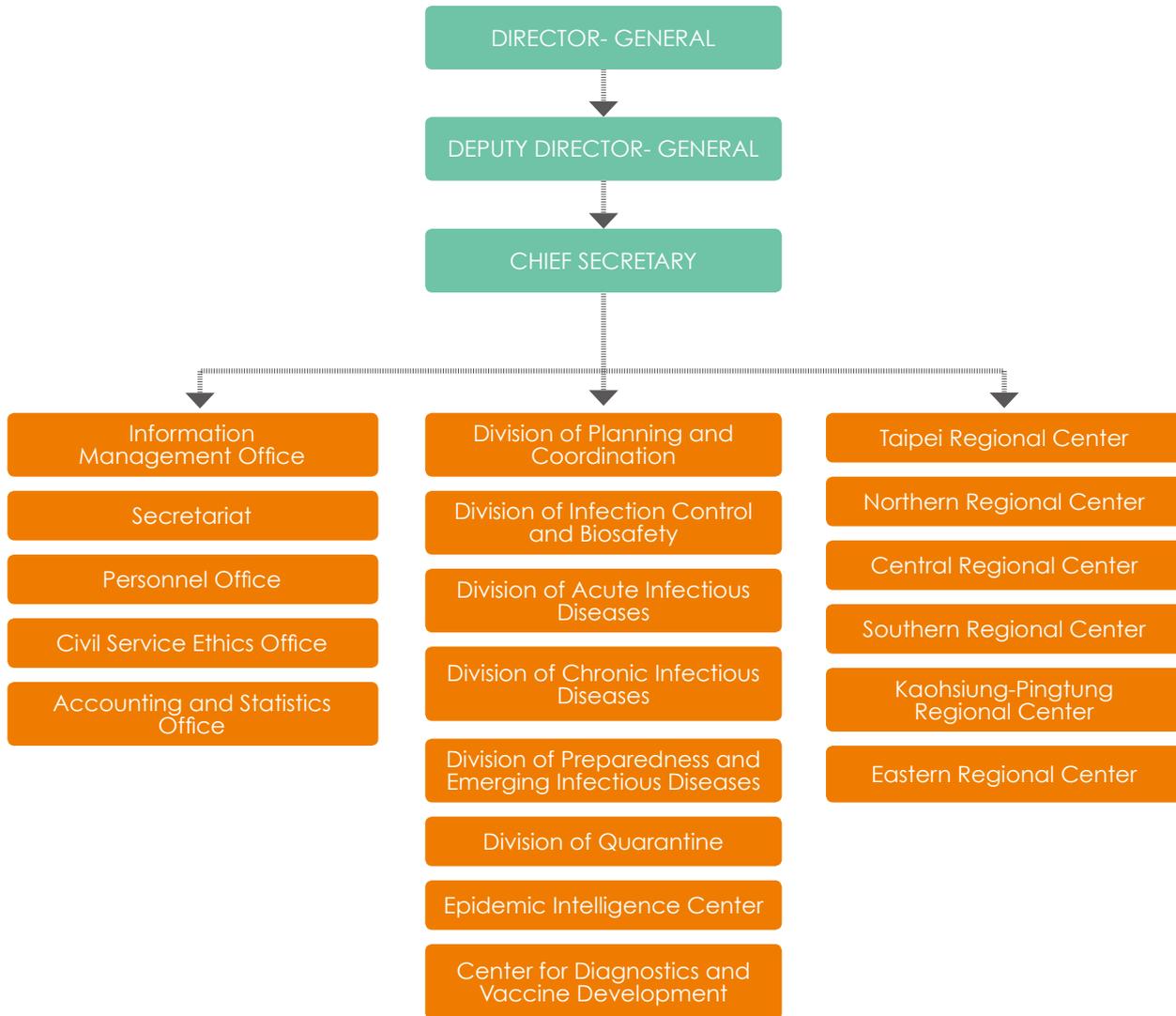
1. Formulating policies, strategies and plans for the prevention and control of communicable diseases;
2. Guiding and assessing local authorities in the execution of matters concerning communicable disease control;
3. Establishing relief funds for compensating vaccine victims and related activities;
4. Conducting quarantines of international and specially designated ports;
5. Organizing international collaborative projects and exchanges on communicable disease control.

Taiwan CDC is under the command of the director-general, who is assisted by two deputy directors and a chief secretary. Since government restructuring in July 2013, Taiwan CDC has comprised six divisions, five offices, two centers, six regional centers, and two task forces (Figure 1-1), as follows:

1. Six Divisions: Division of Planning and Coordination; Division of Acute Infectious Diseases; Division of Chronic Infectious Diseases; Division of Preparedness and Emerging Infectious Diseases; Division of Infection Control and Biosafety; Division of Quarantine
2. Two Centers: Epidemic Intelligence Center; Center for Diagnostics and Vaccine Development
3. Five Offices: Information Management Office; Secretariat; Personnel Office; Accounting and Statistics Office; Civil Service Ethics Office
4. Six Regional Centers: Taipei Regional Center; Northern Regional Center; Central Regional Center; Southern Regional Center; Kaohsiung-Pingtung Regional Center; Eastern Regional Center
5. Two Task Forces: Public Relations Office; Office of Preventive Medicine

Distribution of Employees by Gender, Age, and Education: At the end of December 2018, there were 751 Taiwan CDC employees, with a male to female ratio of 1:3.44. Average age was 43 with 74% under 49 years old (Table 1-1). About 44% graduated from university or college while 56% completed a graduate school degree (Table 1-2).

**Figure 1-1 Organization**



**Table 1-1 Age Distribution of Taiwan CDC Employees**

Under 29 years	30-39 years	40-49 years	50-59 years	60-65 years
7.3%	31.3%	34.9%	24.1%	2.4%

**Table 1-2 Education Level of Taiwan CDC Employees**

Graduate School	University	College	High School or Under
55.9%	34.9%	7.1%	2.1%

# Core Values of Taiwan CDC



## 1. Expertise Cultivation

Putting science and new knowledge into action to strengthen Taiwan's capacity for preventing and confronting emerging infectious diseases.



## 2. Pragmatic Actions

Working relentlessly around the clock to implement disease prevention measures and ensure the health and wellbeing of the people in Taiwan.



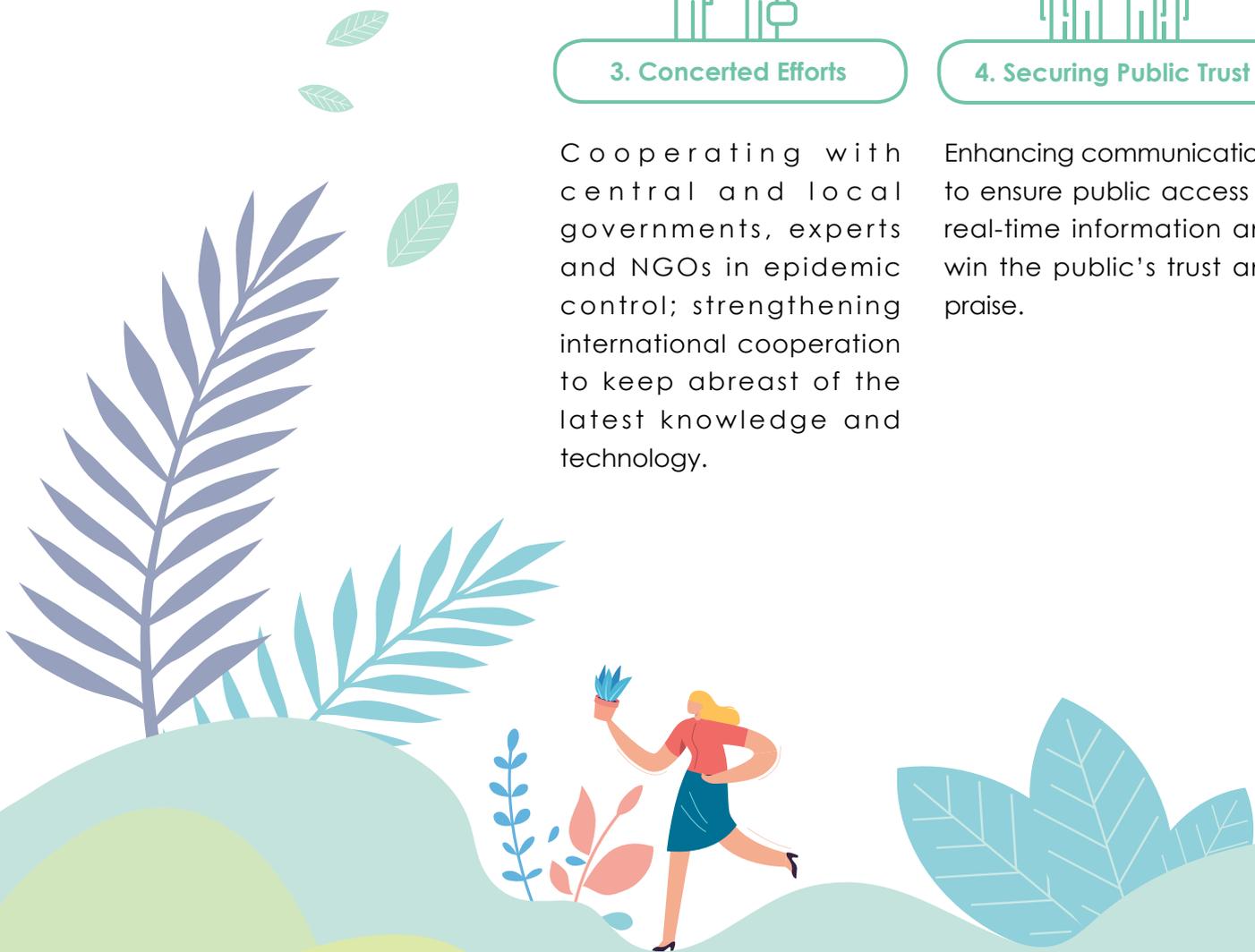
## 3. Concerted Efforts

Cooperating with central and local governments, experts and NGOs in epidemic control; strengthening international cooperation to keep abreast of the latest knowledge and technology.



## 4. Securing Public Trust

Enhancing communications to ensure public access to real-time information and win the public's trust and praise.





# 2019 Focus - Multi-Drug Resistant Tuberculosis (MDR-TB)

# 2019 Focus - Multi-Drug Resistant Tuberculosis (MDR-TB)

## MDR-TB current status

Tuberculosis (TB) is one of the top ten causes of death worldwide, claiming more lives than HIV/AIDS does. Meanwhile, drug resistance can have a serious negative impact on TB patients, medical teams, and public health professionals during the course of TB treatment.

Compared with drug-susceptible TB, which only takes 6 months to cure by a regular administration of medicines, the course of treatment of MDR-TB lasts about 20 months. Additionally, patients usually need second-line injectable agents that can lead to more side effects and long-term hospitalization in an isolated room. Due to the consequent social and psychological impacts, poor treatment results are more frequent in drug-resistance TB than drug-susceptible TB.

According to the Global Tuberculosis Report 2018 by the WHO, worldwide in 2017, approximately 560,000 people developed TB that was resistant to rifampicin (RR-TB), the most effective first-line drug, and of these, 82% had multidrug-resistant TB (MDR-TB). Among cases of MDR-TB, 8.5% developed extensively drug-resistant TB (XDR-TB), which was even more difficult to treat.

The WHO surveyed 127 countries for the treatment outcomes for MDR-TB and RR-TB patients. The treatment success rate was 82% for drug-susceptible TB (2016 cohort), 55% for MDR-TB, and only 34% for XDR-TB (2015 cohort). In 8% the treatment failed, 15% died, 14% were lost to follow-up for MDR-TB and RR-TB. The treatment success rate for MDR-TB and RR-TB in 2015 cohort only hit 50%, with the lowest worldwide in Southeast Asia, a place that is close to Taiwan.

In Taiwan, the strains isolated from first sputum culture positive sample of reported TB cases shall all be tested for first-line TB drug susceptibility, such as isoniazid and rifampicin, to screen for drug-resistant TB cases. Additionally, since 2006, Taiwan CDC has been implementing the DOTS program and MDR-TB registration. The Taiwan Multidrug-resistant TB Consortium (TMTC) was established in 2007 and it has been effectively managing and curing MDR-TB cases, and reducing relapse in advance. All of these have contributed to a significant decrease in the number of MDR-TB cases under management over the past ten years.

## Disease Prevention Measures

### 1. The reporting and confirmation of MDR-TB

Before 2006, Taiwan's MDR-TB cases were not required to be reported and the central government lacked systematic sampling methods to estimate the MDR-TB epidemic precisely.

In order to monitor and manage MDR-TB cases, Taiwan CDC initiated the reporting of MDR-TB cases in December 2006. Furthermore, it included MDR-TB in the list of second-category notifiable infectious disease in July 2007, rendering the reporting of MDR-TB mandatory. In addition, starting in May 2008, clinically diagnosed MDR-TB samples are required to be delivered to the central laboratory for confirmation and second-line TB drug susceptibility tests. MDR-TB cases have been automatically reported and registered into the central TB registry and management system starting from April 2009. Registered MDR-TB patients will be referred to the TMTC and the public health workers for case treatment and management.

Echoing the WHO's recommendation of monitoring and treating RR-TB as MDR-TB, Taiwan initiated the registration of RR-TB in April 2017. Patients diagnosed with RR-TB by healthcare institutions are required to be registered into the central TB registry and management system and managed as MDR-TB cases to prevent RR-TB from developing multidrug resistance.

## 2. Establishing the TMTC (Taiwan MDR-TB Consortium)

Taiwan CDC started to implement the DOTS program in April 2006. The program enrolled contagious TB cases to achieve higher treatment success rates and prevent drug resistance. These measures have significantly reduced the numbers of relapse, loss to follow-up, and treatment failure, and, in turn, prevented the development of MDR-TB. In October 2006, Taiwan CDC organized the TMTC (Taiwan MDR-TB Consortium), a dedicated MDR-TB care system. The TMTC consists of 5 drug-resistant TB management groups, which are regionally assigned to cover all 22 cities and counties in Taiwan. The total enrollment and the timely enrollment rates (enrolling patients within 4 months since the date of collecting sputum sample) for MDR-TB have both reached 90%, substantially preventing MDR-TB from spreading in communities.

After the establishment of the TMTC, the regional TMTC groups coordinated experienced hospitals and doctors to form medical teams which integrate treatment



The inauguration ceremony of the TMTC in 2007



Clinical experts on MDR-TB in southern Taiwan were awarded by the Ministry of Health and Welfare for significant contributions to MDR-TB prevention.

and the DOTS-Plus program. These medical teams have been providing patients with patient-centered care in remote areas. The TMTC also provides more flexible funding and subsidies, enabling TMTC groups to adopt proper care models. As for care quality assurance, Taiwan CDC organized quarterly evaluation meetings to ensure the quality of case management and care. The system has been undertaken for 10 years, significantly contributing to the control of drug-resistant tuberculosis (DR-TB).

### **3. Continuous quality improvement and shorter turn-around time for TB tests**

Taiwan CDC started to promote laboratory accreditation in 2008. As of 2015, a total of 33 laboratories had been accredited. Among these, 31 offer drug susceptibility tests, and 26 offer rapid molecular tests.

Thanks to the development of novel diagnostic tools for tuberculosis, in 2007 Taiwan CDC started to adopt rapid molecular tests for TB drug resistance and offered confirmatory tests for strains isolated from individuals with MDR-TB. From 2010 to 2013, it gradually expanded rapid molecular tests target groups to previously treated TB cases (relapse, lost to follow-up, and failure), people living in high-risk areas in Taiwan, MDR-TB contacts, and people who have stayed in high burden TB/MDR-TB countries for at least 30 days within a year. Rapid molecular tests only take one to three days, enabling early detection and treatment to prevent the spread of TB in communities. In 2017, RR-TB contacts were also included in the list of people who are at risk of developing drug resistance and are provided with rapid molecular tests.

In addition, in July 2015, Taiwan CDC started to offer second-line tuberculosis drug resistance testing by molecular methods to all individuals with RR-TB, including MDR-TB, so as to provide individuals with effective second-line drug regimen more promptly.

### **4. Strengthening the monitoring and management for drug-resistant TB contacts**

To proactively identify potential DR-TB cases, Taiwan CDC has been strengthening the monitoring and management for MDR-TB contacts since 2009 by increasing the frequency of X-ray examinations for contacts. MDR-TB contacts are required to undergo the initial X-ray examination within a month after the index case is reported and one X-ray examination every six months for two consecutive years. Starting from April 2017, RR-TB contacts who are unable to receive LTBI treatment are required to be monitored as MDR-TB cases.

### **5. Effectively preventing the development of drug resistance to fluoroquinolones (FQs).**

FQs play a vital role in treating MDR-TB. High-level resistance to FQs will increase the possibility of treatment failure, relapse, and poor prognosis. The misuse and overuse of FQs can also be prevented by timely and reliable drug susceptibility tests and drug resistance investigations. An analysis of drug resistance surveillance showed that 56% of MDR-TB cases were resistant to FQs before the establishment of the TMTC. In other words, the then prevalent strains had accumulated serious resistance to FQs, considerably

affecting the treatment outcome for MDR-TB. In light of this, Taiwan CDC and the National Health Insurance Administration started to monitor the prescription of FQs by limiting FQs used to treat TB in August 2007. FQs are now centrally procured by Taiwan CDC and delivered to healthcare institutions after approval, to prevent misuse.

Meanwhile, it started to promote rapid molecular tests for resistance to second-line drugs offered by the central laboratory and refer MDR-TB cases to experienced care systems, i.e. TMTC. These strategies have borne fruits. The percentage of new MDR-TB cases that are resistant to FQs has dropped to 10% over the past few years. Additionally, few cases have developed resistance to FQs or second-line injectable agents over the past five years. Starting from September 2017, Taiwan CDC also instructed doctors to recommend the administration of injectable agents and offer free rapid molecular tests to rule out resistance to RMP and prevent resistance to FQs due to improper treatment when treating difficult cases, in which the approval of an FQ prescription is required.

## **6. Introducing global novel TB medications and regimens**

Emerging technologies have been introduced in accordance with the program “Taiwan’s strategy for TB elimination by 2035 in Taiwan”. Treatment and support have been made available to all individuals with TB, especially those with drug-resistant TB. The introduction of new TB drugs and short-term treatment regimens have given hope to MDR-TB by shortening the treatment course. By putting in these efforts, Taiwan hopes to contribute to the goal of ending TB by 2035 globally.

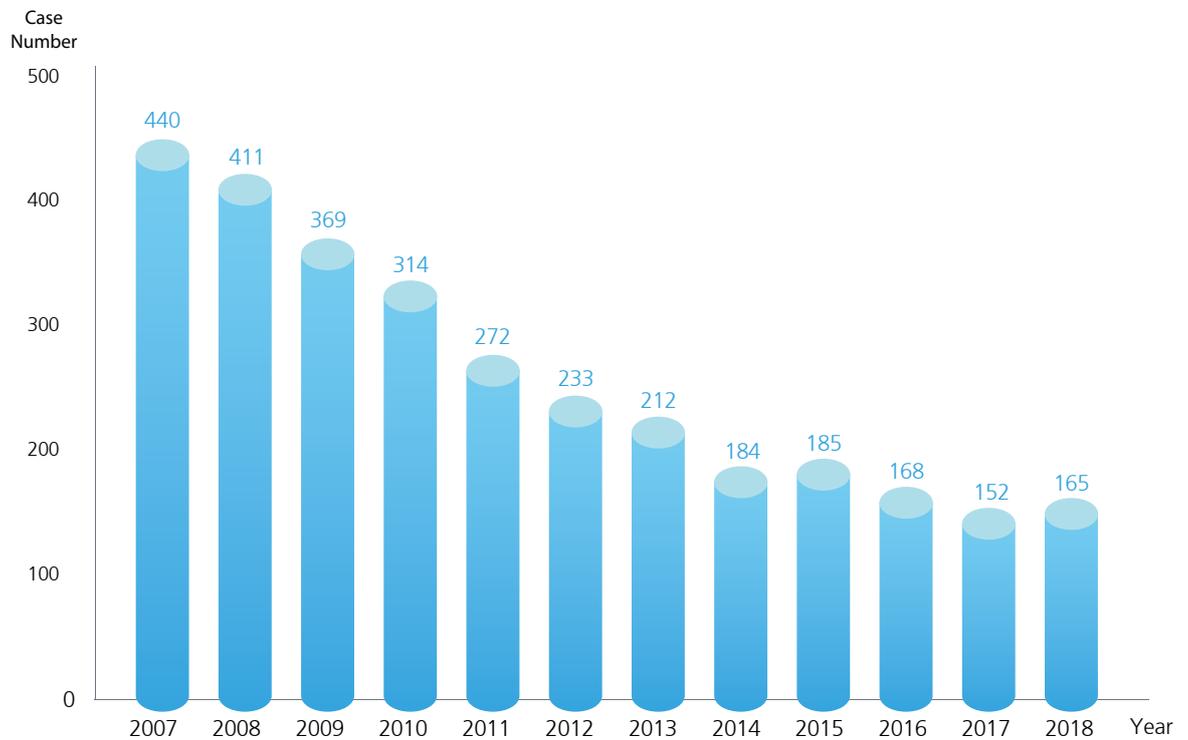
Taiwan CDC introduced bedaquiline and delamanid, two new drugs, into Taiwan in 2015 and 2016, respectively, lighting a beacon of hope again for hard-to-treat cases. With patients being closely monitored for side effects, the aforementioned drugs were administered to a total of 12 individuals in 2018, curing 3 chronic cases who would not have been otherwise treated.

In addition, the TMTC started to provide shorter MDR-TB regimen in 2016. Based on the guidelines for drug-resistant tuberculosis by the WHO, the course of treatment can reduce to 9 months from 18-24 months for applicable MDR-TB cases.

## **Accomplishments**

After ten years of efforts, the number of MDR-TB cases under management reduced from 440 in 2007 to 165 in 2018 at an annual average decrease rate of 9%. The number of reported MDR-TB new cases every year only accounts for 1% of the total tuberculosis cases - a number lower than the global average of 3.5%. The number of MDR-TB cases under management has also been declining every year. (Figure 2-1)

 **Figure 2-1 MDR-TB Cases under Management**



Over the past ten years, the TMTC has taken care of more than 1,300 MDR-TB patients. Follow-up results showed that the sputum conversion rate reached 46% and 77% at two and six months after treatment in 2016, respectively. The treatment success rate after a 24-month treatment increased from 59% in 2007 to 74% in 2016, compared to the global number of 55% shown in the Global tuberculosis report 2018 by the WHO. Between 2007 and 2014, the treatment failure and loss to follow-up rates for cases treated by the TMTC after 36 months stood only at 1% and 2%, respectively. With an adequate case management system in place, the numbers of XDR-TB and chronic cases also decreased significantly. The number of chronic cases under management decreased from 46 in 2006 to 1 in 2018 while the number for managed XDR-TB decreased from 26 in 2006 to 4 in 2018. This shows that the hospital-centered care model delivered by the TMTC offers adequate case management and DOTS-Plus, enabling better care, patient adherence, and a higher treatment success rate.



# Domestic Epidemic Prevention and Control

# Current Immunization Program & Vaccine Injury Compensation Program in Taiwan

## National Immunization Programs

### Current Status

The Taiwan government provides free immunizations to children up to 6 years of age, including BCG, 5-in-1 (diphtheria and tetanus toxoid with acellular pertussis, haemophilus influenza type b, and inactivated polio, DTaP-Hib-IPV), hepatitis B, pneumococcal conjugate vaccine (PCV), varicella, measles, mumps, rubella (MMR), hepatitis A, Japanese encephalitis, tetanus, diphtheria toxoids, acellular pertussis and inactivated polio vaccine (DTaP-IPV) and influenza. The current immunization schedule is shown in table 3-1. Parents of newborns are given a children's health handbook with a recommended immunization schedule. Children can receive vaccinations at 346 health stations and more than 1,600 contracted hospitals and clinics across Taiwan.

Health stations regularly carry out health promotion programs for improving coverage rate. The programs include mailing reminder postcards, making notification phone calls, scheduling home visits and providing media announcements. Moreover, public health nurses at the health

 **Table 3-1 Current Immunization Schedule in Taiwan**

Vaccine	Age	<24hr	1 month	2 months	4 months	5 months	6 months	12 months	15 months	18 months	21 months	27 months	5 years	1-6 <sup>th</sup> grade Primary school students
Hepatitis B		HepB1	HepB2				HepB3							
BCG						BCG								
Diphtheria, Tetanus, Pertussis, Hib, Polio				DTaP-Hib-IPV 1	DTaP-Hib-IPV 2		DTaP-Hib-IPV 3			DTaP-Hib-IPV 4			DTap-IPV	
Pneumococcal conjugate vaccine <sup>note1</sup>				PCV13 1	PCV13 2			PCV13 3						
Varicella								Var						
Measles, Mumps, Rubella								MMR1					MMR2	
Japanese Encephalitis <sup>note2</sup>										JE1		JE2	JE3 <sup>note3</sup>	
Hepatitis A <sup>note4</sup>								HepA1		HepA2				
Influenza														Influenza (yearly)

note1: 2 primary doses at least 8 weeks apart

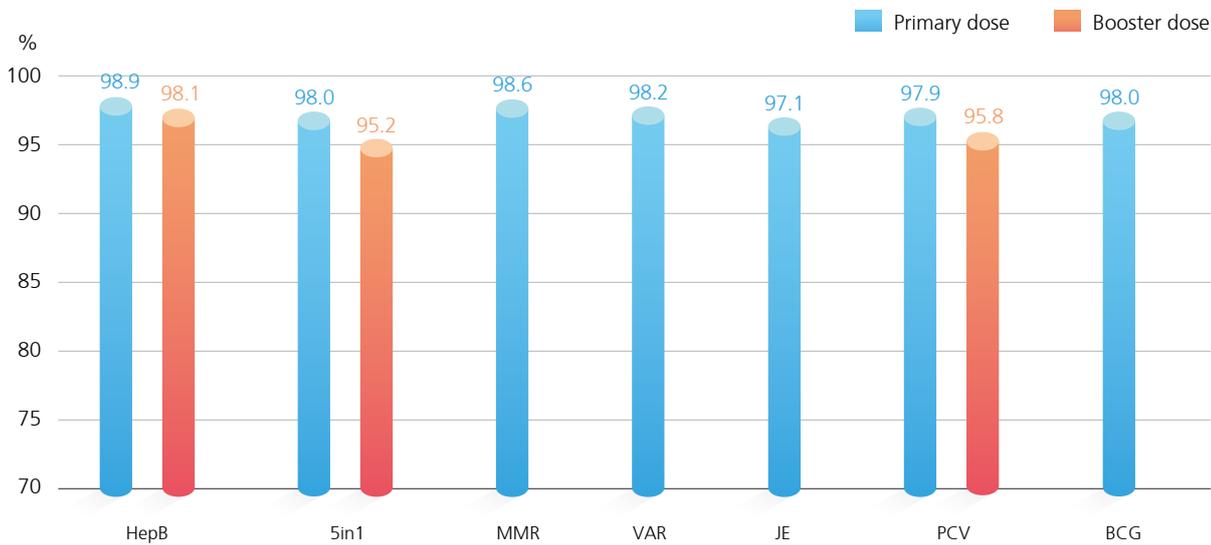
note2: The mouse brain-derived vaccine was replaced by the Vero cell-derived Japanese encephalitis vaccine on May 2017.

note3: JE3 (live attenuated cell-based vaccine) was provided for 5-yr children who have received 2 dose of inactivated JE vaccine.

note4: On January 2018, hepatitis A vaccine was introduced into routine immunization program for children born after January 2017. The original hepatitis A vaccine program for children registered in selected aboriginal areas are implemented continuously.

stations where children are registered regularly monitor immunization records and follow up on children who have not received up-to-date immunization to ensure those children complete the vaccination series. The immunization coverage rate of primary doses was as high as above 96%. (Figure 3-1)

**Figure 3-1 National Immunization Coverage**



Source: The values was calculated in December 2018 by compiling retrospectively the immunization data of National Immunization Information System

Footnote:

- HepB: Hepatitis B vaccine
- 5 in1: DTaP-Hib-IPV
- MMR: Measles, mumps and rubella combination vaccine
- VAR: varicella vaccine
- JE: Japanese encephalitis vaccine
- PCV: pneumococcal 13-valent conjugate vaccine
- BCG: bacillus Calmette-Guérin vaccine

## Accomplishments

1. A vaccine fund was launched in 2010 based on Article 27 of the Communicable Disease Control Act.
2. The 5-in-1 vaccine was launched to replace the traditional DTwP vaccine in March 2010, for reducing adverse reactions such as fever and redness or swelling where the shot is administered.
3. In 2011, Tdap-IPV was given to new primary school enrollees to replace Tdap and OPV. This improved vaccination convenience and successfully switched to IPV in accordance with the WHO suggestion to cease the use of OPV after polio eradication.
4. In April 2012, the schedule for receiving MMR2 and Tdap-IPV was revised from enrollment in primary school to 5 years of age. In addition, the schedule for receiving JE4 was also revised to 5 years of age in 2013.
5. Gradually expanded pneumococcal conjugate vaccine (PCV) vaccination target to include children aged under 5 years who are high-risk groups, who live in mountainous

areas and offshore islands or are from low-income and medium-low income families. Since March 2013, children aged 2-5 years old have been provided with one dose of PCV13. The vaccination targets were further expanded to children aged 1-5 years old in 2014. To prevent invasive pneumococcal disease (IPD) infection of young children, Taiwan CDC has introduced PCV13 into routine immunization for children aged 2 months, 4 months and 12-15 months in 2015.

6. As vaccine manufacturing technology has made an advance, domestic and foreign vaccine manufacturers have gradually stopped producing the mouse brain Japanese encephalitis (JE) vaccines. Therefore, in 2017, Taiwan replaced the mouse brain JE vaccines with cell-cultured type as a routine vaccination for children, which has fewer side effects, higher efficacy, and the manufacturing process is also in line with the humanitarian use of animal models and international standards.
7. In January 2018, Taiwan introduced hepatitis A vaccine into children routine immunization program for children born after January 2017.

## Future Prospects

With a stable source of support from the vaccine fund, Taiwan CDC will gradually add new vaccines to the routine immunization schedule based on cost-effectiveness and recommendations of the Advisory Committee on Immunization Practices. In the future, Taiwan CDC will continue to provide pneumococcal vaccine for elderly over 75 years of age, and plan to gradually expand the targets to high-risk groups and elderly over 65 years of age.

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## National Immunization Information System

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### Current Status

In 2004, Taiwan CDC established the National Immunization Information System (NIIS) to consolidate immunization data scattered among various health stations into one database. NIIS, together with household registration authorities and medical institutions, has improved the management of immunization operations and the efficiency of storage and retrieval of immunization information. Household data are obtained from the Department of Household Registration, Ministry of the Interior. The information is updated daily and transmitted to NIIS. Through NIIS, authorities can remind parents via text and e-mail of their children's immunization schedule, thereby improving immunization coverage rates.

### Accomplishments

1. Enhanced the functions and efficiency of the central database to handle yearly increases in data quantities and improve management efficiency.
2. Adopted multiple strategies to trace and urge the unvaccinated to get vaccinated, thereby reducing delays and raising the coverage rate.

3. For children entering the country, entry information from the National Immigration Agency, Ministry of the Interior is compared with NIS data to find children who have not received the MMR vaccine. Local health agencies will then arrange vaccination.
4. The revision of NIS was launched in 2018, upgrading system capabilities and effectiveness.

## Future Prospects

1. Promote the use of vaccination records in National Insurance IC cards to report immunization information at contract hospitals/clinics, improve the accuracy, completeness and timeliness of immunization data.
2. Strengthen management of atypical cases, such as foreign spouses of citizens, children who follow their parents working abroad and children who fail to complete their immunizations due to family factors.
3. Integrate various databases and systems (foreign spouses, reporting of communicable diseases, National Immigration Agency, Ministry of the Interior) and diversify NIS immunization reminders to improve the coverage rate.

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## Polio, Measles, Congenital Rubella Syndrome, and Neonatal Tetanus Eradication Programs

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### Current Status

Taiwan launched polio, measles, congenital rubella syndrome (CRS), and neonatal tetanus (NT) eradication programs in 1991. Since achieving its goal of polio eradication on October 29, 2000, Taiwan has maintained the eradication situation of polio by maintaining a high polio-related vaccine coverage rate and improving surveillance systems.

Measles became the primary elimination target after polio. In 2018, there were forty confirmed measles cases, twelve of which were imported cases, twenty-three of which were importation-related cases and five of which were imported-virus case. No confirmed NT case has been reported since 1996 apart from a child born to a foreign mother in 2001. From 1994 to 2008, five cases of CRS were confirmed, four of which were in patients born to foreign mothers. No confirmed CRS case has been reported from 2009 to 2016. In 2017, one CRS case born to a foreign mother was confirmed through CRS active surveillance. In 2018, there were no confirmed CRS cases. Rubella occurs worldwide; in 2018, there were ten confirmed cases in Taiwan, nine of which were imported cases.



## Accomplishments

1. In 2018, 66 AFP (acute flaccid paralysis) cases under the age of 15 were reported and investigated. None of the cases were polio or polio compatible.
2. Since January 1, 2009, all foreigners applying for residence or settlement must submit either a report showing they are antibody positive for measles / rubella report or an immunization certificate. This requirement is also included in the physical check for foreign laborers before entry.
3. Encourage the institutions contacting foreign traveler frequently to provide one dose of MMR vaccination for their personnel who were born after 1981.
4. Encourage flight attendants and ground crews to receive one dose of MMR vaccine.

## Future Prospects

1. Prevent the importation of polio to maintain eradication of the disease.
2. Complete measles and rubella elimination certification in accordance with the WHO.

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## Hepatitis Immunization Program

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### Current Status

Since 1982, Taiwan CDC has proposed a series of five-year programs. Priorities include: improving the surveillance system for acute cases, improving the immunization coverage rate of hepatitis B vaccine, severing hepatitis A infection paths, enhancing health education related to liver disease control, improving blood transfusion management, and raising hepatitis examination quality. Since 2018, Taiwan introduced Hepatitis A vaccine into children routine immunization program for children born after January 2017.

## Accomplishments

### Hepatitis A

1. Confirmed cases of acute viral hepatitis A in aboriginal regions were reduced from 183 in 1995 to 0 in 2018 and the incidence rate was lowered from 90.7 out of 100,000 people in 1995 to 0 in 2018.
2. The coverage rate of first dose of HepA for babies born in 2017 was 78.5%.

### Hepatitis B

1. The carrier rate of children at age 6 declined significantly and steadily from 10.5% in 1989 to 0.8% in 2007.

2. The coverage rates of the second and third doses of HepB for babies born in 2017 were 98.7% and 97.9%, respectively.

## Future Prospects

Infants born to a mother who is e antigen positive face a 10% chance of becoming chronic carriers of hepatitis B even after receiving hepatitis B immunoglobulin (HBIG) and three doses of immunoprophylaxis. Taiwan CDC has offered free hepatitis B screenings for these children at age 1 since September 2010. It will continue to raise screening coverage and study effectiveness of the vaccination.

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## Vaccine Injury Compensation Program (VICP)

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In response to a case in which a child received oral poliomyelitis vaccination and subsequently developed polio in 1986, the Ministry of Health and Welfare established a Vaccine Injury Compensation Fund in June 1988. The fund enables individuals to claim compensations from their local health bureau in the event of death, disabilities, serious illnesses, or adverse reaction resulting from vaccination. Review of claims by the Vaccine Injury Compensation Working Group ensures the causal relationship between the vaccine and the adverse events to eliminate vaccination worries.

For effective use of vaccine injury compensation resources and to strengthen protection of compensation rights and guarantees, the Regulations Governing Collection and Review of Relief Fund for Victims of Immunization was amended in recent years. Highlights were as follows:

1. The procedure of statement of opinion was amended. The Working Group may, ex officio or by request of the claimant, notify the claimant to state his or her opinions on a given date at a designated place.



VICP claim evaluation committee meeting

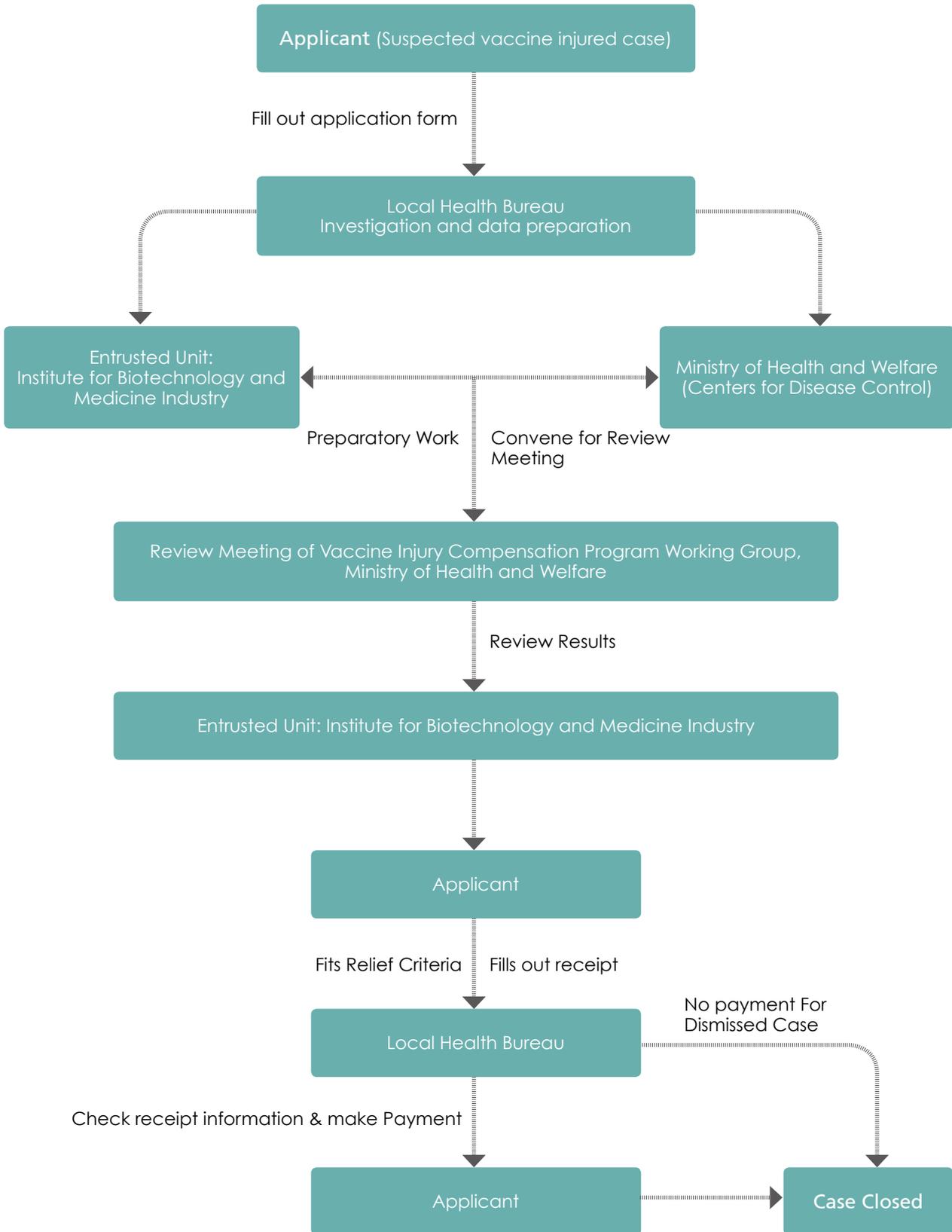
**Table 3-2 Types of Compensation, Vaccine Injury Compensation Program**

Relief Items	Criteria		Amount of Compensation (US\$ 1,000)	
	Definition/Degree of Impairment	Causality Conclusion		
Compensation for Death			Vaccine-related	16.1~193.5
			Indeterminate	9.7~112.9
Compensation for Impairment	By the types and degrees of impairments regulated by laws for the protection of the rights of the mentally and physically impaired, but excluding conversion disorder associated with psychological factors.	4-extremely severe	Vaccine-related	16.1~193.5
			Indeterminate	9.7~112.9
		3-severe	Vaccine-related	9.7~161.3
			Indeterminate	6.5~96.8
		2-moderate	Vaccine-related	6.5~129.0
			Indeterminate	3.2~80.6
		1-mild	Vaccine-related	3.2~80.6
			Indeterminate	1.6~64.5
Compensation for Severe Illnesses	To be decided by the regulations and the scopes of severe illnesses and injuries defined by the National Health Insurance and the illnesses considered as severe adverse reactions by the Procedure for Reporting Severe Adverse Reactions to Medicines, but not meeting the definition of impairment.		Vaccine-related	0.6~96.8
			Indeterminate	0.6~38.8
Compensation for Other Adverse Reactions	Other adverse reactions not meeting the definition of severe illnesses. However, mild, commonly seen or expectable adverse reactions of immunization are excluded		Vaccine-related/ Indeterminate	0~6.5
Funeral Subsidies	Funeral subsidies are provided if an autopsy is performed to determine whether the death is caused by the vaccine.		-	9.7
Medical Cost Subsidies	Examination and treatment performed to help clarify the causal relationship between vaccination and symptoms.		-	0~6.5
Stillbirth or Abortion Suspected to be Caused by Vaccination of the Fetus or Embryo undergone by Autopsy or Testing	Gestation after 20 weeks		-	3.2
	Gestation less than 20 weeks		-	1.6

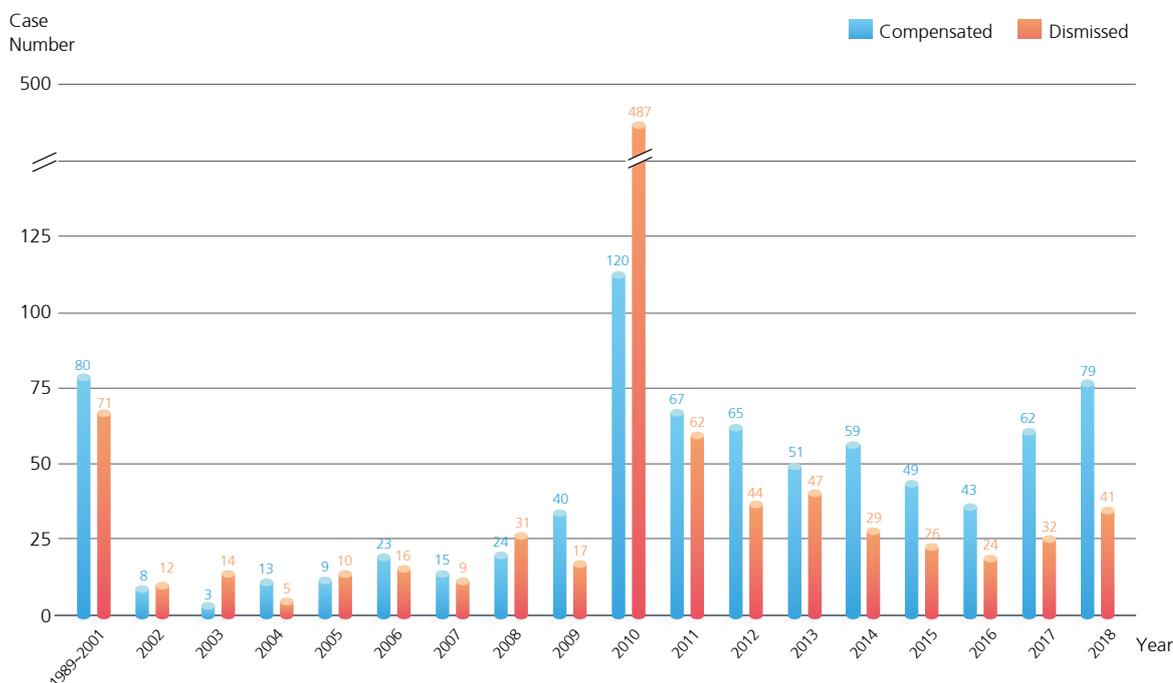
2. We revised the criteria and classification of causality between vaccination and alleged injury (Table 3-2), based on the causality assessment of an adverse event following immunization which was commissioned by the WHO.
3. To implement the essence of no-fault compensation, we established the factors to consider for deciding the amount of compensation.

Following the claim evaluation process (Figure 3-2), in 2018, 120 cases were settled, a total of 1,787 claims had been reviewed since program inception (Figure 3-3), and compensation disbursement had reached US\$ 3.8 million.

**Figure 3-2 Flowchart for Vaccine Injury Compensation Claims Evaluation Process**



**Figure 3-3 Total Number of Cases Settled Per Year from Program Inception in 1989 to 2018**



## Communicable Disease Surveillance System

### Current Status

Following reorganization of Taiwan CDC in July 1999, infectious disease surveillance was shifted to the National Communicable Disease Surveillance and Response Systems. The systems began with surveillance of notifiable diseases and sentinel surveillance to detect epidemics, and later on several systems were built to facilitate collection of timely, complete and precise information on infectious diseases. Taiwan CDC envisions these systems to monitor national health status and rapidly detect outbreaks by integrating various infectious disease surveillance networks.

The progress includes: (1) Constructing diversified disease surveillance systems; (2) Collecting and monitoring data for disease trend analysis, predictions and alerts; and (3) Providing regular analysis and assessments of global and indigenous infectious diseases.

### Accomplishments

#### Notifiable Disease Surveillance System (NDSS)

If a doctor treats a patient suspected of having a notifiable infectious disease, the doctor must report the case within a limited time. Taiwan CDC established the Notifiable Disease

Surveillance System to give medical personnel across the country a platform for reporting diseases and grasping information related to communicable disease occurrences immediately (Figure 3-4).

By using the system, medical personnel can make early and informed decisions on assigning manpower and resources to carry out disease prevention and thereby keep diseases from spreading.

The first stage of constructing the Notifiable Disease Surveillance System, finished in July 2001, involved establishing a web-based version that enabled easier and more detailed dissemination of reported information. The second stage, completed in September 2004, strengthened the surveillance system, while the third stage, completed in September 2006, integrated this system. The fourth stage, finished in June 2008, involved building a single reporting gateway and increasing user-friendliness. In order to increase the communicable disease reporting timeliness, Taiwan CDC has developed several new ways of reporting notifiable diseases since 2014. By creating dedicated disease reporting modules within the hospital electronic medical record systems, infection control staffs from 60 regional hospitals or medical centers have substantial workload reduction. Furthermore, Taiwan CDC allowed healthcare workers to login to the Notifiable Disease Surveillance System accountlessly by having their RSA cards issued by the Healthcare Certification Authority (HCA) verified inside the Virtual Private Network (VPN) of the National Health Insurance Administration. An Application Programming Interface (API) was developed for connecting the Healthcare Information System (HIS) of 53 clinics in Tainan and Kaohsiung to the Notifiable Disease Surveillance System. This allows primary medical institutes a convenient way to report the majority of notifiable infectious diseases.

**Figure 3-4 Notifiable Disease Surveillance System Data Flow**

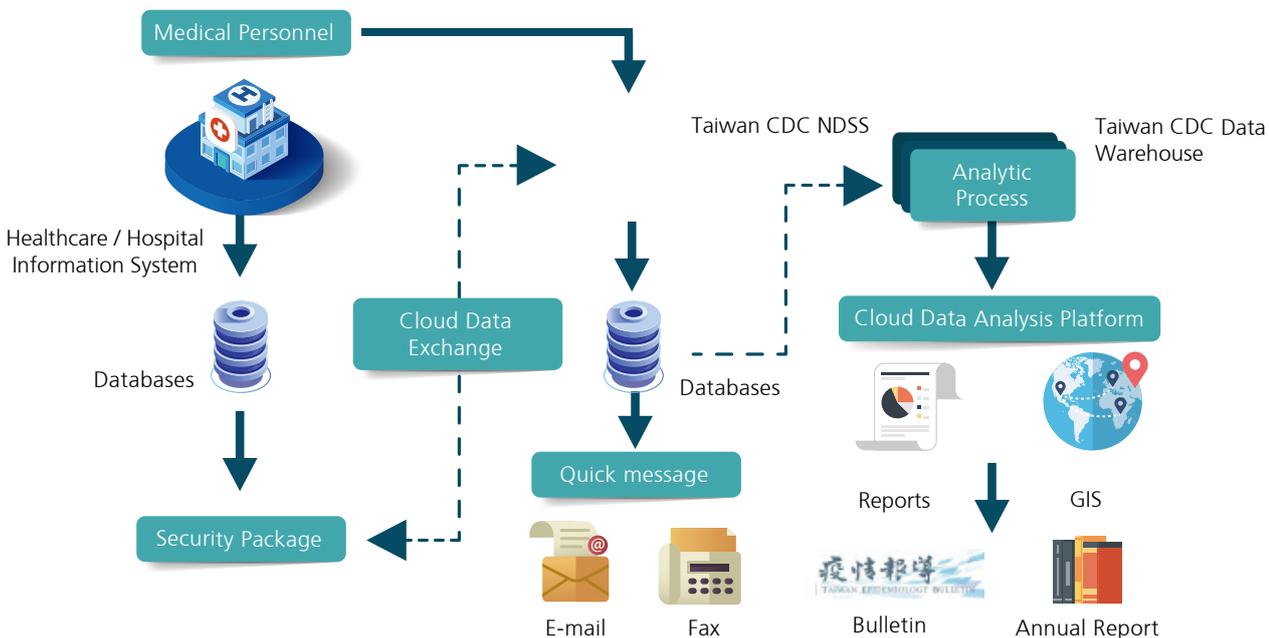


Table 3-3 shows the five categories of notifiable diseases in Taiwan.

 **Table 3-3 List of Notifiable Diseases in Taiwan**

Category	Disease	
I	Smallpox	Plague
	SARS	Rabies
II	Anthrax	Typhoid Fever
	Diphtheria	Dengue Fever
	Paratyphoid Fever	Acute Flaccid Paralysis and Poliomyelitis
	Meningococcal Meningitis	Amoebiasis
	Shigellosis	Measles
	Malaria	Enterohemorrhagic E. coli Infection
	Acute Hepatitis A	Cholera
	Hantavirus Syndrome	Multi-drug Resistant Tuberculosis
	Rubella	West Nile Fever
	Chikungunya Fever	Epidemic Typhus Fever
III	Pertussis	Tetanus
	Neonatal Tetanus	Japanese Encephalitis
	Tuberculosis	Hansen's Disease
	Congenital Rubella Syndrome	Acute Hepatitis B
	Acute Hepatitis C	Acute Hepatitis D
	Acute Hepatitis E	Legionnaires' Disease
	Mumps	Syphilis
	Invasive Haemophilus Influenzae Type B Infection	Congenital Syphilis
	Gonorrhea	Enteroviruses Infection with Severe Complications
	HIV Infection	AIDS
	Acute Viral Hepatitis Unspecified	
IV	Herpesvirus B Infection	Leptospirosis
	Melioidosis	Botulism
	Invasive Pneumococcal Disease	Q Fever
	Endemic Typhus Fever	Lyme Disease
	Tularemia	Scrub Typhus
	Complicated Varicella	Toxoplasmosis
	Brucellosis	Severe Complicated Influenza
	Creutzfeldt-Jakob Disease	Listeriosis
V	Rift Valley Fever	Marburg Hemorrhagic Fever
	Yellow Fever	Ebola Virus Disease
	Lassa Fever	Novel Influenza A Virus Infections
	Middle East Respiratory Syndrome Coronavirus infections	Zika Virus Infection

### **School-Based Surveillance System**

Taiwan CDC has implemented the School-Based Surveillance System since 2001, in order to monitor epidemic trends, detect possible outbreaks and contain the spread of communicable diseases in elementary schools. Taiwan CDC collects information about school children exhibit symptoms such as influenza-like, hand-foot-and-mouth disease or herpangina, diarrhea, fevers, acute hemorrhagic conjunctivitis and varicella (chickenpox) on a weekly basis. These data are used to analyze and estimate the scope and magnitude of diseases at the school and regional levels, followed by the dissemination of weekly reports to participating schools as well as educational and public health authorities to stimulate public health action.

As of 2018, a total of 731 elementary schools enrolling students from kindergarten to 6<sup>th</sup> grade participated in the systems, representing 26% and 98.9% of all number of elementary schools and administrative areas in Taiwan respectively.

### **Symptom Surveillance System**

Increased international contact and travel facilitate transmission of communicable diseases across borders and raise challenges for health workers. For example, in the summer of 2008, 10 out of 11 people in a religious group came down with dengue fever on a trip to Myanmar. To prevent the entry of emerging communicable diseases, facilitate early public health monitoring and implement epidemic prevention measures, Taiwan CDC established the Symptom Surveillance System. In 2006, Taiwan CDC integrated several active surveillance systems to enhance the monitoring of travelers at airports and seaports for diseases contracted abroad. These steps strengthened efforts to battle importation of communicable diseases while controlling cluster incidents and launching prompt disease prevention mechanisms.

Disease categories under surveillance include influenza-like illness clusters, fevers of unknown etiology, diarrhea, coughing persisting for more than three weeks, upper respiratory tract infections, varicella, and enterovirus clusters.

The Symptom Surveillance System monitors inbound passengers at airports and seaports to prevent entry of communicable diseases. It enables Taiwan CDC to effectively control epidemic events and quickly launch prevention measures.

### **Surveillance System for Populous Institutions**

The Surveillance System for Populous Institutions is aimed at early cluster detection of infectious diseases among institution inhabitants or workers. It applies to elderly homes, long-term care facilities, apartments for the elderly, facilities for the disabled, juvenile protectories, veterans' homes, prisons, nursing homes, outpatient centers for mental rehabilitation and infant care centers. If an individual or a cluster case with symptoms of respiratory, gastrointestinal disease or fever of unknown origin is found, the facility must file online reports within 24 hours; in addition, the facility must report the number of people under its care weekly. As of 2018, a total of 2,956 populous institutions participated in the system.

**Real-time Outbreak and Disease Surveillance (RODS)**

The ICD-9-CM/ICD-10-CM diagnosis codes from over 180 emergency rooms nationwide are forwarded daily to enable early and immediate analysis of aberrations for various syndromes. RODS also enables routine monitoring of specific disease trends such as influenza-like illness, enterovirus infection, diarrhea and conjunctivitis.

**Syndromic Surveillance Using National Health Insurance Data**

Daily aggregate outpatient clinic, hospitalization and emergency room data of specific diseases gathered by the National Health Insurance Administration from IC cards have been used to monitor trends of influenza-like illness, enterovirus infections and diarrhea since April 2009. In 2011 and 2014, scarlet fever and varicella were added to the disease watch list respectively.

**Pneumonia and Influenza Mortality Surveillance**

Daily updated death certification reports from the Department of Statistics, Ministry of Health and Welfare were used to identify pneumonia and influenza associated deaths, and monitor trends of pneumonia and influenza mortality. This information provides a reference for influenza prevention and control.

**Laboratory Automated Reporting System**

To immediately monitor disease outbreaks and establish epidemic curves caused by important pathogens, Taiwan CDC has developed the Laboratory Automated Reporting System (LARS) to collect the laboratory-confirmed cases caused by any of 20 pathogens via automated submitting of reports from hospital laboratory information system (LIS) to the LARS since 2014. LOINC (Logical Observation Identifiers Names and Codes), a universal code system for reporting laboratory and clinical observations, is used as the standardized format for the electronic exchange of laboratory data. The use of LOINC to identify laboratory observations could improve the quality of public health surveillance by reducing data transcription errors and facilitate data sharing of laboratory test results between hospitals and countries.

As of 2018, a total of 66 hospitals participated in the LARS. Recently, more than 14,000 pieces of data are collected weekly and used in monitoring pathogen activity.

**Establishing Support Systems for Disease Management and Data Analysis**

1. Taiwan CDC utilized the capabilities of the Notifiable Diseases Surveillance System, the Geographical Information System (GIS) and other surveillance systems to present and analyze data, and developed a GIS-based prediction model for estimating the distribution of infectious diseases.
2. Taiwan CDC installed multifaceted surveillance systems for data acquisition and analysis.

### **Reporting via the Internet**

To effectively detect and monitor infectious diseases, all the Taiwan CDC reporting systems are electronic-based for users to upload information.

### **Systems Integration**

To enhance presentation and application of surveillance systems, Taiwan CDC combined and analyzed information to improve the integration of surveillance systems, including the Notifiable Disease Surveillance System, the Symptom Surveillance System and the Syndrome Surveillance System. This task was completed in September 2006.

### **Information Sharing**

Taiwan CDC generates the School-based Surveillance Weekly Report, the Influenza Express, the Weekly Report of Enterovirus Infection and other statistical reports of designated communicable diseases which are available online. Daily reports on international epidemics are forwarded to related authorities, while regular collaboration with academics assists with evaluation or development of surveillance systems. Key tasks include collection, evaluation and dissemination of information to the public, local health departments and governmental authorities.

In addition, the website "Taiwan National Infectious Disease Statistics System" (NIDSS) was launched in 2008, which aims at providing the general public, academic researchers, health care providers and public health authorities with an intuitive interface to obtain the latest information on the notifiable and other infectious diseases or conditions in Taiwan. "The Taiwan CDC open data portal" provides more than 300 datasets including numbers of all notifiable disease cases and emergency department visits of selected syndromes, and information on quarantine practices, vaccines, nosocomial infections, etc. Extent of most of the information, e.g., datasets related to numbers of cases of all notifiable diseases and emergency department visits are updated automatically and daily. New datasets will be publicly posted after discussion to meet the principles of open data.

### **Training and Education**

Taiwan CDC offers training workshops on surveillance systems to keep users informed about updated information.

# Reducing Key Infections

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## Tuberculosis

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Tuberculosis (TB) has always been one of the most severe communicable diseases in Taiwan. Around 9,000 TB cases and 500 TB deaths are reported in Taiwan annually. Half a century of hard work by health workers has reduced prevalence of the disease, but when compared with other advanced countries, Taiwan leaves much room for improvement.

Tuberculosis control in Taiwan faces several challenges such as high population density, aging of population, comorbidities, frequent international travel, foreign spouses and labors from high TB prevalence countries. All of those factors could make TB control in Taiwan more challenging. To protect the health of the general public, Taiwan needs to adopt more active and aggressive methods when faced with new challenges for TB control.

### Current Status

#### 1. Incidence

There were 16,472 and 9,180 TB cases in 2005 and 2018, respectively. The incidence rate went from 72.5 to 39 persons per 100,000 over this time period, and there was a 6% drop between 2017 and 2018. (Table 3-4).

The number of Multi-Drug Resistant TB (MDR-TB) reported cases was 120, and the proportion of MDR-TB in new cases was 1% in 2018.

#### 2. Mortality Rate

TB claimed 506 lives in Taiwan in 2018, with a mortality rate of 2.1 per 100,000 populations. From 2005 to 2018, the mortality rate dropped by 51%.

### Future Prospects

1. To detect infected persons as early as possible by implementing active case finding and improving contact investigation.
2. To prevent individuals with latent TB infection (LTBI) from developing active TB and decrease the number of TB cases by providing comprehensive medical treatment for TB patients and preventive therapy for LTBI individuals.
3. To increase the completion of treatment and cure rates by implementing DOTS and DOPT.
4. To reach the goal of TB elimination (incidence rate < 10 per 100,000 populations) by 2035.

 **Table 3-4 Taiwan TB Incidence and Mortality Rate, 2005 – 2018**

Year	Cases	Incidence	Death	Mortality
2005	16,472	72.5	970	4.3
2006	15,378	67.4	832	3.6
2007	14,480	63.2	783	3.4
2008	14,265	62.0	762	3.3
2009	13,336	57.8	748	3.2
2010	13,237	57.2	645	2.8
2011	12,634	54.5	638	2.8
2012	12,338	53.0	626	2.7
2013	11,528	49.4	609	2.6
2014	11,326	48.4	591	2.5
2015	10,711	45.7	571	2.4
2016	10,328	43.9	547	2.3
2017	9,759	41.4	511	2.2
2018	9,179	38.9	506	2.1

## Accomplishments

### 1. Improving Surveillance and Monitoring

National TB Reporting and Management System

(1) Nationwide real-time surveillance on TB laboratory system and TB drug prescription

(2) Strengthen monitoring among high-risk groups

### 2. Establishing a High Quality and Rapid TB Diagnosis Network

(1) Monitor quality of contract and authorized laboratories

(2) Train staff members

(3) Develop new TB diagnosis techniques

### 3. DOTS Program

- (1) DOTS coverage rate has been 100% since 2006.
- (2) Treatment success rate for bacteriological positive TB cases was about 69 % in 2016 cohort. It has not increased significantly due to population aging.



World TB Day Press Conference, March 23, 2018

### 4. Establishing the Drug-Resistant TB (DR-TB) Medical Care System

"DR-TB Medical Care System"  
(established in May 2007)

- (1) Taiwan CDC contributes resources and designated teams to offer patient-centered care according to WHO DR-TB guidelines.
- (2) DR-TB teams actively treat each patient for 9 months to 2 years, and designated health workers provide incentive, allowance and personal care via the DOTS Plus program.



National TB Prevention and Care Review Conference, August 27-28, 2018

- (3) A total of 155 (96%) MDR-TB cases and 64 (96%) RR-TB cases were managed in the DR-TB system through the end of December 2018, leading to a favorable outcome. About 75% of patients in 2016 cohort were cured or completed the 24-month treatment.

### 5. LTBI Treatment Program

(1) "The LTBI Treatment for All Contacts Program" (Initiated in April, 2016)

- Expand LTBI screening to all contacts as long as their index cases are highly contagious, and broadening early LTBI prevention and treatment.
- Provide 12-dose regimen (3HP) as an alternative to the 9-month-isoniazid (9H) for LTBI contacts aged 12 years and older.

(2) In 2018, up to 8,138 contacts received LTBI treatment, and the DOPT rate reached 97%.

(3) In addition to contacts, conduct LTBI screening and treatment pilot programs for other high-risk groups, such as inmate of the long-term care facilities, patients receiving dialysis, people living with HIV, illicit drug users, poorly-controlled diabetic patients.

## 6. Hosting the Indonesia Delegation of Health Financing and Provider Payment Mechanisms Study Tour

The government of Indonesia organized a study tour to learn the experience of Health financing and provider payment mechanisms in tuberculosis control in Taiwan. The delegation composed of high-level officials at the TB section, Health Financing Division, Planning and Policy Development and Research and Development Division of the Ministry of Health, as well as consultants from USAID and World Bank. The exchange of experience and ideas with each other made the study tour a fruitful interactive event.

## Future Prospects

Echoing the WHO end TB strategy, besides case management, Taiwan CDC will focus on preventive treatment of persons at high risk. By continuously implementing LTBI treatment program and introducing WHO-recommended new diagnostic tools and new regimen, to achieve annual reduction of new TB cases and gradually eliminate TB by 2035.



Study Tour: A delegation from Indonesia learns Taiwan's experience in health financing and provider payment mechanisms, July 30-August 3, 2018.

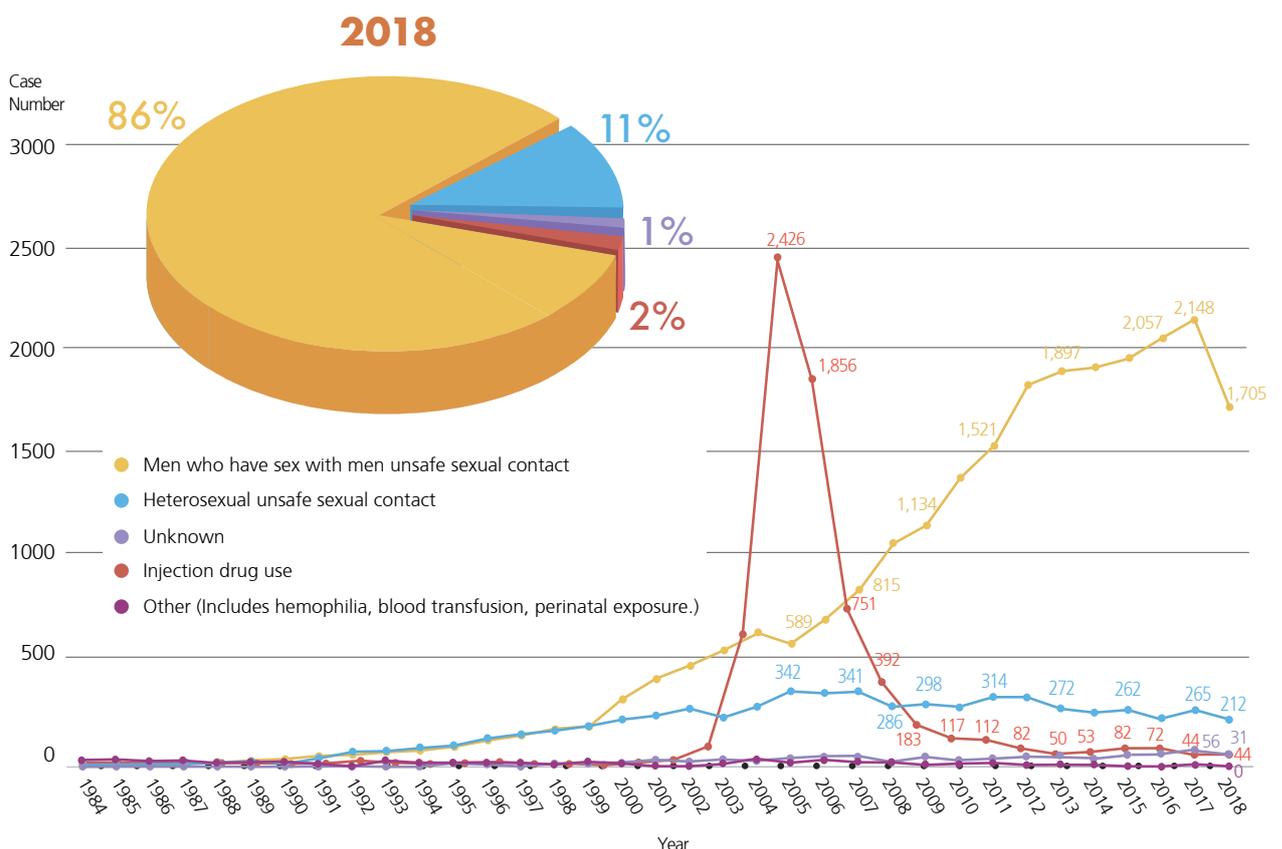
## HIV/AIDS

### Current Status

The first HIV case in Taiwan was reported in 1984. By 2018, there were an accumulated 37,917 patients (17,902 of whom had developed full-blown AIDS with 6,466 deaths). Infections surged in 2005 due to skyrocketing infections among injecting drug users (IDUs). Faced with this dire situation, Taiwan CDC cooperated with other departments in dedicating a tremendous amount of effort and resources to harm reduction programs. Total reported cases dropped in 2006, marking the first trend reversal since 1984. In 2008, the epidemic took another turn, with new infections mainly occurring among men who have sex with men (MSM); however, the epidemic has decreased in 2018.

In terms of age, people in the 25 to 34 age group accounted for 880, or 44%, of new infections diagnosed in 2018, more than any other groups. The second largest group was the 15 to 24 age group, numbering 510, or 26%, of all cases. An analysis of risk factors showed that the highest proportion of HIV infections was a result of unsafe sexual contact among MSM, accounting for 86% of all cases. The second largest proportion of infections was heterosexual contact, accounting for 11% of cases (see Figure 3-5). The three major transmission modes were sexual contact (MSM and heterosexual) and IDU. Of Taiwanese nationals diagnosed with HIV in 2018, 1,949, or 98%, were males and 43, or 2%, were females. The sex ratio of new diagnoses was 45:1.

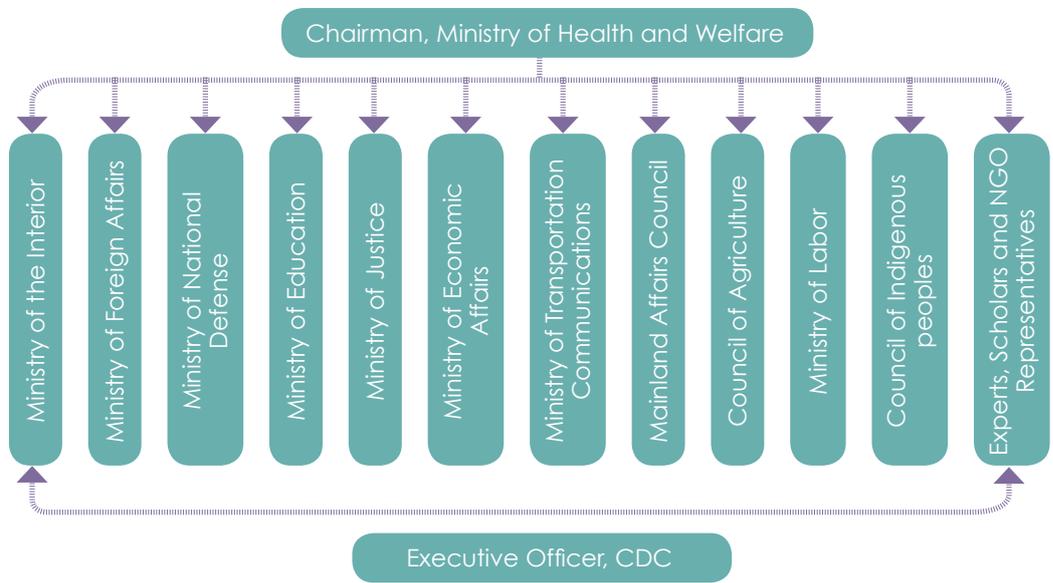
 **Figure 3-5 HIV Infection Risk Factors in Taiwan, 1984-2018**



## Accomplishments

1. The Committee for HIV Infection Control and Patient Rights Protection (Figure 3-6) held two cross-ministerial meetings in 2018.
2. To ensure the dignity and rights of people living with HIV/AIDS (PLWHA), the HIV Infection Control and Patient Rights Protection Act was amended in 2015. This amendment canceled all restriction on the entry, stay and residence of HIV-infected non-nationals. For the need of organ transplantations of the HIV infected, the HIV Infection Control and Patient Rights Protection Act was amended on May 18, 2018, for the HIV infected who are in good health status to donate organs to another HIV infected. Related regulations were amended and announced.
3. The harm reduction program has made significant progress. The reported number of HIV infections among IDUs dropped in 2006. Toward the end of 2010, Taiwan saw an effective reduction in the number of HIV infections, with the largest decline among IDUs. The percentage of all newly reported cases attributable to IDUs fell from a high of 72% in 2005 to only 2% in 2018.
4. Taiwan CDC promotes diversified prevention programs to confront the epidemic among MSM. Initiatives include (1) Establishment of MSM Community Health Centers that provide lesbian, gay, bisexual, and transgender (LGBT) friendly health services. (2) Implementation of health education and intervention services, such as online opinion leaders and HIV testing advertisement on mobile dating apps. (3) Providing voluntary HIV counseling and testing outreach services at saunas and pubs. (4) Installation of condom vending machines in venues frequented by the gay population. (5) Establishment of a free hotline for MSM to provide immediate and accurate health information and counseling on HIV-related matters.
5. To enhance disease surveillance, Taiwan began to screen blood donors in 1988, drafttees in 1989, prison inmates in 1990. There were 52 hospitals that provided anonymous HIV blood-screening services in 2018. They screened 42,837 people, with 610, or 1.4%, found to be HIV positive.

**Figure 3-6 Committee for HIV Infection Control and Patient Rights Protection, Ministry of Health and Welfare, Executive Yuan**



6. To prevent mother-to-child transmission, HIV screening has been incorporated into standard prenatal checkups since 2005. All pregnant women in Taiwan are offered HIV screening during the first prenatal screening in the first trimester. Pregnant women found to be HIV-infected are provided with free perinatal prophylaxis, which includes antiretroviral therapy during pregnancy, intra-partum and for exposed infant during the first 6 weeks of life.



From December in 2018, Taiwan CDC have cooperated with chained convenient stores to provide HIV self-testing kit by pay-at-pickup services.

7. To enhance the willingness of high-risk groups receiving HIV screening, which enables early diagnosis and early treatment that block the spread of the virus, on July 10, 2018, Taiwan CDC launched the "Checketer (Check-together) program". The program is based on the practical community work experience of Johns Hopkins University in the US, and cooperated with Public Health Bureau and NGOs to mobilize peer mentors (PM) to promote safe sex, HIV screening and health education. Until the end of October, 2018, a total of 18,220 people received HIV screening, and HIV-positive rate was 0.7%.



Taiwan CDC invited people to stand in the shape of a red ribbon to commemorate World AIDS Day and its theme for 2018 Live life positively –know your HIV status on November 30, 2018.

8. Moreover, to decrease the barrier for people to know their own HIV sero-status, from December 2018, Taiwan CDC launched a program to distribute HIV blood-test kit at NGOs or health stations, and HIV oral-test kit through pay-at-pickup services provided by chained convenient store, and through vending machines at LGBT health centers, health stations, and gay sauna.

Users paid 6 US dollars to get the kits, and could receive full redeem after logging their test results online.

Until the end of December, 2018, 4,707 kits were sold: 830(18%) through vending machines, 739(16%) distributed by LGBT health centers and health stations, 3,138(66%) distributed through pay-at-pickup services provided by chained convenient stores. 1% of respondents reported being newly tested HIV-positive.

9. Taiwan offered TDF/FTC as PrEP for people with high HIV risk behavior through government-funded programs since 2016. It was implemented as a fully-funded PrEP program from September, 2018 to the end of 2019. HIV-negative youth under 30 years

old or people who are HIV serodiscordant couple, after being evaluated by physician as eligible, were enrolled in the integrated program. The program provided free medication for one year per person, HIV prevention education, counseling, STDs test, drug addiction assessment and referral services. As of May 31, 2019, there were a total of 1,031 participants under PrEP; of which 787 were youth (76%) and 244 (24%) participants were HIV serodiscordant couple.

- 10. The Taiwan government has provided HIV/AIDS patients with free medical treatment since 1988 and free highly active antiretroviral therapy (HAART) since 1997. At the end of 2018, 77 designated hospitals, 1 clinic and 29 pharmacies provided HIV/AIDS patients medical service, and over 90% of HIV patients were receiving medical care. Furthermore, to serve the need of long term care in HIV/AIDS patients, the government designated 24 nursing homes, signed agreements with 18 HIV designated hospitals and 31 long-term care institutes to provide services.
- 11. Due to the amendment of HIV Infection Control and Patient Rights Protection Act, the medical expenses for treatment of HIV patients after two years from confirmed diagnosis and medication initiation have been totally subsidized by the health insurance since February 4, 2017. The average cost per patient fell from US 6,700 dollars in 2012 to US 4,690 dollars in 2018. After multidisciplinary medical expense control countermeasures, up to 88% people living with HIV received HARRT and 94% of all people receiving HARRT had viral suppression in 2018.

### Future Prospects

Years of hard work led to remarkable results in HIV prevention, but still, the number of new cases has not been brought under control. Taiwan CDC hopes that, through participation from all sectors, combined with the implementation of multipronged strategies, Taiwan will reach the UNAIDS 90-90-90 treatment goal by 2020 and end the HIV epidemic in the near future.



Taiwan CDC and Taiwan Urbani Foundation jointly held a poster design competition to encourage young students to recognize HIV/AIDS and reduce discrimination on December 4, 2018.

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## Preparing for Influenza Pandemics

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### Current Status

Taiwan began to prepare for potential pandemics since the avian influenza epidemic emerged at the end of 2003. From the experience of SARS in 2003, government agencies were highly supportive and willing to allocate necessary funding for preparations.

Taiwan CDC started to prepare for influenza pandemic since 2003. In May 2005, the first National Influenza Pandemic Preparedness Plan (hereafter referred to as the 'Preparedness Plan') was approved by the Executive Yuan. In May 2015, the Executive Yuan approved the Phase III plan as a continuation of the Phase II plan, to engage with all the preparation work.

The influenza pandemic strategic plan in Taiwan is composed of four major strategies and five lines of defense. The four major strategies are as follows: (1) Surveillance and assessment, (2) Interruption of transmission, (3) Antivirals, and (4) Influenza vaccines; and the five lines of defense are defined as following: (1) Containment abroad, (2) Border control, (3) Community epidemic control, (4) Maintenance of medical system functions, and (5) Individual and family protection. Together, these measures minimize the morbidity and mortality rate, economic losses and impact of novel influenza viruses.

### Accomplishments

The content of the Preparedness Plan is outlined as follows:

#### 1. Vaccine Stockpile and Use

##### (1) Seasonal Influenza Vaccines

The seasonal influenza vaccination program, which began on October 15, 2018 targeted on nine groups of people: 1. Persons aged 50 years and above; 2. Children and adolescents aged 6 months through 18 years; 3. People with catastrophic illnesses; 4. Residents and staff in nursing homes and long-term care facilities; 5. Healthcare workers and public health personnel; 6. Poultry and livestock farmers and animal health inspectors; 7. People who had underlying medical conditions; 8. Pregnant women and parents of infants less than 6 months of age; 9. Kindergarten caretakers, and child-care professionals. The program subsidizes a policy of not charging diagnostic fees for all vaccination groups to lower the barrier and increase the willingness of influenza vaccination. Influenza vaccines were given to school-aged students at campus and to other groups at clinics or hospitals.

##### (2) Pandemic Influenza Vaccines

In recent years, the emergence of the H5N1, H1N1pdm and, more recently, the H7N9 virus has continued to cause more and more human infections, indicating the urgent need for influenza pandemic preparedness. To ensure that pandemic vaccines are available and sufficient when a pandemic occurs, Taiwan CDC now continues to act in accordance with the phase III Pandemic Preparedness plan to ensure the acquisition of vaccines in time of pandemic adopting the approach under the concept of advanced marketing commitment.

(3) The program for developing human influenza vaccines against H7N9 infection

In response to the outbreak of H7N9 avian influenza in 2013, the Ministry of Health and Welfare submitted a request to the Executive Yuan for using the Second Reserve Funds to develop H7N9 influenza vaccines. The National Health Research Institutes (NHRI) and the Taipei Veterans General Hospital (TPVGH) were commissioned to execute the project to conduct the first and second phase clinical trials of those vaccines manufactured by Medigen Vaccine Biologics (MVB) and ADIMMUNE Corporation (ADIMMUNE) respectively. The third phase clinical trial by MVB and ADIMMUNE were under planning.

## 2. Stockpiling and Use of Antiviral Drugs

In accordance with the WHO recommendation to maintain a diverse stockpile of influenza antivirals in preparation for a pandemic, Taiwan CDC has established national stockpiles of Tamiflu, Relenza, Eraflu, Rapiacta and Avigan. These stockpiled antivirals are sufficient to supply at least 10% of the population. In response to seasonal influenza control, as well as the proper use of stockpiled drugs, it followed recommendations from the Advisory Committee on Influenza Control and Prevention to supply antivirals to those who were at increased risks for influenza-related complications such as infants, elderly and patients with chronic diseases. In addition, during the peak of flu season, usually from December 1 to March 31, Taiwan CDC expands the target population for antiviral drug use and adjusts the duration based on actual conditions. There were more than 4,200 contracted hospitals and clinics to administer government-funded antivirals.

## 3. Stockpiling and Management of Personal Protective Equipment (PPE)

Taiwan CDC established a 3-tier stockpiling framework of PPE. Taiwan CDC, local health authorities and medical institutions should maintain a minimum stock of PPE (including surgical masks, N95 respirators and coveralls) and ensure a sufficient supply for personnel engaged in epidemic control and health care services during the early phase of an epidemic.

In 2011, Taiwan CDC initiated a stockpile replacement model in order to optimize the PPE stockpiling efficiency. This stockpile replacement model employs a first-in-first-out principle in which the oldest stock in the central government stockpile is regularly replaced and replenished with the same amount of new and qualified products, ensuring the availability and the maintenance of the minimum stockpiles.



Taiwan CDC PPE stockpiles



Staff training and drills

In 2018, the quantities of replacement and replenishment of surgical masks, N95 respirators and coveralls are 10 million, 350,000, and 45,000, which account rates of 28%, 35% and 18%, respectively.

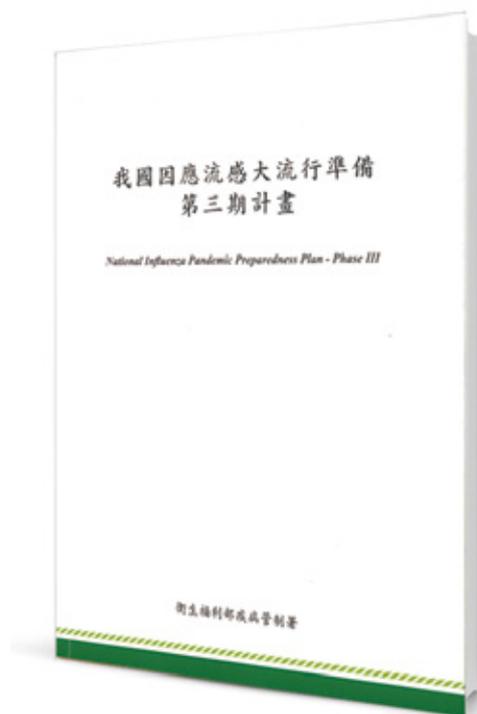
#### 4. Communicable Disease Control Medical Network Preparedness

The Communicable Disease Control Medical Network (CDCMN) was set up in 2003 after SARS. It has brought together the medical and public health systems to provide safer, more effective treatments for communicable disease patients, and strengthen Taiwan's capacity to handle contingencies in the prevention and control of communicable diseases. In 2018, the CDCMN with its 6 sub-regions organized 132 designated isolation hospitals for treating communicable disease patients(Figure 3-7).

There are 6 response hospitals for treating patients suspected of having contracted category 1 or category 5 notifiable diseases or emerging infectious diseases. Additionally, 6 designated support hospitals provided medical treatment advice, and local health authorities offered manpower support to response hospitals. To improve staff capabilities, there were 94 communicable disease response training courses and 6 practice drills for response staff. Each sub-region of the CDCMN had a commander and a deputy commander who assisted with area epidemic control and preparedness of response hospitals.

### Future Prospects

Mutation of influenza viruses is still ongoing. We need to continue to prepare for possible pandemics. Therefore, it is important to maximize the use of limited resources in accordance with the Pandemic Influenza Risk Management, which is a guidance released by the WHO in May, 2017. Taiwan CDC will put effort in developing and strengthening existing pandemic strategies as well as consolidating a sustainable stockpile of antivirals, vaccines and PPEs. We expect the above actions to pave the way for appropriate responses to possible pandemics in order to ensure people's health.



National Influenza Pandemic Preparedness Plan- Phase III

**Figure 3-7 Communicable Disease Control Medical Network**



In the six Communicable Disease Control Medical Network sub-regions there are 132 isolation hospitals, including 6 responding hospitals and 6 support hospitals.

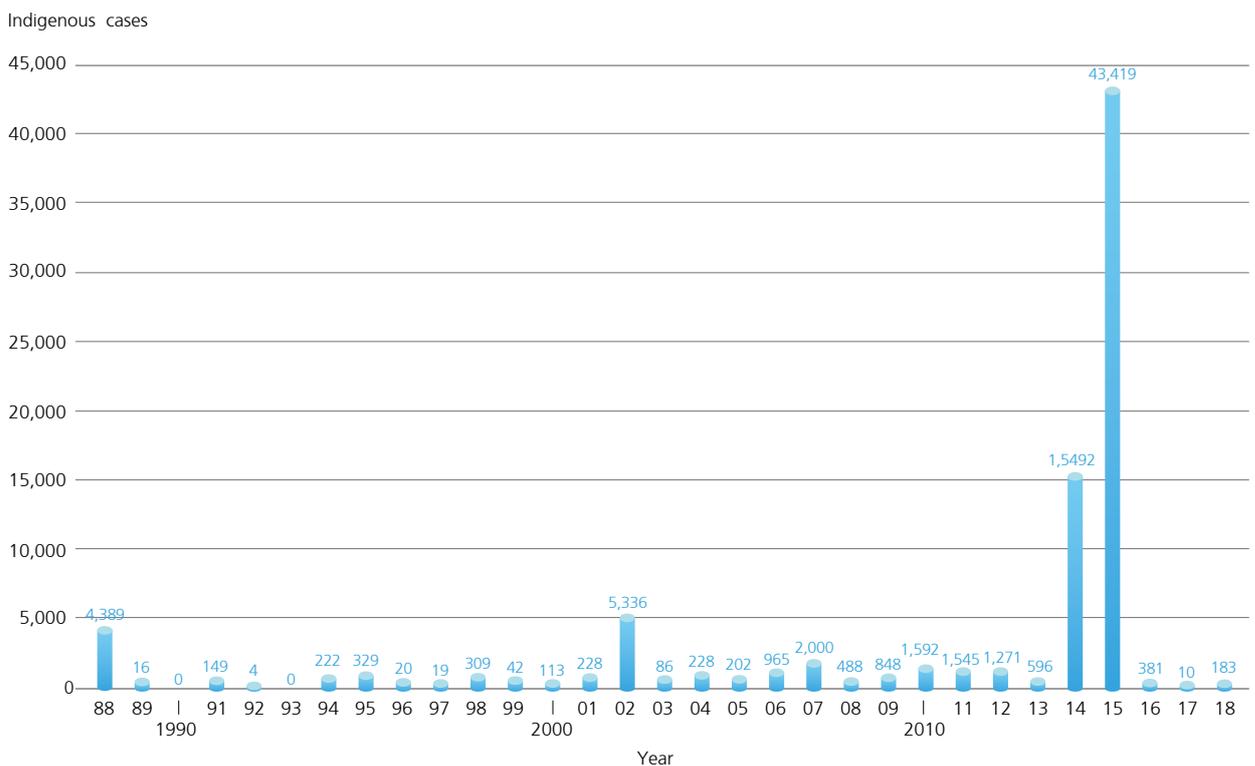
## Dengue Fever

### Current Status

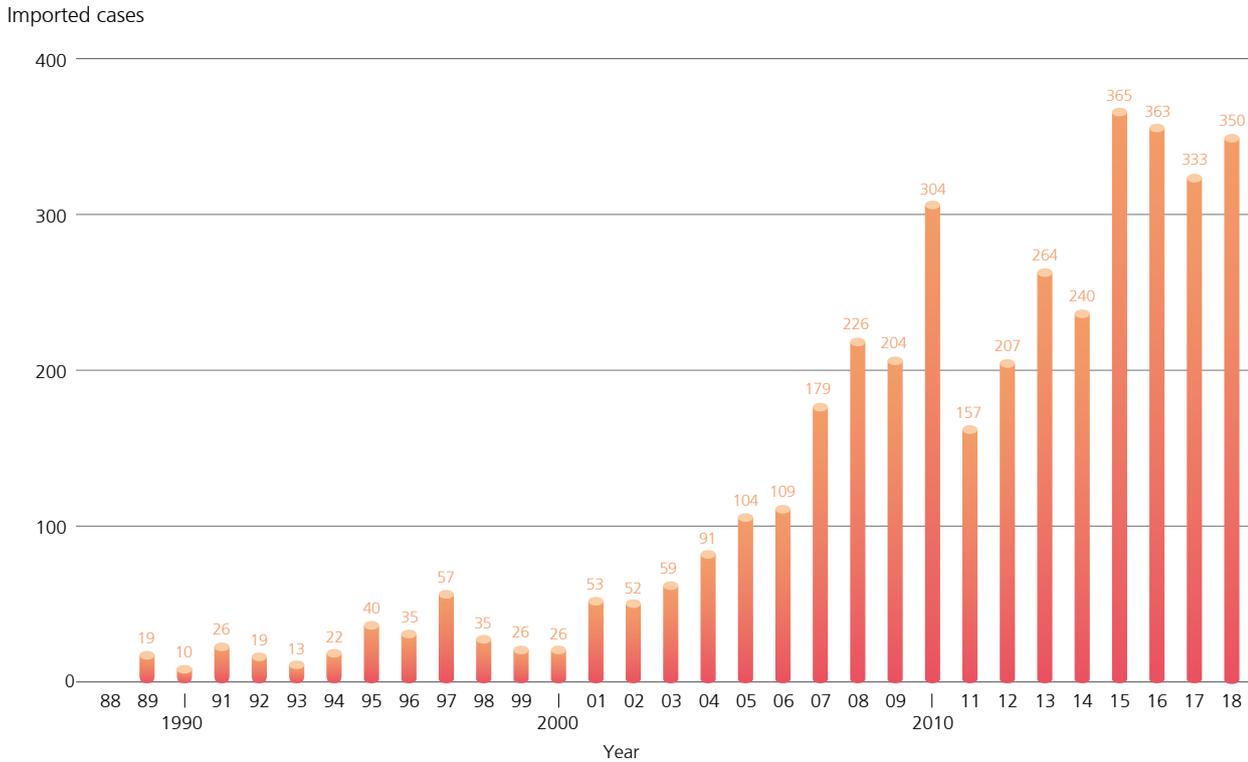
During the first half of the 20<sup>th</sup> century, there were three island-wide dengue outbreaks in Taiwan (1915, 1931 and 1942). After almost 40 years of dormancy, a DEN-2 outbreak occurred in Liuchiu Township, Pingtung County in 1981, and another DEN-1 outbreak occurred in the Kaohsiung area (1987-1988). Thereafter, dengue outbreaks became more common. Epidemics mainly have occurred in Kaohsiung, Tainan and Pingtung, with several instances in the north. The past ten years have seen an increase in cases of dengue fever and severity level. There were more than 1,000 cases in Taiwan in 2007, 2010, 2011, and 2012, respectively. Though the number of cases did not reach 1,000 in 2006, 2009, and 2013, there were still more than 500 cases each year. 2014 and 2015 saw unprecedentedly severe outbreaks with more than 10,000 cases. Some 97% of the indigenous cases were concentrated in Kaohsiung only in 2014 while indigenous cases were concentrated respectively in Kaohsiung (45%) and Tainan (52%) in 2015. After suffering the serious dengue outbreaks, Taiwan CDC developed and implemented new approaches to prevent the outbreaks. There were few indigenous cases in Taiwan from 2016 to 2018. In 2018, the number of indigenous cases in Taiwan was 183. (Figure 3-8)

Severe dengue epidemics in Southeast Asia in recent years have led to an increase in imported cases in Taiwan, reaching 365 in 2015, 363 in 2016, and 350 in 2018. (Figure 3-9)

 **Figure 3-8 Indigenous dengue cases in Taiwan, 1988-2018**



**Figure 3-9 Imported dengue cases in Taiwan, 1988-2018.**



## Goals & Strategies

The main strategies to control dengue in Taiwan are eliminating vector (mosquito) breeding sources and lowering vector density.

Taiwan CDC has devised a three-stage prevention strategy for controlling the dengue epidemic. Primary prevention measures include source reduction and control of the vector population. Secondary measures cover disease surveillance and emergency/contingency mechanisms. Tertiary prevention involves controlling the mortality rate.

### Primary Prevention

1. Implementing health education through diverse communication channels to promote dengue fever and severe dengue awareness.
2. Involving the community in improving environmental and household sanitation along with reducing vector sources through volunteer training.
3. Encouraging regular inspection and eliminating vector breeding sources by cleaning empty houses, vacant lots, and other potential vector breeding sources, and keeping records for future inspections.
4. Strengthening education and training for disease prevention workers and volunteers.
5. Setting up a vector surveillance mechanism to check places with a high mosquito density probability and promptly wipe out vector sources.

## Secondary Prevention

1. Constructing a disease surveillance mechanism for prompt control of suspected cases; strengthening disease surveillance and disease trend evaluation through official epidemic reporting systems, emerging disease surveillance, public reporting, and symptom declaration forms.
2. Setting up emergency/contingency mechanisms to promptly investigate suspected transmission sources, spraying insecticide to eliminate those sources, and publicizing the importance of eliminating vector-breeding sites to prevent infection.

## Tertiary Prevention

1. Establishing guidelines for dengue fever and diagnosis and treatment for severe cases.
2. Organizing continuing education workshops for medical personnel to raise health care quality and lower mortality rates.

## Accomplishments

The following strategies have yielded remarkable results: strengthening border quarantine efforts; improving disease surveillance system; providing subsidies to support local governments to implement prevention and control programs; convening the Cross-Ministerial Meeting on Measures to Combat Mosquito-Borne Diseases monthly to facilitate the communication between the central and local governments; cooperating with the National Mosquito-Borne Diseases Control Research Center. There were only ten indigenous cases in Taiwan in 2017, 183 cases in 2018, hitting the lowest and second lowest record over the past five years. The aforementioned achievements are remarkable under the conditions of the serious global epidemic of dengue, frequent international interactions, and climate change, which resulted in rapid propagation of mosquito vectors.



Seminars On the Prevention and Control of Dengue Fever, Chikungunya Fever, and Zika Virus Infection were organized for related personnel of Health Bureaus across Taiwan on March 21-23, 2018.

### Primary Prevention

1. Distributed health education and promotional materials, including leaflets, posters, banners, the Combat Manual for Dengue Fever, and VCDs.
2. Produced promotional materials, such as epidemic control programming and newspaper ads, which called on the general public to eliminate breeding sources. These included TV commercials and short films for screening in TV slots reserved for public service announcements.
3. Published the Guidelines for Dengue Control to be the reference for local health organizations.
4. Formulated the Community Mobilization Plan for Cleaning Up Breeding Sources of Vectors. Taiwan CDC encouraged community organizations in southern Taiwan to propose plans to CDC units and organize volunteer teams to exterminate mosquitoes.
5. Encouraged experts to conduct studies in insecticide efficiency and mosquito resistance to promote better insecticide use.
6. Promoted dengue fever vector mosquito surveys and the Dengue Fever Control Plan. Implementation was entrusted to the health bureaus of high-risk counties and cities in southern Taiwan (areas infested with *Aedes aegypti* mosquitoes).



The APEC Conference on Severe Dengue Prevention and Strategies for Reducing Disease Burden was held in Tainan from May 3 to 4, 2018, bringing together experts from ten countries in the Asia-Pacific region to discuss new technologies for preventing and controlling dengue fever and future prospects.

### Secondary Prevention

1. Established an incentive system to encourage physicians to report cases, in turn, enabling early detection of the disease. Medical professionals, including physicians, who reported the year's first indigenous case in each city and county were awarded US\$130, and those who reported an imported case were awarded US\$80.



The Minister of Health and Welfare and the Minister of Environmental Protection Administration co-chaired the 22<sup>nd</sup> Cross-Ministerial Meeting on Measures to Combat Mosquito-Borne Diseases on January 16, 2018. A monthly meeting to facilitate the communication, coordination, and cooperation between the local and central governments.

2. Continued fever screening at international airports and seaports to limit disease importation. Around 40% of imported dengue cases were detected at ports.

### **Tertiary Prevention**

About 500 clinical physicians attended dengue diagnosis and treatment training courses between July and September in 2018.

## **Future Prospects**

After Taiwan suffered the serious dengue outbreak in 2015, from 2016 to 2018, Taiwan implemented several prevention and control strategies that have yielded concrete results, which will serve as the foundation for Taiwan CDC to strengthen the cooperation between the central and local governments to combat dengue fever. Additionally, Taiwan CDC will continue to strengthen border quarantine efforts, improve disease surveillance system, raise public awareness through diverse channels, and stay abreast of the technological trends for preventing and controlling communicable diseases in order to respond to upcoming challenges.

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## **Enteroviruses**

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Enterovirus belongs to a group of small RNA viruses, including polioviruses, Coxsackie A viruses, Coxsackie B viruses, echoviruses and other enteroviruses. Enterovirus 71 (EVA71) has a significantly higher pathogenicity compared to other known enteroviruses, especially regarding neurological complications. Enteroviruses are found in the gastrointestinal tract (the stool of infected persons, mouth) and respiratory tract (such as saliva, sputum, or nasal mucus). Infections can be produced by direct contact with the secretions of infected persons or with contaminated surfaces or objects.

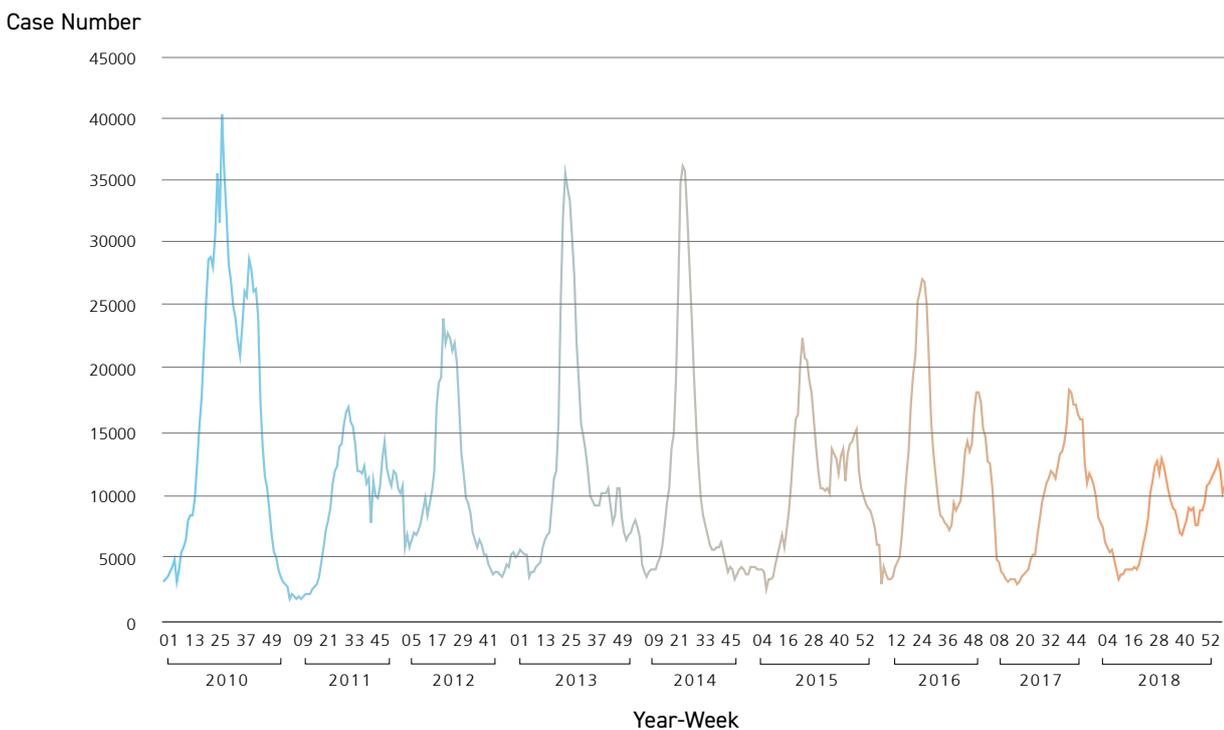
### **Current Status**

According to survey data gathered over a period of several years by Taiwan CDC and National Health Insurance Administration (NHI), the number of weekly outpatients and emergency visits for enterovirus infection, shown by the data transferred from the database of NHI, increases in late March and peaks around mid-June. It decreases after mid-June. There is usually another smaller outbreak when schools reopen in September (Figure 3-10). Many types of enteroviruses exist around the world. Humans appear to be the only known host and source of transmission. The patient is contagious before their onset, and the infectivity will last for weeks although the patient is recovered. There are currently no preventive vaccines for non-polio enteroviruses in Taiwan and no known highly efficacious medicine to eliminate the virus once it is inside the human body. Therefore, enteroviruses will continue to pose a threat to human health in the foreseeable future.

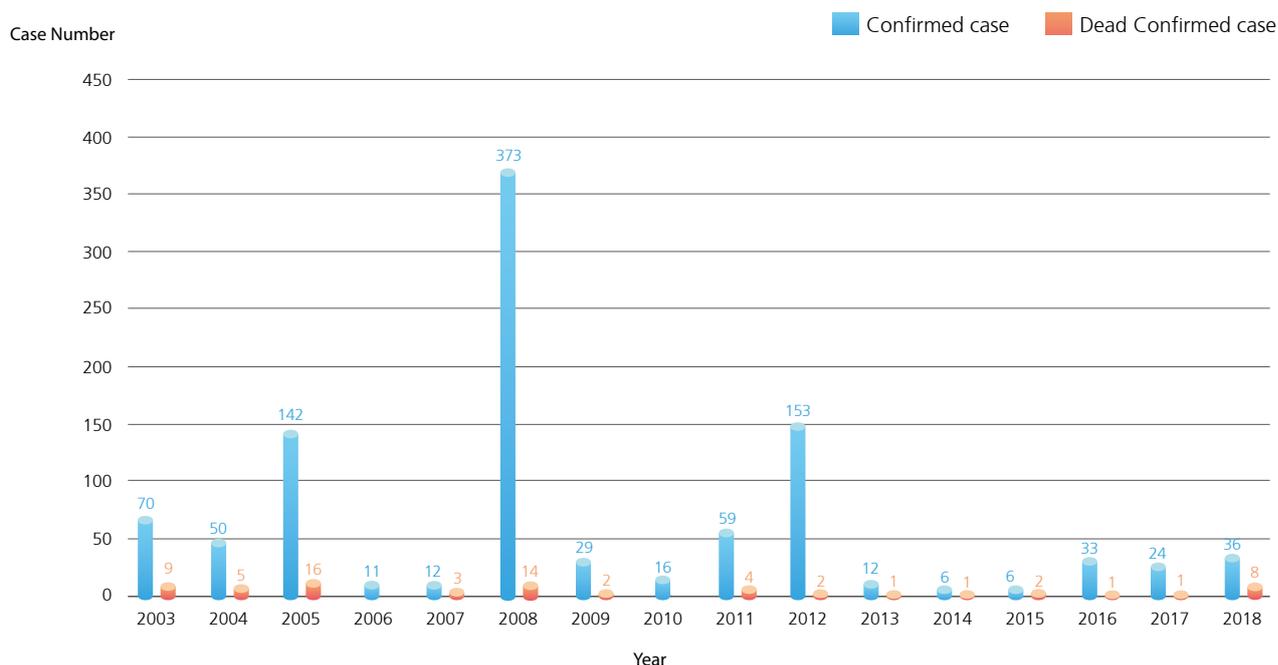
The peak season for enterovirus infections in temperate regions is in summer. According to various surveys, enterovirus infection trends suggest that children under the age of 5 are more prone to critical complications and death. The major symptoms of enterovirus infection are herpangina and hand-foot-and-mouth disease (HFMD). EVA71 is the most commonly seen serotype of cases of enterovirus infection with severe complications (EVSC) in Taiwan. In May 2018, Taiwan CDC detected that echovirus type 11 (Echo 11) was prevalent in the community through contract laboratory surveillance. Neonatal cases of Echo 11 infections with severe complications and Echo 11 clusters in neonatal care units of hospitals or postpartum nursing care centers were also confirmed successively. In response to the Echo 11 outbreak, Taiwan CDC and local governments conducted special programs to increase the awareness on the prevention, symptom identification, and disease severity among pregnant women, baby caregivers, and medical professionals, improve the quality of critical care for newborn infants with enterovirus infection, ensure an efficient referral mechanism, and provide guidance on infection control and prevention for medical institutions and postpartum nursing care centers.

In 2018, Coxsackie A virus was found to be the predominant circulating virus. There were 36 confirmed cases of EVSC infected by Echo 11 (12), EVA71 (8), enterovirus D68 (1), Coxsackie A virus (9) and Coxsackie B virus (6) (Figure 3-11). Eight cases died, all were newborn.

**Figure 3-10 The Number of Weekly Outpatient and Emergency Visits for Enterovirus Infection in Taiwan, 2010-2018**



**Figure 3-11 The volume of Confirmed Cases and Deaths of EVSC in Taiwan, 2003-2018**



## Accomplishments

1. Established multiple and real-time surveillance systems for enterovirus infections, covering HFMD and herpangina, severe cases, clustering, virus isolation and typing.
2. Constructed a medical service network, including 6 regional chiefs, 75 responsible hospitals and 8 contract laboratories.
3. Health Education
  - (1) Local organizations worked with the community to promote enterovirus education and prevention.
  - (2) Restaurants, schools, hospitals, clinics and other public gathering places must conduct regular inspections for environmental sanitation and provide hand-washing facilities.
4. Established consultation channels staffed by clinical professionals. The professionals provided clinical health care consultation and guidelines for treating enterovirus complications. Primary care for patients with complications was also provided, which effectively lowered the mortality rate.
5. "The Manual for Enterovirus Prevention" and "The Handbook for Enterovirus Prevention for Child Care Workers" list all necessary precautions. These materials are provided on the Taiwan CDC website and updated timely.
6. Workshops are held on the clinical treatment of critical enterovirus complications or neonatal enterovirus infection by hospitals and societies to enhance doctors' skills in treating the disease, raise treatment quality and reduce mortality rates and sequelae.

7. According to the risk of EVSC clustering, the recommendation of class suspension has been revised for the pre-school education and care institutions, which are high-risk groups.
8. Research and development progress of EVA71 vaccine in Taiwan: After accepting the technology of EVA71 vaccine from the National Health Research Institutes, the two domestic biotechnology companies have completed the Phase II clinical trials, and one of them began the Phase III clinical trials in the 2<sup>nd</sup> quarter of 2018.

## Future Prospects

### 1. Enterovirus Prevention Enhancement

- (1) Increase the public awareness of hand-washing and not going to school or work when they are sick.
- (2) Enhance caregivers' awareness of prodromal complications for enterovirus infections with severe complication.
- (3) Raise the awareness of pregnant women, care workers and medical staff for prevention and risk of neonatal enterovirus infection.
- (4) Strengthen the implementation of infection control measures in hospitals or nursing homes to reduce the risk of neonatal enterovirus clusters.

### 2. Assessment of Current Prevention Policies

- (1) Continuous monitoring of the epidemic changes, timely adjustment of prevention and control strategies
- (2) Assess consequences resulting from suspending classes.
- (3) Check the integrity of the equipment and the rationality of manpower allocation in hospitals to assess the ability of the hospital treating severe cases.

### 3. Follow the development progress of EVA71 vaccine continuously.



In 2018, seminars on the clinical diagnosis and treatment of enterovirus D68 were held for related personnel of hospitals and health bureaus.

## Emerging Infectious Diseases (EID) Response

### Emerging Infectious Diseases (EIDs) risk surveillance, response and preparedness

In recent years, rapid changes in the global ecosystem and frequent international exchanges have resulted in the occurrence and spreading of many emerging infectious diseases (EIDs), which recognize no geographical borders and spread rapidly. This has threatened public health, economic development, and even national security. The SARS outbreak in 2003, the MERS-CoV outbreak in 2012, and the Ebola outbreak in 2014 are cases in point. EIDs surely have drawn international attention. In light of this, Taiwan CDC proposed the "Surveillance, Response, and Preparedness Plan for the Risk from Emerging Infectious Diseases", which was approved by the Executive Yuan on the 9<sup>th</sup> of June in 2015, to effectively prevent and control EIDs. The program started in 2016 and will come to an end in 2021. It aims at maintaining the core capacities at the designated PoEs based on the IHR, expanding the capabilities of testing and diagnosis of emerging pathogens, strengthening preparedness and emergency response, enhancing training and conducting drills to counter possible bioterrorism, and increasing international cooperation.

### Accomplishments

1. Successfully maintained the core capacities at 7 designated PoEs based on the IHR and improved skills for monitoring EIDs and risk assessment.
2. Increased to 12 diagnostic methods for emerging pathogens and advanced diagnostic technology and capacity.
3. Carried out proper maintenance for both software and hardware in Center for Infectious Disease Control and Prevention, Taiwan CDC. In addition, drills, exercises and multiple channels of training courses were offered for more than 420 persons.
4. Conducted training programs and exercises for the Biohazard Response and Verification Expert Team (BRAVE) and maintained the equipment. More than 75% of BRAVE members have obtained the certification. These efforts ensured a sufficient capacity for bioterrorism response.



Students from the department of nursing practiced PPE donning and doffing in the Center for Infectious Disease Control and Prevention, Taiwan CDC.

5. Commissioned the Foundation of Professor Wei-Chuan Hsieh for Infectious Disease Research and Education to organize International Symposium of Preparedness and Response to Emerging Infectious Disease of Medical Institutions in 2018, with 10 units of video conferencing and a total of 699 attendees nationwide.
6. Dispatched officers to attend "International Conference on Emerging Infectious Disease" in the U.S. and "The 7<sup>th</sup> International Meeting on Emerging Diseases and Surveillance" in Austria respectively, increasing Taiwan's international visibility.



## Infection Control and Biosafety

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### Healthcare-associated Infection Control

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#### Current Status

The SARS outbreak highlighted the importance of infection control in hospitals. To improve patient safety and combat nosocomial infections, Taiwan CDC coordinates annual inspection programs, gathers surveillance data on the occurrence of nosocomial infections and antimicrobial resistance, and formulates nosocomial infection control guidelines.

Our goals are:

1. To reduce nosocomial infections through national action plans and compilation of infection control guidelines.
2. To improve the performance of infection control programs in hospitals by boosting the quality of nosocomial infection control inspection programs and sharing nosocomial infection control experiences in on-site audits.
3. To continue promoting hospital participation and strengthening data quality in the Taiwan Nosocomial Infection Surveillance (TNIS) system.
4. To promote infection control and reduce healthcare-associated infections in long term care facilities by implementing infection control inspections.

## Accomplishments

### 1. Nosocomial Infection Control Inspections

Starting in 2008, Taiwan CDC commissioned the Taiwan Joint Commission on Hospital Accreditation to implement a quality improvement project for infection control inspections. Experienced infection control practitioners and infectious disease specialists joined local health authorities in conducting on-site inspections. Since 2017, the inspection frequency for each hospital was adjusted to at least once in every two years. In 2018, of 254 hospitals inspected, 1 of them failed to pass the threshold of the designated index.

### 2. Nosocomial Infection Surveillance and Reporting

Hospitals may either provide nosocomial surveillance data through web-based entry or convey their data electronically through interchange platform to the reporting system. More than 430 hospitals enrolled in reporting in 2018. Participating hospitals and health authorities could retrieve feedback reports from the system, including infection densities, most common pathogen for nosocomial infection, their antimicrobial resistance proportions, etc.

### 3. Infection Control Journal

Taiwan CDC commissioned the Infection Control Society of Taiwan to publish the bimonthly Infection Control Journal, which provides healthcare workers with information on trends and research related to the prevention and control of nosocomial infections.

### 4. Infection Control Inspections in Specific Facilities

In 2018, Taiwan CDC implemented infection control inspections of correctional organizations and baby care centers. Local competent authorities and infection control experts inspected 51 correctional organizations and 353 baby care centers. The correctional organizations pass rate was 100% and the baby care centers pass rate was 99.7%. Follow-up inspections at 1 audited facility that failed to meet requirements were conducted.



## Future Prospects

1. Draft, implement and revise regulations and guidelines on healthcare-associated infection based on recommendations announced by the WHO and leading countries. The information Taiwan CDC gathers from around the world on policies, laws, regulations and implementation results will serve as a reference for policymaking.

2. Revise the nosocomial infection control inspection quality improvement project on an annual basis, according to the implementation experiences from previous years and outside recommendations.
3. Continue to promote hand hygiene and the care bundles that prevent device-associated infections including CLABSI, VAP and CAUTI. Thus, enable hospitals to make sustained progress in patient safety and healthcare quality, as well as reduce medical costs by reducing HAIs.
4. Continue to improve usefulness, simplicity, and efficiency of nosocomial surveillance system. It is expected that data reported to TNIS system will be useful for quality improvement activities.
5. Continue to conduct the infection control inspections of long-term care facilities in order to improve health care quality, reduce healthcare-associated infections and prevent outbreaks.

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## Antimicrobial Resistance

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### Current Status

Antimicrobial resistance (AMR) has become a major global crisis. In response to the increasingly serious threat posed by AMR, Taiwan CDC implemented the National Antimicrobial Stewardship Program, established multi-channel surveillance on multidrug-resistant organisms (MDROs), conducted hospital accreditation and hospital infection control inspection related to the antimicrobial stewardship, carried out coordinated infection control interventions, and implemented appropriate use of antimicrobials to alleviate the AMR crisis. Furthermore, Taiwan CDC proactively created relevant guidelines, e-learning materials and hand hygiene and antimicrobial awareness campaigns to engage all people to curb AMR.

Our goals are:

1. To strengthen surveillance of antimicrobial resistant pathogens and to control the spread of carbapenem-resistant Enterobacteriaceae.
2. To conduct hospital accreditation and hospital infection control inspection to require or encourage all hospitals to implement antimicrobial stewardship.
3. To provide a series of e-learning courses for the antimicrobial stewardship to strengthen understanding and awareness among healthcare workers.
4. To hold national campaigns to raise awareness of the public and healthcare workers.
5. To cooperate with human health and animal sectors to combat AMR.

## Accomplishments

### 1. Surveillance of Antimicrobial Resistant Pathogens

Taiwan CDC has conducted AMR surveillance via National Notifiable Disease Surveillance System (NNDSS) and Taiwan Nosocomial Infection Surveillance (TNIS) system for years. To further improve the AMR surveillance efficacy, Taiwan CDC has added a new reporting function, namely the Antimicrobial Resistance Management and Surveillance System, to the TNIS system to collect laboratory testing data of clinical isolates since March 2017. Hospitals are encouraged to report cases through Electronic Data Interchange mechanism. More than 100 hospitals enrolled in this module in 2018.

### 2. Hospital accreditation and hospital infection control inspection related to antimicrobial stewardship

Three indicators have been identified to evaluate the antimicrobial stewardship through the hospital accreditation and hospital infection control inspection system, namely leadership and accountability of antimicrobial stewardship program, surveillance and management mechanism of antimicrobial use, and surveillance and precaution measure of MDROs. A total of 242 hospitals were assessed through hospital infection control inspection in 2018. The percentages of criteria being graded as "meeting or superior to" the minimum requirement were 95.9% (232/242), 95.9% (231/241), and 97.3% (214/220), respectively.

### 3. E-learning for the management of AMR

Taiwan CDC continued to provide a series of e-learning courses for the antimicrobial stewardship to strengthen understanding and awareness among healthcare workers.

### 4. National campaigns

To raise awareness of hand hygiene and AMR, Taiwan CDC continued to support the WHO's World Hand Hygiene Day (May 5) and the World Antibiotic Awareness Week (November). Taiwan CDC invited delegates from several relevant government agencies, health professional associations, leaders and healthcare workers from hospitals to attend the launch ceremony and to show the public their commitment to hand hygiene and antimicrobial resistance. Campaign information was also distributed to all healthcare facilities and healthcare workers were encouraged to display their engagements in practicing hand hygiene and tackling AMR.

### 5. 'One Health' Strategy

In response to the first action package of Global Health Security Agenda (GHSa), AMR, Taiwan CDC cooperates with the BAPHIQ, the Ministry of Science and Technology and Academia Sinica to implement a 4-year research project since 2017. The collaboration is under a 'One Health' approach to promote antimicrobial stewardship and reduce the emergence and spread of antimicrobial resistant pathogens in both humans and animals. In addition, the BAPHIQ and Taiwan CDC had compiled the National Action Plan on AMR 2019-2022 (draft).

## 6. International cooperation

To exchange Taiwan's experiences in implementing antimicrobial stewardship with the world, Taiwan CDC held the APEC Conference on "Strategies Against the Evolving Threats from Antimicrobial Resistance: From Awareness to Concrete Action" in Taipei on September 20 and 21, 2018. Domestic and foreign AMR experts, scholars, and decision-makers from various governmental departments shared insights and practical experiences on the topics of strengthening surveillance and laboratory capacity to combat AMR, policies to promote ASP, and infection control strategies to contain AMR. In addition, posters showcasing APEC member economies' research findings had been displayed and a site visit to Linkou Chang Gung Memorial Hospital had been arranged.



APEC Conference on "Strategies Against the Evolving Threats from Antimicrobial Resistance: From Awareness to Concrete Action" on September 20 and 21, 2018.

## Future Prospects

1. Promote hospitals to participate in the Antimicrobial Resistance Management and Surveillance System while strengthening surveillance of AMR.
2. Continue to require or encourage all hospitals to implement the antimicrobial stewardship.
3. Continue to strengthen surveillance of antimicrobial-resistant pathogens and promote cooperation between human health and animal sectors to combat antimicrobial resistance.

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## Laboratory Biosafety and Biosecurity Management

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### Current Status

#### Legislative and Regulatory Changes

In 2018, Taiwan CDC completed the editing, revision, and the announcement of the "Guideline for Governing Management of Select Agents and Toxins", "Guidance on the Inventory of Select Agents and Toxins", "Security Guidance for Select Agent or Toxin Facilities", "Guidance for Suitability Assessments", "Drills and Exercise Guidance", and "Select Agents or Toxins Biosafety/ Biocontainment Plan Guidance". We also accomplished the amendment of the "Regulations Governing Management of Infectious Biological Materials" on January 31, 2019, categorizing select agents and toxins as a special section.

### Biosafety Mechanism Registration

By December 2018, 502 entities reported biosafety management units to Taiwan CDC, of which 496 entities established biosafety committees and 6 entities designated a biosafety specialist staff. These included 20 government agencies, 153 medical institutions, 54 academic research institutions and 275 other groups.

### Biosafety Inspections of Microbiological and Biomedical Laboratories

In 2018, Taiwan CDC completed the annual routine laboratory biosafety and biosecurity inspecting of 15 BSL-3 laboratories and RG3 pathogens storage facilities. In addition, Taiwan CDC supervised the local government health bureaus to complete the laboratory inspecting of 181 BSL-2 microbiology laboratories of biotechnology industries. In order to strengthen biosafety and biosecurity of the entities that possess or use select agents and toxins, Taiwan CDC has counseled and visited the facilities of 7 entities in 2018.

### Laboratory Biosafety Education and Training

In 2018, 4 e-learning courses on laboratory biosafety were recorded. Taiwan CDC also organized 3 biorisk management and 3 select agents and toxins training course sessions, with a total attendance of 429 laboratory workers. Taiwan CDC developed "Laboratory biosafety management information system" (ver. 2.0) which helps to conduct and oversee the condition of management of storage and transformation of infectious biological material. We held 10 operation training and 2 systematic data maintenance symposiums to help all entities getting familiar with the system, and 508 laboratory workers attended.

### Laboratory Biorisk Management

In 2018, the bio-risk management system using CWA 15793 standard was introduced to 17 biotechnology-related microbiology laboratories. By focusing on continuous improvement and the Plan-Do-Check-Act (PDCA) cycle, this system will identify and monitor all aspects of laboratory biosafety and biosecurity.

## Future Prospects

Taiwan CDC has participated in the Global Health Security Agenda (GHSA) for several years and realized the international concern of Biological Select Agents and Toxins (BSAT). In 2016, we applied JEE Tool (Joint External Evaluation Tool) published by WHO to assess the epidemic prevention system of our nation which includes reviewing the level of BSAT management. For the JEE Tool, the highest score for each indicator is score 5-sustainable. Taiwan was scored 3-developed capacity



An awards ceremony was held to recognize biotechnology-related microbiology laboratories to implement the Lab biorisk management system on November 9, 2018.

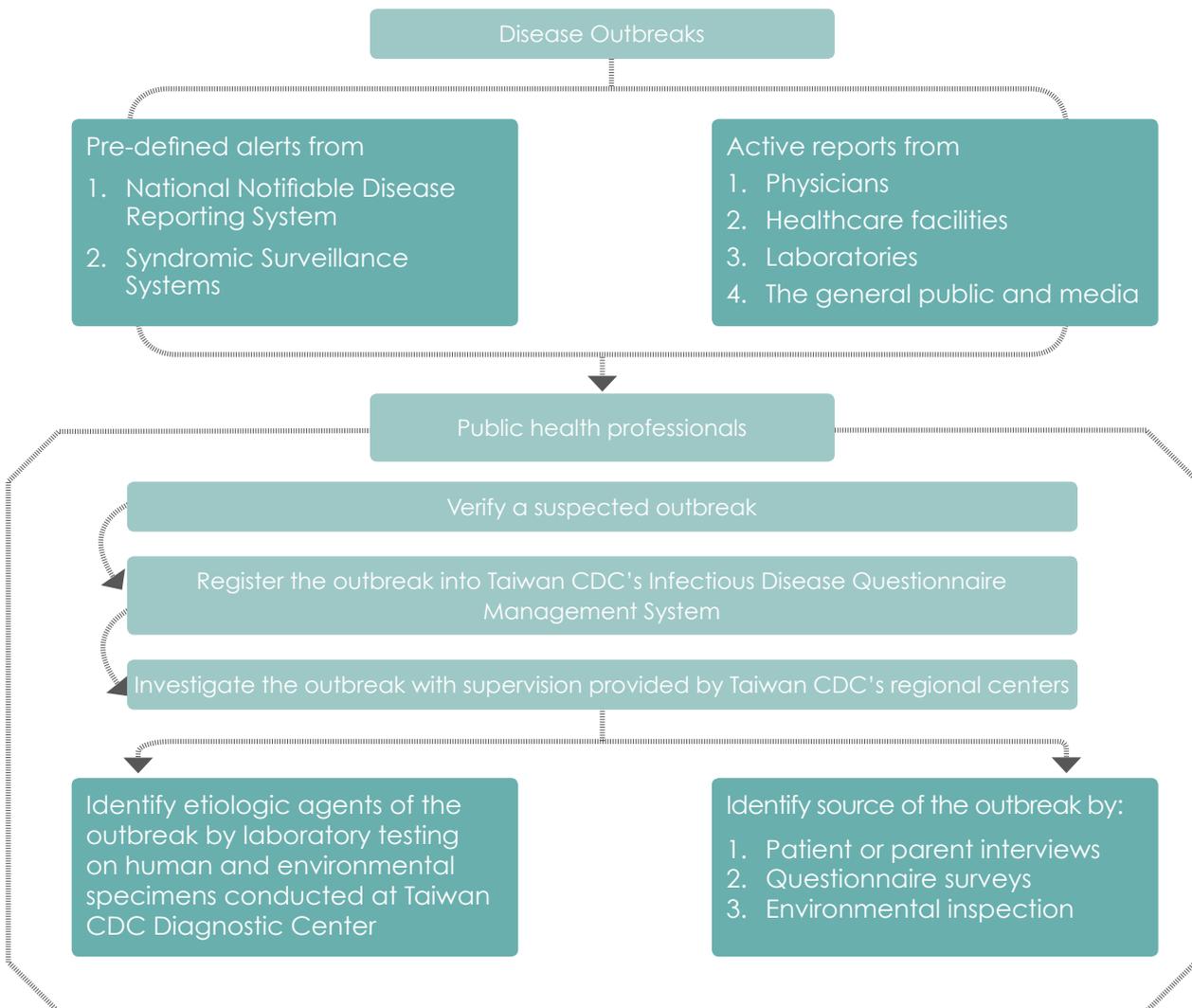
in BSAT management. As a result, by 2018, Taiwan CDC has improved the insufficiency of BSAT management and has made a great progress on it. We believe by the time of 2020, we will reach a higher score on BSAT management on JEE tool, to prove the nation's ability of managing BSAT can be as well as other advanced countries.

## Outbreak Investigation

### Current Status

One of the core capacities of public health departments is investigating a disease outbreak to institute control and prevention measures. Outbreak investigations are challenging because the cause and source are frequently unknown and could cause public concern and anxiety. There may be hostility and defensiveness if an individual, product, or institution is suspected of being the source of the outbreak. In such pressure-packed settings, public health investigators have to remain calm, professional, and objective.

 **Figure 3-12 Flowchart of Outbreak Investigation**



In Taiwan, outbreaks are mainly detected through pre-defined alerts or activity reports. Public health professionals will verify a suspected outbreak and conduct outbreak investigation and control measures with supervision by Taiwan CDC's regional offices (Figure 3-12).

## Field Epidemiology Training Program and medical officers

The Field Epidemiology Training Program (FETP) of Taiwan CDC was established in 1984 to train public health professionals as disease investigators. The program is a 2-year on-the-job training focusing on hands-on field investigations and analysis of public health surveillance data. In 2005, Taiwan CDC began to recruit medical officers in preparation for emerging infectious diseases. Since then, the FETP has become a mandatory training program for newly recruited medical officers.

## Accomplishments

1. In 2018, of 1,281 suspected outbreaks registered into Taiwan CDC's Infectious Disease Questionnaire Management System and investigated by public health authorities, 763 (60%) were confirmed outbreaks.
2. The top four reported diseases/syndromes of confirmed outbreaks were influenza-like illness (n = 217, 28%), acute respiratory infection (n = 211, 28%), acute diarrhea (n = 161, 21%), and varicella/chickenpox (n = 116, 15%) (Table 3-5).

 **Table 3-5 Number of Reported Diseases/Syndromes of Confirmed Outbreaks — Taiwan, 2018**

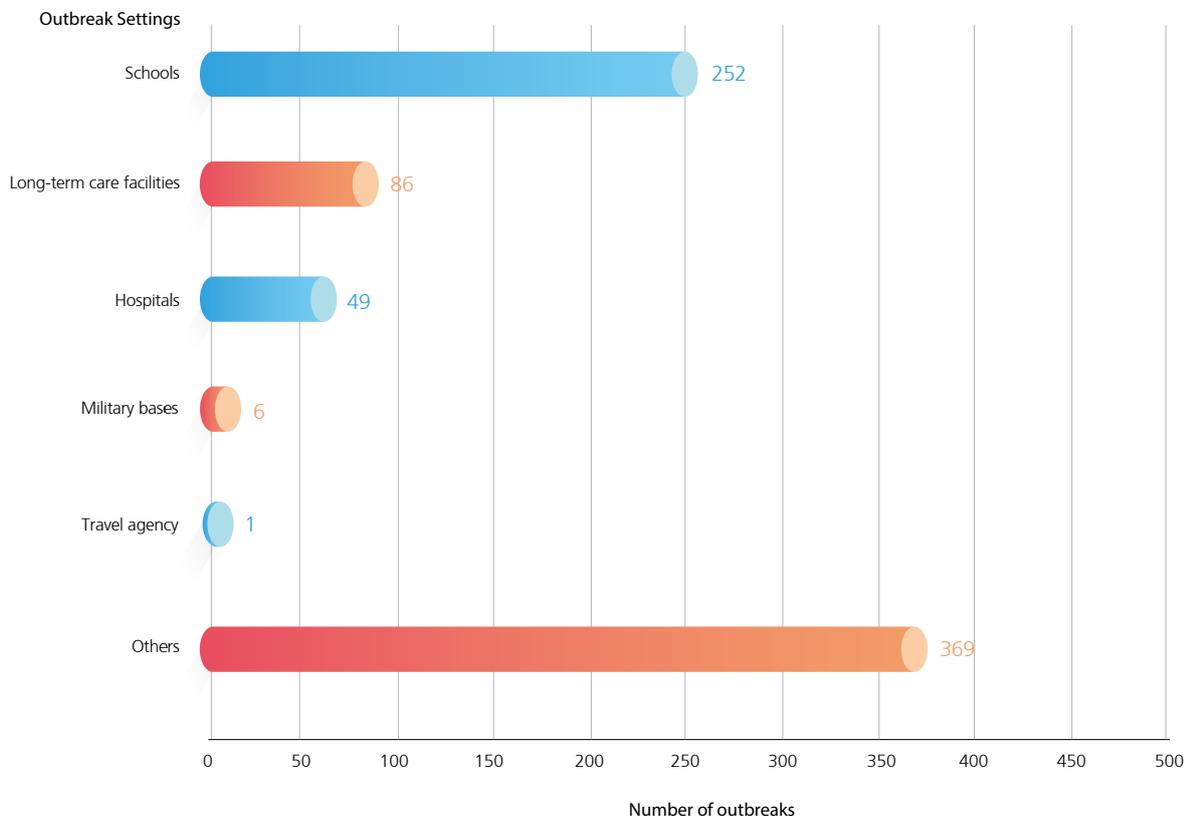
Reported diseases/syndromes	Total number of outbreaks
Influenza-like illness	217
Acute respiratory infection	211
Acute diarrhea	161
Varicella/chickenpox	116
Tuberculosis	22
Dengue fever	14
Unknown cause of fever	10
Enterovirus	9
Pertussis	2
Measles	1
Total	763

- 3. The top three outbreak settings were schools (n = 252, 33%), long-term care facilities (n = 86, 11%), and hospitals (n = 49, 6%) (Figure 3-13).
- 4. Special events in 2018 included Salmonellosis outbreak associated with French toast sandwich in a restaurant and measles transmission from an international traveler in the aircraft and airport.
- 5. By the end of 2018, there were 24 medical officers at Taiwan CDC. Their medical specialties include infectious diseases, internal medicine, family medicine, emergency medicine, pediatric gastroenterology, pediatric cardiology, and pathology.

### Future Prospects

- 1. Strengthen collaborations with partners, including local health departments, food and agricultural authorities, universities, and other academic institutes.
- 2. Enroll newly recruited medical officers and public health professionals of interest from Taiwan CDC and local health departments into the FETP.
- 3. Collaborate with international networks of FETP to enable rapid response in outbreak investigations as well as control and contribute to global health diplomacy.

**Figure 3-13 Number of Outbreaks by Setting — Taiwan, 2018**





# International Health

# International Cooperation

## Background

Taiwan CDC has made great efforts to enhance international health exchanges related to infectious diseases by strengthening bilateral and multilateral relationships, helping allies raise their capacities for communicable disease control, exchanging the latest technology and information with other countries, and participating in international public health conferences and related activities. As a result, Taiwan CDC has been able to share its unique experiences with the world as it endeavors to achieve the goal of "Health for all".

## Accomplishments

### International Training Program

#### 1. International Workshop on Laboratory Diagnosis for Enterovirus:

With the US-Taiwan Global Cooperation Training Framework (GCTF) as a foundation, the U.S. and Taiwan co-organized the four-day International Training Workshop on Laboratory Diagnosis for Enterovirus from April 23 to 26, 2018. The workshop shared the molecular method for detecting enterovirus infection and demonstrated the use of EV-71 Rapid Test Kit developed

by Taiwan CDC. Participating countries could apply the method to detect EV-71 infections quicker and prevent the spread of the virus in the future. 31 laboratory professionals from 15 countries, including Australia, Cambodia, Indonesia, Japan, Malaysia, Mongolia, Nepal, New Zealand, Pakistan, Papua New Guinea, Singapore, Sri Lanka, Thailand, the United States and Vietnam attended the workshop. Experts from the U.S. Centers for Disease Control and Prevention and Japan's National Institute of Infectious Diseases (NIID) also joined the workshop as lecturers. Their knowledge and experience sharing could enhance the diagnostic capacity for enteroviruses, improve regional capacity for tackling infectious diseases, reinforce global health security, and ward off the threats posed by infectious diseases around the world.



International Workshop on Laboratory Diagnosis for Enterovirus, April 23-26, 2018

#### 2. APEC-funded Conference on Severe Dengue Prevention and Strategies for Reducing Disease Burden :

Taiwan CDC was sponsored by APEC funding to host the APEC Conference on Severe Dengue Prevention and Strategies for Reducing Disease Burden from May 3 to 4, 2018. In total, 88 participants from 10 APEC member economies, including Indonesia, Korea,

Malaysia, Mexico, Russia, Singapore, Chinese Taipei, Thailand, the United States and Vietnam attended this conference. The participants discussed the challenges of dengue control strategies and the current situation concerning the effect of global warming on vectors and dengue pandemics. The latest development in surveillance systems, environmental management and vector control, pilot studies of drugs and vaccine development for dengue treatment and prevention were also introduced to enhance APEC economies' capacity building in dengue prevention and clinical case management. The conference aimed to improve regional capacity for tackling dengue and to ensure global health security by establishing a disease control network through partnering with countries in the Asia-Pacific region.



APEC-funded Conference on Severe Dengue Prevention and Strategies for Reducing Disease Burden, May 3-4, 2018

### 3. APEC-funded Conference on Strategies Against the Evolving Threat from Antimicrobial Resistance(AMR): From Awareness to Concrete Action

To facilitate experience exchange on infection control and to address the antimicrobial resistance issue with other member economies, Taiwan CDC successfully obtained the APEC funding for the APEC Conference on Strategies Against the Evolving Threat from Antimicrobial Resistance (AMR): From Awareness to Concrete Action held on September 20-21, 2018. In total, 143 participants from Australia, Chile, Hong Kong, Indonesia, Japan, Korea, Malaysia, Peru, the Philippines, Singapore, Switzerland, Chinese Taipei, Thailand, the United States, and Vietnam attended this conference. Topics discussed included the surveillance system of antimicrobial resistance, infection control policies and antimicrobial resistance strategies. Poster presentations were also displayed to show AMR control and research findings from APEC member economies.



APEC-funded Conference on Strategies Against the Evolving Threat from Antimicrobial Resistance (AMR): From Awareness to Concrete Action, September 20-21, 2018

## Bilateral and Multilateral Cooperation Progress Report

1. Implementing Arrangement No. 4 – Epidemic Intelligence Service training program: Taiwan CDC sent clinicians to the US CDC to participate in the EIS program in order to improve Taiwan's capacity to prevent, detect and respond to diseases. As of 2018, a total of 5 individuals had participated in the program.

2. Implementing Arrangement No. 5 – Influenza training program: Taiwan CDC shared H7N9 influenza virus and seasonal influenza virus with the US CDC's subordinate agencies. In addition, two experts from US CDC shared their experiences at the “Influenza Disease Burden & Vaccine Cost-Effectiveness Analysis Workshop” held on August 8-10, 2018 in Taipei.
3. Since 2004, Taiwan CDC and Japan NIID have taken turns to organize an annual bilateral symposium. The two sides took a step further in 2011, signing an agreement regarding joint research. This agreement has enabled Taiwan CDC and the NIID to conduct joint research on infectious disease prevention. Nine joint projects were conducted in 2018. The 15<sup>th</sup> Taiwan-Japan Symposium was held in Taiwan from September 3 to 4, 2018. 20 Japanese experts and 81 Taiwanese participants shared their experiences in preventing and controlling diseases under the concept of one health, the diagnosis and control of imported infectious diseases, biosafety and biosecurity. Participants from both sides also discussed the results of the collaborative project report.



15<sup>th</sup> Taiwan-Japan Symposium, September 3-4, 2018

### New Southbound Policy

Taiwan CDC is working in conjunction with the government to implement the New Southbound Policy. Taiwan CDC has strengthened cooperation and exchange with New Southbound countries in prevention and control, and established the New Southbound Health Center to build a joint prevention and control network for infectious diseases and prevent cross-border transmission of diseases.

#### (I) Strengthening cooperation and exchange with New Southbound countries:

Taiwan has close ties with Southeast Asian countries in terms of trade and tourism. In addition, migrant workers in Taiwan are mainly from Southeast Asian countries, such as Indonesia, the Philippines, Vietnam and Thailand. Therefore, Taiwan CDC has chosen diseases that are more prevalent in Southeast Asia, namely dengue fever and tuberculosis, as the focus of cooperation in disease prevention and control.

1. Exchange and cooperation in dengue fever prevention and control: Cooperate with Indonesia on the “New Southbound Dengue Prevention and Control Exchange Program.”

Program outline:

- (1) The “2018 New Southbound: Indonesia-Taiwan Dengue Workshop” was held from October 22 to 31. 15 professionals from



2018 New Southbound: Indonesia-Taiwan Dengue Workshop, October 22-31, 2018

Indonesia's dengue prevention and control units, including Health Ministry of Indonesia, Bandung Institute of Technology (ITB), Bandung Health Office, etc., attended the training in Taiwan.

- (2) Taiwan CDC invited domestic dengue prevention and control experts to Bandung City, Indonesia from November 25 to 29 to work with dengue control workers in the area and carry out dengue prevention and control.
2. Exchange and cooperation in tuberculosis prevention and control: Cooperate with Vietnam on the "Taiwan-Vietnam TB Control Collaborative Project."

Project outline:

- (1) The "2018 Tuberculosis Control and Prevention Workshop under New Southbound Policy" was held from June 11 to July 6. The province of Quang Ninh in Vietnam dispatched high-level officials and 26 professionals from the fields of public health, clinical care, and laboratory diagnosis to attend the training in Taiwan.



2018 Tuberculosis Control and Prevention Workshop under New Southbound Policy, June 11-6, 2018

- (2) Taiwan CDC invited domestic TB prevention and treatment experts to Quang Ninh, Vietnam from September 23 to October 6, to work with TB control workers in the region and carry out TB prevention and treatment. In addition, Taiwan CDC facilitated the signing of the MOU between Taipei Municipal Wanfang Hospital and Quang Ninh Tuberculosis and Lung Hospital, and the establishment of a cooperation office in Vietnam. In addition, the both sides also exchanged information on medical professions other than tuberculosis.

## (II) New Southbound Health Center:

Taiwan CDC provides services such as health education on infectious diseases, counseling, and health care transfer for individuals traveling between Taiwan and New Southbound countries.

Services include:

1. A specialized website that provides a list of recommended hospitals for medical treatment in six countries, including Indonesia, India, the Philippines, Vietnam, Thailand, Malaysia, as well as recommendations on hospitals in Taiwan, information on infectious disease prevention and control and education materials, and related Q&A.
2. Consultation provided by "Overseas Health Manager" and "Overseas Consultant Physician" on referral medical services such as information on infectious disease prevention and control, medical treatment, and preventive health care services.
3. A service line and a mailbox for the public to access consultation services provided

by “Overseas Health Manager” and “Overseas Consultant Physician.”

### International Exchanges in 2018

1. A total of 94 guests from different countries visited Taiwan CDC.
2. Taiwan CDC attended 6 APEC Conferences, including the 2018 1<sup>st</sup> and 2<sup>nd</sup> APEC Health Working Group (HWG) Meetings, the 8<sup>th</sup> APEC High-Level Meeting on Health & the Economy, APEC High-Level Roundtable on Mobilizing a Multi-sectoral Response to Antimicrobial Resistance and Tuberculosis, Asian Tuberculosis Research and Clinical Trials Integrated Organisational Network (A-TRACTION) and the 5<sup>th</sup> APEC Blood Safety Policy Forum. In addition, Taiwan CDC held two APEC conferences, including the “APEC Conference on Severe Dengue Prevention and Strategies for Reducing Disease Burden” and the “APEC Conference on Strategies against the Evolving Threats from Antimicrobial Resistance (AMR): From Awareness to Concrete Action”. These two conferences were approved and supported by the APEC Health Working Group as an APEC-funded project.
3. Taiwan CDC participated in 38 international conferences, sent 70 staff overseas, and dispatched 52 employees to join 37 short-term study programs in 2018.



Taiwan CDC commissioned the National Taiwan University Hospital to establish the “New Southbound Health Center.”

### Future Prospects

While globalization spurs the speed and frequency of the spread of infectious diseases more than ever before, a crisis anywhere may easily and soon become a problem everywhere. In order to achieve global health security, all countries need to have the capabilities to rapidly and effectively detect and respond to infectious diseases and other health threats. As a result, Taiwan CDC will continue to strengthen our bilateral and multilateral cooperation with other countries and international public health institutes. Taiwan CDC will continue to assist its counterparts in the Asia Pacific and Southeast Asian regions to enhance their disease surveillance and diagnosis capabilities and core capacities to detect, assess, report, notify, verify and respond to the threats and challenges presented by emerging infectious diseases under the US-Taiwan Global Cooperation Training Framework (GCTF). In addition, we will continue to seek more opportunities for active participation in the international arena in order to help ensure a world safe and secure from infectious disease threats and promote global health security as an international security priority that will be beneficial to us and the region.

# Implementation of the IHR

## WHO International Health Regulations

The WHO International Health Regulations (IHR) are an international legal instrument to help the international community to prevent and respond to public health risks that have the potential to cross borders and threaten people worldwide. The main purpose of the IHR is to implement public health responses that can prevent and control the spread of diseases across borders while limiting interference with international transport and trade. The IHR also require that state parties investigate, evaluate and report public health risks and emergencies while reacting promptly to these threats.

Over the years, international transportation has become more convenient, which leads to frequent movement of people and goods. Diseases can spread far and wide via international travel and trade. A health crisis in one country can impact livelihoods and economies in many parts of the world, such as the severe acute respiratory syndrome (SARS) outbreak in 2003. For these reasons, in 2005 the WHO's World Health Assembly (WHA) revised and passed the new IHR, inviting countries around the world to join in. The regulations, which took effect in 2007, cover public health incidents and emerging or re-emerging diseases, such as SARS, influenza and polio. Meanwhile, the IHR establish a number of procedures and practices for assessing whether an affected country or region is facing a public health emergency of international concern (PHEIC). The purpose of this model is to prevent the time when an epidemic occurs in a place where it is not yet confirmed to be a communicable disease. The new IHR also strengthen the National Focal Point (NFP) for each country. The NFP is the state-designated center responsible for communicating with the WHO on public health incidents that have the potential to become an international concern.

Following the IHR, Taiwan CDC works with the WHO and other countries to conduct prevention and control measures for communicable diseases and other major public health events.

## Operations of IHR Focal Point in Taiwan

### **1. Receiving information on epidemics or public health incidents that meet WHO IHR standards for reporting:**

WHO established the Event Information Site (EIS) for IHR National Focal Points (NFPs) and has granted Taiwan's access in 2009 by WHO Director General's Office. If an epidemic or public health incident occurs that meets IHR standards for reporting, the WHO uses IHR channels to alert each country, including Taiwan.

### **2. Establishing a national, cross-departmental communication channel for forwarding of IHR information promptly:**

A cross-departmental contact point has been established in Taiwan CDC to facilitate

timely correspondence with the WHO IHR on information regarding major public health incidents. Agencies with available counterparts include departments within the Ministry of Health and Welfare, the Taiwan Food and Drug Administration (TFDA), the Ministry of Foreign Affairs, the Bureau of Animal and Plant Health Inspection and Quarantine, local health departments, and related authorities. This channel ensures prompt reporting, communication and response to related events.

### **3. Case referral and reporting diseases or public health events meeting IHR standards:**

The Taiwan IHR focal point serves as a point of single contact for international referral of communicable disease cases (each country's IHR NFP is the counterpart of case referral). Through the IHR channel, relevant countries are informed of follow-up investigation results to facilitate attending and monitoring referred cases. If a PHEIC occurs, Taiwan immediately informs the WHO IHR contact point as well.

## **Accomplishments**

In 2018, Taiwan CDC referred and acquired 264 items of public health risks of international importance through the NFP and EIS mechanisms. Among the referrals and received items, the majority were tuberculosis cases and contacts investigation collaboration and assistance requests, followed by Measles, Rubella, Hansen's Disease (Leprosy), Zika virus disease and Dengue Fever. Furthermore, as a member of the global village, Taiwan is devoting itself and would take responsibilities and have obligations to make contributions to health safety in the international society.

# **International Ports Quarantine Activities**

## **Current Status**

Situated in a subtropical zone with thriving international tourism and trade sectors, Taiwan is highly vulnerable to tropical diseases. To early detect the import of disease and ensure public health, the government established quarantine offices at airports (Songshan, Taoyuan, Taichung and Kaohsiung), seaports (Keelung, Suao, Taipei, Taichung, Mailiao, Kaohsiung, and Hualien), and the three terminals (Kinmen, Matsu and Makung) of the "Mini Three Links" with Mainland China.

To meet WHO's International Health Regulations (IHR, 2005) and prevent the import of diseases by aircraft and ships, Taiwan CDC revised the Regulations Governing Quarantine at Ports. These authorize quarantine units to take all necessary quarantine measures against inbound ships and aircraft together with their crew and passengers for national security and public health protection. Revisions included:

1. **Improved Information Management:** Enhanced the one-stop information system for quarantine operations. Made the quarantine process and information management more efficient.
2. **Streamlined and Standardized Operations:** Called for timely revision and standardization of operational procedures in response to the latest epidemic information and historical events.
3. **Quarantine Procedure Follow-up:** All inbound aircraft and ships, including their crew and passengers, are subject to quarantine to prevent disease importation. After release from quarantine, follow-up health checks may be performed.
4. **IHR Core Capacities at Designated Points of Entry (PoEs):** Strengthened and maintained core capacities at designated PoEs.

## Accomplishments

### 1. One-Stop Information Service

Established the one-stop information system for all information regarding quarantine operations. This included quarantine operations for aircraft and ships, ship sanitation certificates, vaccinations, fee collection, and online statistics.

### 2. Aircraft and Ship Quarantine:

- (1) Any aircraft with crew or passengers exhibiting communicable disease-like symptoms or death must notify Taiwan CDC and document the event. Taiwan CDC will take appropriate measures.
- (2) Any ship arriving at a port in Taiwan must declare the state of its sanitation and passengers' health before arrival via telegraph, telex, fax, mobile phone or e-mail. Permission to enter port is granted after the report is reviewed.
- (3) Possible scenarios for onboard quarantine:
  - A. For aircraft: According to the event or emergency, Taiwan CDC may decide to execute aircraft onboard quarantine or other control measures.
  - B. For ships: In the following cases, quarantine officers may board a ship to implement quarantine measures.
    - a. The inbound ship did not apply for quarantine.
    - b. It has applied but failed to meet quarantine requirements.
    - c. It has reported a passenger/crew member suspected of suffering from a communicable disease.
    - d. There was an abnormal death of animals.
    - e. There was a suspected illness or death on the ship.

The following table shows the state of quarantine in 2018:

 **Table 4-1 Quarantine Work at International Ports in 2018**

Regional Center	Quarantine Office	Ships	Passengers	Aircraft	Passengers
Taipei	Keelung	4,561	484,658	-	-
	Suao	503	1	-	-
	Taipei	3,695	45,714	-	-
	Kinmen	9,932	950,401	3	24
	Matsu	1,690	28,183	-	-
	Songshan	-	-	8,956	1,612,449
Northern	Taoyuan	-	-	96,653	20,605,106
Central	Taichung*	7,142	38,721	6,291	679,522
Southern	Mailiao	2,657	38	-	-
	Anping	392	95	-	-
	Tainan	-	-	758	96,593
Kaohsiung-Pingtung	Kaohsiung*	15,254	28,528	18,141	2,846,167
	Makung	173	911	-	-
Eastern	Hualien*	1,044	2,102	259	35,581
	Taitung	-	-	6	575
Total		47,043	1,579,352	131,067	25,876,017

Source: Taiwan CDC Quarantine Information System

\*Include the quarantine office at airport and seaport.

### 3. Crew and Passenger Inspection and Quarantine

All arriving passengers are required to have their body temperature measured using infrared thermometers for early detection and prevention. Passengers showing symptoms are required to fill out the Communicable Disease Survey Form. Depending on the severity of symptoms and travel history, those individuals are required to offer on-site specimen and subject to hospitalization and/or submit to follow-up tests by local health authorities.

Arriving passengers who became ill after entry are encouraged to seek medical advice and inform their doctor of recent travel history. Of the 27,623,223 passengers who arrived in Taiwan in 2018, 26,401 showed symptoms and were put on the local quarantine follow-up list. Among all symptomatic passengers, 158 communicable disease cases were confirmed, of which 151 cases were diagnosed with dengue fever, 7 cases with chikungunya fever.

#### 4. Control of Disease Vectors in Ports

To control vector density (i.e., any infectious disease carrier such as rats or mosquitoes) at ports and prevent the spread of communicable diseases, Taiwan CDC adopted the following measures:

##### (1) Rat Surveillance and Control:

- A. Putting out anticoagulant baits in places where rats are rampant. Baits are replenished every 10 to 15 days to ensure efficacy.
- B. Examining captured rats for parasites and test blood serum for *Rickettsia typhi*, plague, and hantavirus.



A quarantine officer used a sweep-net to collect mosquitoes inside a passenger aircraft.

##### (2) Mosquito Surveillance and Control:

Mosquitoes are vectors of several communicable diseases, including yellow fever and dengue fever. The mosquito population density is closely related to the development of an epidemic. To understand the variety and quantity of mosquitoes, the following methods have been adopted:

- A. Discovering and eliminating breeding sources of dengue fever vectors: Empty containers that are prone to retain water (bottles, jars, tires, etc.) and containers were checked monthly to prevent vector breeding.



A quarantine officer conduct ship sanitation inspection.

- B. Setting Ovitrap: Traps were placed around the port/airport for mosquitoes to lay eggs. The inside of the traps was laid with pieces of coarse cloth moistened with Temephos to kill the larvae after they hatched out. The traps were replaced monthly, and the number of eggs laid was used for calculating the mosquito population density in the port areas.

- C. Surveying Adult Mosquitoes: Lamps were hung in selected places for trapping mosquitoes to identify their species and track their activities.

##### (3) Organizing International Port Sanitary Groups: members are made up of port authority personnel and stakeholders, including Custom, Immigration, TCDC regional centers,

Animal and Plant Quarantine, National Security Bureau, representatives of airline companies, cargo terminal, and other relevant organizations. Depending on each state of PoE, these representatives meet every three to six months to coordinate action plans and implement policies concerning port security and sanitation.

## 5. IHR Core Capacities at Designated PoEs

Taiwan has 7 designated PoEs (4 airports and 3 seaports). These PoEs meet requirements of IHR (2005) core capacities and are able to cover over 95% of passenger and 86% cargo movement in order to ensure national health and safety. These PoEs were established in two different phases, which were supervised by the Homeland Security Office of the Executive Yuan. The first-phase protocol for achieving core capacity requirements at designated PoEs in Taiwan was approved by the Executive Yuan in 2011. The first two designated ports, Taoyuan International Airport (TIA) and Port of Kaohsiung (PoK), underwent follow-up external assessments undertaken by two Australian experts. The performance not only is a testament that the improvement project has met the IHR core capacity requirements but also demonstrated that the capabilities of these designated PoEs were on a par with those of other developed nations. To pass down these valuable experiences to other PoEs, the Executive Yuan approved the second-phase protocol in 2014. It designated Taipei Songshan International Airport, Taichung Airport, Kaohsiung International Airport, Port of Keelung, and Port of Taichung as the PoEs to establish core capacities in the second phase. Self-assessments and initial internal assessments were carried out by domestic experts in 2014. Several gaps were identified and action plans were developed based on the experts' advice to implement the IHR (2005). The PoEs passed the external assessment with flying colors in 2015. Therefore, we have not only become able to detect, assess, report, and respond to potential public health events of international concern more effectively, but we have also met the requirements and expectations of the WHO. To ensure that our designated PoEs are able to maintain core capacities and coordination infrastructure, annual self-assessment is necessary and an external evaluation is required every 5 years. The first two designated ports, TIA and PoK were scheduled to be assessed by international external experts in 2018. The assessment team reached the conclusion that both indicators (PoE.1 and PoE.2) in WHO Joint External Evaluation (JEE) tool received score at the higher level (5), demonstrating sustainable capacity to fulfil the IHR requirements for PoEs and scored TIA and PoK with 100% using the WHO assessment tool for PoEs. We will further develop sustainable capacity and capabilities accordance with IHR (2005) requirements to ensure the health and welfare of the people in our nation.



IHR External Evaluation of the Core Capacity & Sustainable Development at Designated Points of Entry in Taiwan, 2018

## 6. Other Sanitation Control Measures:

(1) Shipboard Sanitation Control: To prevent the spread of diseases on ships on international routes, Taiwan CDC imposes ship control measures in accordance with IHR (2005) and the Regulations Governing Quarantine at Ports.

A. Implementation of IHR (2005) on June 15, 2007, including the issuance of required sanitary documents for international shipping such as the Ship Sanitation Control Exemption Certificate and the Ship Sanitation Control Certificate. Taiwan CDC granted these documents a six-month period of validity. On these documents, shipping crew must identify and record all areas of ship-borne public health risks, and the required control measures conducted.

B. To prevent rats from running to shore along mooring cables, rat guards must be hung on every cable. Ships that fail to do so would be immediately reported and put on record for quarantine reference the next time they call on the port.

(2) Since direct voyage routes between several authorized fishery ports in Taiwan and China were permitted, local health authorities began to conduct additional quarantine work to prevent transmission of communicable diseases.

## 7. Promoting Travel Health

A total of 30 travel clinics, distributed across the country, provide pre-travel health consultations and vaccinations. Taiwan CDC established the Training Center for Travel Medicine to promote related education and research, and it has also been providing up-to-date travel health information via its official website.

2018 Taiwan Symposium on Travel Medicine and Infectious Disease was held in Taipei on October 5, 2018. Four foreign

experts from Thailand, Japan, and Australia were invited to share the regulation of travel medicine in their countries and up-to-date knowledge regarding travel medicine. The personnel of travel clinics and official health-related workers were also invited to participate in the symposium to renew the knowledge relevant to travel medicine.



2018 Taiwan Symposium on Travel Medicine and Infectious Disease, October 5, 2018

## 8. Reinforced Border Quarantine and Cross-Border Collaboration For Disease Prevention-Phase I Project (2018-2022)

In addition to continuing to strengthen the existing quarantine practices, the establishment of Smart Quarantine Network, the improvement of quarantine personnel quality and quantity, the promotion for the concept of travel medicine, and the active

sharing of experiences with other countries have all contributed to an increase in Taiwan's capabilities for border quarantine at its international ports and emergency preparedness. This has effectively relieved the stress on disease prevention domestically and prevented infectious diseases from spreading into Taiwan. The achievements of 2018 are listed as follows:

- A. Conducting a program to ensure IHR core capacity and sustainable development at designated points of entry in Taiwan. The assessment team from the European Union conducted an external evaluation for TIA and the PoK, following the methods in the WHO JEE tool and WHO Assessment tool for PoEs. The TIA and PoK received the highest score, demonstrating sustainable capacity to fulfill the IHR requirements for points of entry. These results have shown that the emergency preparedness of Taiwan is on a par with that of advanced countries.
- B. Through implementing the Phase I project for building the Smart Quarantine Multifunctional System, we aimed to digitalize paper documents to increase the operation efficiency of front-line quarantine personnel. The system also helped to encourage inbound passengers with symptoms to report their daily health conditions so as to involve the public in disease prevention. The effective use of digital technology has helped quarantine personnel to deal with the increasing workload.
- C. Taiwan has been improving its capabilities for border quarantine and emergency preparedness. As a result, there are no secondary outbreaks caused by communicable diseases of international concern in Taiwan in 2018.

## Future Prospects

- 1. With limited manpower and equipment, CDC aimed to strengthen quarantine capacities and effectively execute quarantine measures to prevent any import of disease.
- 2. Cultivate professional quarantine personnel, encourage the development of new quarantine techniques, and improve quarantine officers performance.
- 3. Further eradicate vectors on ships and monitor rat and mosquito populations in port areas to avoid the spread of communicable diseases.
- 4. Continue to maintain and strengthen core capacities at the seven designated PoEs based on the IHR (2005) in order to extensively improve respond capabilities of our international ports and prevent the spread of disease in our nation.



# Scientific Research and Development

# Research, Development and Manufacturing

## Accomplishments

### **The National Laboratory System for Public Health in Taiwan**

Taiwan CDC supervises quality management of the National Laboratory System conducting diagnostic testing of major infectious diseases, which includes 10 appointed lab, 16 commissioned labs, 268 authorized labs, and 1 pathological anatomy lab. All of the indicators, including laboratory testing for detection of 10 priority diseases, specimen referral and transport system, effective modern point of care and laboratory-based diagnostics, as well as laboratory quality system, were verified to have sustainable capacity and thus reached to the full-score level. In 2018, the CDC national laboratories conducted 122,376 tests, and were accredited by TAF according to the ISO15189 from December 26, 2017 to December 25, 2020.

### **National Influenza Center (NIC)**

1. In 2018, 48 A/H1N1pdm09, 311 A/H3N2 and 183 influenza B viruses were antigenically characterized. Of them, 31 (10%) A/H3N2 and 8 (4.4%) influenza B viruses were inhibited poorly by post-infection ferret antisera raised against vaccine strains. Influenza A(H3N2) and A/H1N1pdm09 viruses were found to have an increased viral genetic heterogeneity.
2. In 2018, 248 A/H1N1pdm09, 374 A/H3N2 and 209 influenza B viruses were tested for oseltamivir resistance. All of them were susceptible to oseltamivir.

### **Viral Respiratory Diseases Laboratory**

1. Integrated multiplex real-time PCR reactions into one reaction, which targeted influenza A and B, human adenovirus, RSV, coronaviruses (229E, OC43, NL63, HKU1, MERS), human metapneumovirus, bocavirus, parainfluenza type 1-4, enterovirus, rhinovirus, Parvovirus B19, HSV1, HSV2, CMV, VZV, Legionella pneumophila and Mycoplasma pneumoniae.
2. 40 measles cases were confirmed from 472 reported cases in 2018 and the available viruses were characterized as genotype D8 (n=34) and B3 (n=3). Ten rubella cases were confirmed from 91 reported cases in 2018 and the available viruses were characterized as 1E (n=7) and 2B (n=1).

### **Viral Enteric and Diarrhoeal Diseases Laboratory**

1. Norovirus was the major cause of acute gastroenteritis (AGE) outbreaks in Taiwan. An increasing scope in AGE outbreaks involving reemergence of genotype GII.4 Sydney was observed and replaced former GII.P16-GII.2 strain toward the end of year 2018. Unlike previous outbreaks which often involved restaurants or healthcare facility, GII.4 Sydney outbreaks mainly occurred in schools.

- Two rotavirus vaccines (Rotarix and RotaTeq) became available on the private market in Taiwan, 2006. In order to monitor the impact of vaccines, hospitalized children aged <5 years with AGE were enrolled from sentinel surveillance hospitals in Taiwan. Systematic hospital-based rotavirus strain surveillance has been conducted to describe baseline strain prevalence data before and during the introduction of rotavirus vaccines and to document possible changes as vaccine use increases in Taiwan.
- Established and evaluated the application of multiplex molecular detection methods to confirm novel viruses of reported diarrhea syndrome cluster and foodborne-related outbreaks.

### HIV and Emerging Diseases Laboratory

- Continued HIV drug resistance surveillance survey among treatment naïve patients. The overall drug resistance rate for any class of anti-HIV drugs was around 12% in 2017.
- 13 medical centers established real-time PCR to detect EV-D68 infection in case of an outbreak.
- International Workshop on Laboratory Diagnosis for Enterovirus was held in conjunction with U.S. CDC on April 23-26, 2018, and the workshop included 27 trainees from 14 countries.
- Participated in a National Foodborne Illness Surveillance Study mainly focused on HAV and HEV infection. An HAV epidemic has been identified among MSM group since 2015. After promoting HAV vaccine campaigns and education, the number of HAV infections has declined significantly after 2017.



The training process of rapid enterovirus diagnosis test on the International Workshop on Laboratory Diagnosis for Enterovirus on April 23-26, 2018.

### Vector-Borne Viral and Rickettsial Diseases Laboratory

- Established and maintained the vector-borne viral and rickettsial reference laboratory to provide laboratory standards and diagnostic services to domestic and international health agencies.
- Developed recombinant protein-based serological and rapid point-of-care tests for the detection of scrub typhus.

3. Conducted a surveillance program for monitoring emerging and re-emerging vector-borne viral diseases and provided essential information on the global expansion and genetic evolution of vector-borne viruses.

#### **Bacterial Respiratory Diseases Laboratory**

1. In 2017-2018, a total of 988 cases of invasive pneumococcal disease (IPD) were notified. The incidence was 2.1 cases per 100,000 population, and the case fatality rate was 9.0%. Among invasive *Streptococcus pneumoniae* strains, the most prevalent serotypes were 19A, 23A, 15A, and 3. Toward penicillin, cefotaxime, and erythromycin, 61%, 72%, and 14% strains were susceptible, respectively. In 2018, serotype 19A became the most prevalent serotype.
2. In 2017-2018, a total of 399 cases of Legionnaires' disease were laboratory-confirmed, including 313 male and 340 cases older than 50 years.

#### **Bacterial Enteric and Emerging Diseases Laboratory**

1. Analysis and comparison of a multidrug resistant *E. coli* coproducing NDM-9 and MCR-1 by next generation sequencing.
2. Establishment of multiplex real-time RT-PCR for detection of pathogens that cause encephalitis. Pathogen detection rate was 15 % in 2018.
3. Employed high-throughput sequencing for unknown pathogen discovery.

#### **Parasitic Diseases Laboratory**

1. Diagnosed imported malaria cases and identified *Plasmodium* to the species level by rapid test, microscopic and molecular methods.
2. Published printed and online "Atlas of Human Blood Parasites" as diagnostic references for medical technicians and health care workers.
3. Organized two Malaria Microscopy Training Courses.
4. Conducted amoeba and toxoplasma diagnosis in high-risk populations.

#### **Mycotic Diseases Laboratory**

1. Conducted diagnostic assays and molecular epidemiology studies of fungal and nocardial pathogens, sexually-transmitted pathogens, and other pathogens, such as *Chlamydia pneumoniae*, *Chlamydia psittaci*, *Chlamydia trachomatis*, and *Mycoplasma pneumoniae* infections.
2. Identified the first case of *Candida auris* infection in Taiwan.
3. Carried out G-NICE (gonococci-National Isolate Collection for Epidemiology) for the surveillance of resistance trend and molecular epidemiology study on *Neisseria gonorrhoeae*. Identified an azithromycin resistant clone in Taiwan and two isolates resistant to third-generation cephalosporin were identified.

### Tuberculosis Research Center and Mycobacterial Disease Laboratory

1. Established a laboratory program for analyzing 171 bovine tuberculosis human cases in Taiwan and was invited to share results in the UNION annual conference.
2. Conducted surveillance of bedaquiline drug-resistance in multidrug-resistant *Mycobacterium tuberculosis* isolated during 2013-2018.
3. Provided detailed genetic analyses of RR/MDR/XDR *Mycobacterium tuberculosis* for personalized tuberculosis treatment and better outcomes.
4. Investigated whole genome sequencing technique for detecting drug-resistance and for delineating transmission routes in outbreak investigations.

### Vector Biology Laboratory

1. Conducted ectoparasite identification of rats on harbor-airport surveillance.
2. Performed data analysis of dengue vector surveillance weekly.
3. Conducted species identification of mosquitoes collected from malaria vector (*Anopheles minimus*) surveillance and harbor-airport mosquito surveillance.
4. Carried out virus detection on *Culex* vectors of Japanese encephalitis and *Aedes* vectors of dengue by request.

### Establishment and Application of a Pathogen Genome Sequence Database in Taiwan

Taiwan Pathogenic Microorganism Genome Database (TPMGD)-open version (<https://tpmgd.cdc.gov.tw>) is accessible to the general public online. Anyone can browse the website, download data from the website, or conduct a contrastive analysis over 33,000 pathogen sequence data and simple epidemiological information. In the contrastive analysis of database, several common bioinformatics tools are available online, such as primer3, blast and multiple sequence alignment by clustalW. Furthermore, WHO-recommended composition of influenza virus vaccine strains were updated over time.



# Manufacturing of Serum and Vaccines

## Accomplishments

Currently, Taiwan CDC is the only institute supplying snake venom serum. After years of efforts, the National Antivenom Hyperimmune Horse Farm was formally opened on October 20, 2018. It aims to raise immune horses and produce serum with quality materials, and improve the horses' welfare.



National Antivenom Hyperimmune Horse Farm Opening Ceremony, October 20, 2018

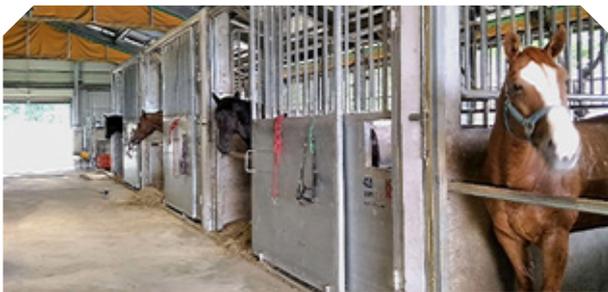
The Farm consists of six stables, four outdoor fields, two horse walkers, administrative areas, and professional cleanrooms. The facility is able to accommodate up to 100 horses. Management practices that are in line with international standards are adopted. Professional animal caretakers are stationed throughout the day. Additionally, veterinarians are hired to take care of the horses that contribute to the health of people in Taiwan.



Horse walker



Washing area



Environment in the stable



Outdoor field

## Production of Bio-Products

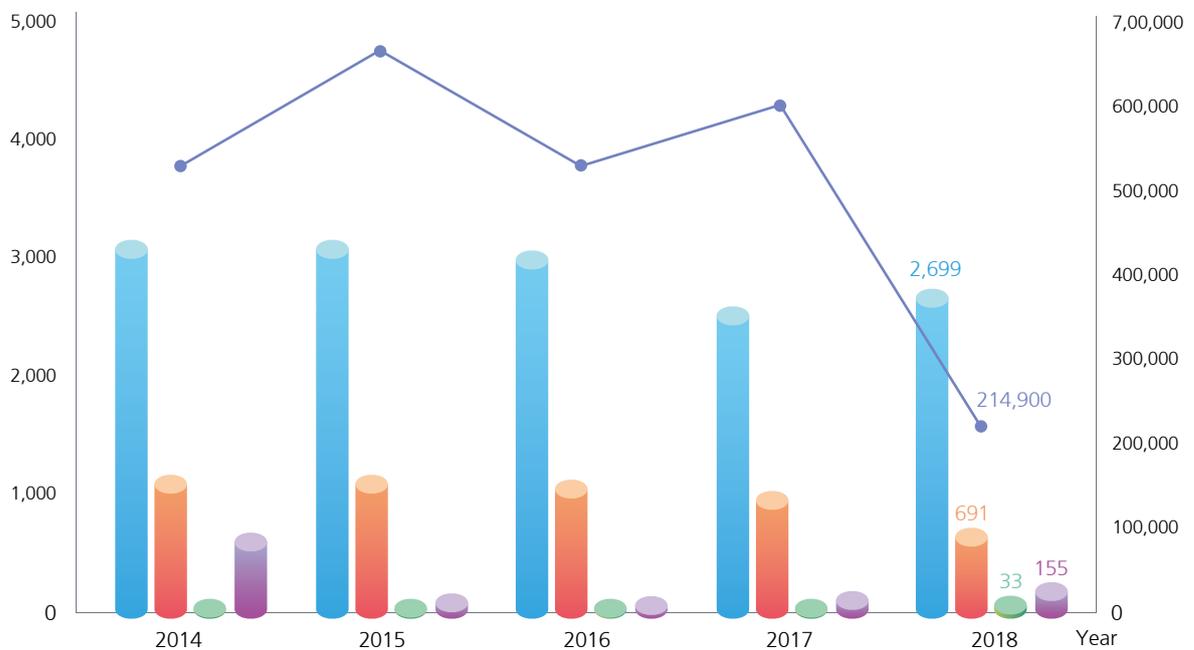
1. A total of 500 liters of antivenom immunoglobulins is separated from the blood of hyperimmunized horses in 2018.
2. A supply of 218,478 doses of vaccines and antivenoms was available in 2018 (Figure 5-1). Income from the sales of these biologics totaled about US\$ 2 million.

**Figure 5-1. Biologics Supplied by Taiwan CDC in 2014~2018**

■ Antivenin of *Tr. mucrosquamatus* and *Tr. gramineus* (Lyophilized)    ■ Antivenin of *B. multicinctus* and *N. naja atra* (Lyophilized)  
■ Antivenin of *D. russellii* (Lyophilized)    ■ Antivenin of *D. acutus* (Lyophilized)  
● Freeze-Dried BCG Vaccine

The does of antivenom

The does of BCG



## Contract manufacturing

In 2018, a total of 2,600 doses of antivenin were supplied by the contract acceptor, the bioproduction plant of National Health Research Institutes.



# Marketing and Publications

# Marketing and Publications

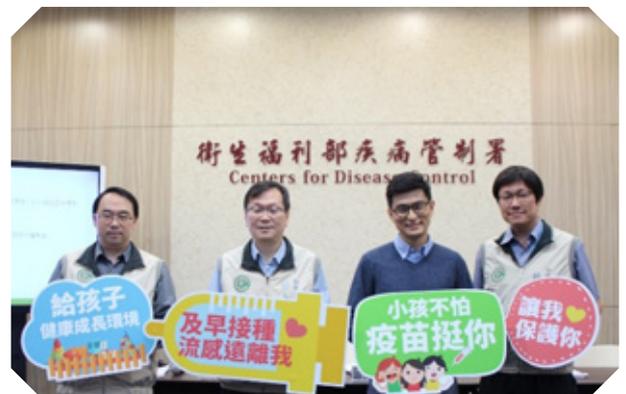
## Current Status

To improve public awareness about communicable diseases and related policies, as well as public support for Taiwan CDC's efforts, the agency has created a health marketing program. The program is aimed to promote disease prevention among the general public through a series of interactive events.



## Goals

To strengthen risk communication with the public, improve public awareness, and involve everyone in efforts against epidemics.



## Accomplishments

### 1. Media Monitoring and Timely Response

A news monitoring and alert mechanism was set in place to enhance communication of communicable disease control policies. In 2018, a total of 29,267 pieces of related news were reported in response to public concern over matters related to disease control. Competent authorities voluntarily held press conferences and issued press releases to keep the public informed and intensify policy communication. Moreover, 72 press conferences had been held, 237 press releases had been issued, and a total of 3,591 news reports had been made.



### 2. Integrated Marketing of Disease Prevention

Each year Taiwan CDC selects specific diseases to focus on. Through focusing on specific diseases, Taiwan CDC aims to spread key messages related to disease control and increase public health





Campaign for the 2018 World AIDS Day

awareness. In 2018, Taiwan CDC's major focuses were AIDS, seasonal influenza, tuberculosis, enterovirus, and novel influenza A virus infections.

(1) Press conferences: When announcing disease prevention measures and new communicable diseases, Taiwan CDC holds press conferences to improve awareness about major policies and achievements.



Press conference for promoting vaccination against influenza

To echo the World AIDS Day and its theme for 2018 "Live life positively-know your HIV status", Taiwan CDC held a campaign titled "Beat AIDS and be Healthy Together" on November 30 at the National Taiwan Museum, a renowned landmark in Taipei. Legislators who had paid keen attention to HIV/AIDS prevention and control, representatives from



Parents are urged to take their children to hospitals and clinics to receive influenza vaccination.

a commission on preventing AIDS and safeguarding rights of people with AIDS and NGOs as well as the well-known comedian group “Plungon” were invited to the event. Participants gathered and formed a large red ribbon to raise people’s health awareness and call for an open and friendly environment with no discrimination and encourage more people to seek HIV testing proactively.

Facing potential human health threats posed by influenza every year, Taiwan CDC always promotes measures for preventing influenza and the importance of vaccination through different channels before the influenza season begins. A total of three events were organized to help different groups of people to understand the benefits of influenza vaccination. A total of thirty press conferences were held to give updates on the outbreak along with press releases. Additionally, on Taiwan CDC’s 1922 Facebook fan page, we shared 86 educational posts and engaged celebrities in three Facebook Live videos to promote measures for preventing influenza.

- (2) Creative Promotional Materials: To promote disease prevention concepts, Taiwan CDC makes creative, stylish and useful promotional materials available online for use (see appendix).



### 3. Communicable Disease Reporting and Consultation Hotline: 1922

To provide a convenient channel for communicable disease reporting and consultation, Taiwan CDC has operated an easy-to-remember, toll-free hotline “1922” since 2003. By calling 1922, callers can access 24-hour case reporting service, communicable disease counseling service, prevention policy promotion and control measure education all year round.



In 2018, the 1922 hotline received 63,893 calls, made 41,940 referrals and 97% of the respondents said they were satisfied.

#### 4. Social Marketing Media

To reach different groups of target audience, Taiwan CDC is constantly looking for new marketing channels. In 2018, besides continuing to improve the existing marketing strategies via traditional channels such as print media and TV, Taiwan CDC also developed interactive digital marketing strategies.

Marketing channels include:

- (1) The Internet: The Internet's influence is far-reaching and powerful, and it has become an important marketing tool for Taiwan's media. Taiwan CDC also focused on the Internet as a marketing channel.
- (2) Featured Multimedia and Tools: Responding to Internet trends, Taiwan CDC uses popular online social media tools to promote healthy living and disease prevention. Taiwan CDC established an online disease prevention community on Facebook, LINE@, and Instagram. These sites promote communicable disease control and act as a bridge for Taiwan CDC to communicate with people over the Internet.



The Taiwan CDC 1922 Facebook fan page already has more than 107,353 fans. Besides daily epidemic information, the page offers lifestyle news such as weather reports along with epidemic prevention information, comics, and themed activities to interact with fans. Taiwan CDC also posted creative videos on YouTube which attracted more than 1.2 million views in 2018.

Taiwan CDC LINE@ issues at least two push notifications to share the latest information on disease prevention every week. Currently, some 78,789 Line users have added Taiwan CDC LINE@ as a friend. Additionally, Taiwan CDC launched LINE @ chatbot- the Disease Control Butler, an AI "chatbot" jointly developed by HTC Corp., on September 28, 2017. LINE @ chatbot- the Disease Control Butler, upon its launch, has been providing basic consultations on influenza vaccination. The Version 2.0 was launched on September 19, 2018. In addition to the existing consultations on vaccination, users now can also access information on epidemics

in more than 200 countries and seek consultations on a list of more than 90 newly added infectious diseases. For instance, information on preventive measures for dengue fever, symptoms of enterovirus infection, and locations of nearby healthcare institutions are available on the chatbot. Travelers can also access information on epidemics at the destinations, preventive measures, whether or not vaccination and medications are required, and the nearby healthcare institutions offering travel health services. The chatbot also reminds travelers 45 days prior to departure to take preventive measures and manage their health conditions after returning from overseas trips if dates of departure and arrival are set in advance.



Taiwan CDC LINE@ chatbot- the Disease Control Butler

LINE users can also use the chatbot to access phone consultations as well as ask information about contracted healthcare facilities for further consultations. The chatbot is responsive, significantly shortening the time required for people seeking consultations.

## 5. Correspondence Letters

To provide up-to-date information on communicable diseases, clinical treatments and disease prevention policies, Taiwan CDC sends special correspondence letters to the healthcare community. In 2018, Taiwan CDC sent out 24 medical correspondences and reached 9,135 regular subscribers.

## 6. Corporate Cooperation

Taiwan CDC cooperates with private companies and foundations that are also involved in disease prevention to maximize resource efficiency, creativity, and marketing opportunities and improve awareness of related issues.

To promote public awareness about influenza vaccination, Taiwan CDC has proactively cooperated with HTC Corp. and PX Mart Co., Ltd. to develop LINE @ chatbot- the Disease Control Butler and provide the public with convenient accesses to influenza vaccination. People were able to receive vaccination from 165PX Mart stores across Taiwan.

Taiwan CDC collaborated with the Benesse Corp. Taipei Branch to prevent and control enterovirus infection. The Benesse Corp. Taipei Branch made a special video featuring the Taiwan CDC mascot and the cartoon idol, "Shimajiro", who also visited kindergartens to teach children how to wash their hands and hosted an online video contest to combat enterovirus. The video was available for download.

Many people in Taiwan travel during summer vacations. To prevent people from contracting communicable diseases during their trips and create a safety net to combat epidemics, Taiwan CDC cooperated with Watsons, a health care and beauty care chain store, to urge people to prepare travel kits to protect against infectious diseases. Campaign materials for elevating public awareness were available at some 550 Watsons stores in Taiwan with staff pharmacists advising people about things that need to be considered before, during, and after a trip.

Corporates are encouraged to pay more attention to disease prevention and to cooperate with the government to prevent communicable diseases.



A press conference was held for the launch of LINE @ chatbot- the Disease Control Butler 2.0 on its one-year anniversary.



Press conference jointly held by Taiwan CDC and PX Mart Co., Ltd.



Taiwan CDC, TEDxDaanPark and the Rotary Club of Taipei Voyagers jointly urged the public to receive influenza vaccination at the TEDxGlobalDay event.



Taiwan CDC and the Benesse Corp. Taipei Branch jointly organized a press conference to prevent enterovirus infection.

## Future Prospects

Taiwan CDC will continue to promote disease prevention, develop new marketing channels, and improve risk communication concerning infectious disease to ensure the health and wellbeing of the people in Taiwan.

### Educational materials on Health and Sanitation:

CF

(<https://www.youtube.com/user/taiwandcd>)

Latent tuberculosis infection, Novel influenza A virus infections, and Enterovirus



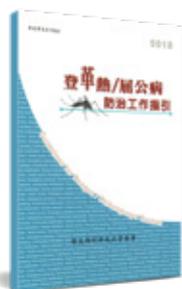
### Poster and Flyers

(<http://www.cdc.gov.tw>)

Influenza, AIDS, Novel influenza A virus infections, and Dengue fever



# 2019 Centers for Disease Control Annual Report Periodicals and Books



Guidelines for Dengue / Chikungunya Control (11E)



Taiwan Epidemiology Bulletin



CDC Annual Report



Infection Control Journal



Taiwan Tuberculosis Control Report 2017



Statistics of Communicable Diseases and Surveillance Report 2017 (English version)



Statistics of Communicable Diseases and Surveillance Report 2017 (Traditional Chinese version)



We All Deserve Respect

# 2019 Centers for Disease Control Annual Report

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