

Epidemiology and Prevention of Meningococcal Meningitis: The Role of Vaccines

Su-Hsing Chen^{*}, En-Tzu Wang, Wei-Ju Su, Jer-Jea Yen

Abstract

Meningococcal disease is caused by the bacterium *Neisseria meningitides*. Clinically, it often appears with acute severe complications such as meningitis, bacteremia and septicemia, and is likely to cause sequelae. The most effective method of prevention is vaccination. In recent years, with the wide use of vaccines, the incidence rate of the disease has dropped significantly.

The epidemic type varies in different regions, recently, serogroup B meningococcus has become the major pathogen among meningococcal meningitis in many countries. Therefore, new serogroup B vaccines (Bexsero[®] and Trumenba[®]) have played an important role in disease prevention.

Since 2006, the annual incidence of meningococcal meningitis in Taiwan has reduced to less than 0.1 case per 100,000 populations. Compared to countries in Europe and North America, Taiwan is a low incidence country. Although recently, most of meningococcal meningitis cases in Taiwan were identified as serogroup B, the number of cases was low and most were sporadic. Therefore, antibiotic treatment and prophylaxis are still the primary measures on disease prevention.

Keywords: Meningococcal meningitis, *Neisseria meningitides*, Serogroup B meningococcus vaccine

Measles Outbreak in a Duty Free Shop, Northern Taiwan, 2015

Wan-Ching Chen^{1*}, Hsiu-Yi Wu¹, Yu-Fang Tsai¹, Ying-Shih Su²,
Jiunn-Shyan Julian Wu¹, Wen-Yueh Cheng³, Jer-Jea Yen¹

Abstract

On May 12–16, 2015, Taiwan Centers for Disease Control received three reports of measles from different hospitals, all from patients working at the same duty free shop (DFS) in Northern Taiwan. Monitoring of all employees in this DFS until July 12 identified additional 16 case-patients. Seventeen of the 19 cases (ages 22–34 years) were measles PCR positive and the viruses were confirmed as Hunan genotype H1, but none of the 19 patients had travelled to China. Because Chinese tourists visit this DFS frequently, it is suspected that this outbreak is associated with cases brought in from China.

These patients were birth cohorts provided with measles, mumps, and rubella (MMR) vaccine in Taiwan, and vaccine protection against measles might have waned over time. Timely MMR vaccination is key to prevent ongoing transmission. We recommend that venues with large numbers of international visitors, such as tourist attractions, shops, and hotels should provide MMR vaccine to their employees to prevent infection and spread of measles.

Keywords: Measles, Genotype, Imported cases, Indigenous cluster

¹Taipei Regional Center, Taiwan Centers for Disease Control

²Office of Preventive Medicine, Taiwan Centers for Disease Control

³Center for Research, Diagnostics and Vaccine Development, Taiwan Centers for Disease Control

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Corresponding author : Wan-Ching Chen *

E-mail : MORABBIT@mohw.gov.tw

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Weekly Data of Notifiable Infectious Diseases (by week of diagnosis)

Classification	Case diagnosis week Disease Diagnosed ¹	Week 4		Week 1 – 4	
		2016	2015	2016	2015
Category I	Plague	0	0	0	0
	Rabies	0	0	0	0
	SARS	0	0	0	0
	Smallpox	0	0	0	0
Category II	Acute Flaccid Paralysis	0	0	1	1
	Acute Viral Hepatitis type A	13	4	27	10
	Amoebiasis	7	6	21	29
	Anthrax	0	0	0	0
	Chikungunya Fever	1	0	2	0
	Cholera	0	0	0	0
	Dengue Fever	31	14	426	105
	Diphtheria	0	0	0	0
	Enterohemorrhagic E. coli Infection	0	0	0	0
	Epidemic Typhus Fever	0	0	0	0
	Hantavirus Pulmonary Syndrome	0	0	0	0
	Hemorrhagic Fever with Renal Syndrome	0	0	0	0
	Malaria	0	0	2	2
	Measles	0	0	0	0
	Meningococcal Meningitis	0	0	0	0
	Paratyphoid Fever	0	0	0	3
	Poliomyelitis	0	0	0	0
	Rubella	1	1	1	1
	Shigellosis	3	16	11	31
Typhoid fever	0	0	1	3	
West Nile Fever	0	0	0	0	
Category III	Acute Viral Hepatitis type B	0	0	1	0
	Acute Viral Hepatitis type C ⁵	0	5	4	10
	Acute Viral Hepatitis type D	3	4	11	16
	Acute Viral Hepatitis type E	0	0	0	0
	Acute Viral Hepatitis untype	0	1	3	1
	Congenital Rubella Syndrome	0	0	0	0
	Enteroviruses Infection with Severe Complications	0	0	0	0
	Haemophilus Influenza type b Infection	0	0	1	0
	Japanese Encephalitis	0	0	0	1
	Legionellosis	0	0	0	0
	Mumps ²	1	0	9	19
	Neonatal Tetanus	10	15	52	54
	Pertussis	0	0	0	0
	Tetanus ²	0	3	1	22
Category IV	Botulism	0	0	0	0
	Brucellosis	0	1	0	1
	Complicated Influenza	0	0	0	0
	Complicated Varicella ⁴	47	13	120	32
	Endemic Typhus Fever	0	1	5	5
	Herpesvirus B Infection	0	0	2	0
	Invasive Pneumococcal Disease	0	0	0	0
	Leptospirosis	16	17	61	78
	Lyme Disease	2	1	3	10
	Melioidosis	0	0	0	0
	Q Fever	0	0	0	7
	Scrub Typhus	2	0	2	3
	Toxoplasmosis	19	9	57	66
	Tularremia	0	0	1	0
Category V	Ebola Virus Disease	0	0	0	0
	Ebola-Marburg Hemorrhagic Fever	0	0	0	0
	Novel Influenza A Virus Infections ⁶	0	0	0	0
	Lassa Fever	0	0	0	0
	Rift Valley Fever	0	0	0	0
	Middle East Respiratory Syndrome Coronavirus	0	0	0	0
Yellow Fever	0	0	0	0	

1. The following 8 chronic diseases are excluded from the table: MDR-TB, Tuberculosis, Syphilis, Gonorrhea, HIV Infection, AIDS, Hansen Disease and Creutzfeldt-Jakob Disease.
2. Reported cases.
3. Since 2014/1/1, "Varicella" was modified to "Complicated Varicella".
4. Since 2014/3/6, the case definition for confirmed Acute hepatitis C was changed from "meet the clinical and laboratory conditions" to "meet the clinical or laboratory conditions".
5. Since 2014/7/1, various subtypes of human cases of avian influenza are reported as "novel influenza A virus infections", a Category V Notifiable Infectious Disease. The original "H5N1 flu" and "H7N9 flu", which were respectively listed as a Category I Notifiable Infectious Disease and a Category V Notifiable Infectious Disease were removed from the list on the same day.

Suspected Clusters

- Twenty one clusters were reported, including 8 diarrhea clusters, 6 tuberculosis clusters, 6 upper respiratory tract infection clusters, and 1 varicella cluster.

Imported Infectious Diseases

- 16 confirmed cases were imported from 8 countries during Week 4 of 2016.

Country Disease	Indonesia	Cambodia	Malaysia	Vietnam	Philippines	Hong Kong	China	Thailand	Total
Dengue Fever	2		2	2	1			1	8
Hepatitis A	1	3							4
Rubella						1			1
Chikungunya Fever	1								1
Q Fever							1		1
Amoebiasis	1								1
Total	5	3	2	2	1	1	1	1	16

Note: The statistics listed in this table include imported cases that were either confirmed or updated* in the previous week.

- A total of 43 confirmed cases were imported from 13 countries in 2016.
- Top 3 imported diseases : Dengue fever (21), Amoebiasis (8), Malaria (2).
- Top 3 countries responsible for most imported cases : Indonesia (13), Philippines (6), Vietnam (6).

Summary of Epidemic

- **Dengue Fever** : Dengue activity has slowed down. The public is urged to clean up and remove any vector breeding sites. The epidemic has decreased in Kaohsiung City and the number of new cases reported during Week 4 is 60% less than that reported during Week 3. Clusters of cases have continued to be reported in Pingtung County.
- **Influenza** : Influenza activity has increased significantly. According to the past year surveillance data, the number of emergency visits for influenza-like illness will likely reach a peak following the upcoming Chinese Lunar New Year holiday. Since July 1, 2015, a cumulative total of 311 cases of severe complicated influenza have been confirmed. Among these cases, 43 died. H1N1 is currently the dominant strain circulating in the community. In terms of viral surveillance, some H1N1 isolates tested are considered as low reactors to the currently used influenza vaccine virus. Thus far, none of the viruses identified has shown drug resistance.

Weekly Data of Notifiable Infectious Diseases (by week of diagnosis)

Classification	Case diagnosis week Disease Diagnosed ¹	Week 5		Week 1–5	
		2016	2015	2016	2015
Category I	Plague	0	0	0	0
	Rabies	0	0	0	0
	SARS	0	0	0	0
	Smallpox	0	0	0	0
Category II	Acute Flaccid Paralysis	4	1	5	2
	Acute Viral Hepatitis type A	10	2	37	12
	Amoebiasis	8	11	29	40
	Anthrax	0	0	0	0
	Chikungunya Fever	0	1	2	1
	Cholera	0	0	0	0
	Dengue Fever	31	13	457	118
	Diphtheria	0	0	0	0
	Enterohemorrhagic E. coli Infection	0	0	0	0
	Epidemic Typhus Fever	0	0	0	0
	Hantavirus Pulmonary Syndrome	0	0	0	0
	Hemorrhagic Fever with Renal Syndrome	0	0	0	0
	Malaria	1	0	3	2
	Measles	0	0	0	0
	Meningococcal Meningitis	0	0	0	0
	Paratyphoid Fever	0	0	0	3
	Poliomyelitis	0	0	0	0
	Rubella	0	0	1	1
	Shigellosis	2	5	13	36
Typhoid fever	0	0	1	3	
West Nile Fever	0	0	0	0	
Category III	Acute Viral Hepatitis type B	2	1	6	11
	Acute Viral Hepatitis type C ⁵	3	4	14	20
	Acute Viral Hepatitis type D	0	0	0	0
	Acute Viral Hepatitis type E	1	0	4	1
	Acute Viral Hepatitis untype	0	0	0	0
	Congenital Rubella Syndrome	0	0	0	0
	Enteroviruses Infection with Severe Complications	0	0	1	0
	Haemophilus Influenza type b Infection	0	0	0	1
	Japanese Encephalitis	0	0	0	0
	Legionellosis	8	6	17	25
	Mumps ²	9	16	61	70
	Neonatal Tetanus	0	0	0	0
	Pertussis	0	3	1	25
	Tetanus ²	1	0	1	0
Category IV	Botulism	0	0	0	1
	Brucellosis	0	0	0	0
	Complicated Influenza	115	14	235	46
	Complicated Varicella ⁴	0	1	5	6
	Endemic Typhus Fever	0	0	2	0
	Herpesvirus B Infection	0	0	0	0
	Invasive Pneumococcal Disease	14	13	75	91
	Leptospirosis	1	0	4	10
	Lyme Disease	0	0	0	0
	Melioidosis	0	0	0	7
	Q Fever	1	0	3	3
	Scrub Typhus	6	7	63	73
	Toxoplasmosis	0	0	1	0
Tularremia	0	0	0	0	
Category V	Ebola Virus Disease	0	0	0	0
	Ebola-Marburg Hemorrhagic Fever	0	0	0	0
	Novel Influenza A Virus Infections ⁶	0	0	0	0
	Lassa Fever	0	0	0	0
	Rift Valley Fever	0	0	0	0
	Middle East Respiratory Syndrome Coronavirus Yellow Fever	0 0	0 0	0 0	0 0

1. The following 8 chronic diseases are excluded from the table: MDR-TB, Tuberculosis, Syphilis, Gonorrhoea, HIV Infection, AIDS, Hansen Disease and Creutzfeldt-Jakob Disease.
2. Reported cases.
3. Since 2014/1/1, "Varicella" was modified to "Complicated Varicella".
4. Since 2014/3/6, the case definition for confirmed Acute hepatitis C was changed from "meet the clinical and laboratory conditions" to "meet the clinical or laboratory conditions".
5. Since 2014/7/1, various subtypes of human cases of avian influenza are reported as "novel influenza A virus infections", a Category V Notifiable Infectious Disease. The original "H5N1 flu" and "H7N9 flu", which were respectively listed as a Category I Notifiable Infectious Disease and a Category V Notifiable Infectious Disease were removed from the list on the same day.

Suspected Clusters

- Twelve clusters were reported, including 5 diarrhea clusters, 4 upper respiratory tract infection clusters, 2 influenza-like illness clusters, and 1 tuberculosis cluster.

Imported Infectious Diseases

- 20 confirmed cases were imported from 9 countries during Week 5 of 2016.

Country \ Disease	Indonesia	Philippines	Thailand	Vietnam	Ghana	Singapore	Japan	Cambodia	Malaysia	Total
Dengue Fever	2	4	1	2		1			1	11
Hepatitis A	1		2				1	1		5
Amoebiasis	2									2
Malaria					1					1
Shigellosis	1									1
Total	6	4	3	2	1	1	1	1	1	20

Note: The statistics listed in this table include imported cases that were either confirmed or updated* in the previous week.

- A total of 64 confirmed cases were imported from 14 countries in 2016.
- Top 3 imported diseases : Dengue fever (35), Amoebiasis (10), Hepatitis A (6).
- Top 3 countries responsible for most imported cases : Indonesia (19), Philippines (10), Vietnam (8).

Summary of Epidemic

- **Influenza** : Influenza activity has increased significantly. The number of emergency visits for influenza-like illness will likely reach a peak coincided with the Chinese Lunar New Year holiday. Since July 1, 2015, a cumulative total of 419 cases of severe complicated influenza have been confirmed. Among these cases, 53 died. H1N1 is currently the dominant strain circulating in the community. Thus far, none of the viruses identified has shown drug resistance.

Weekly Data of Notifiable Infectious Diseases (by week of diagnosis)

Classification	Case diagnosis week Disease Diagnosed ¹	Week 6		Week 1–6	
		2016	2015	2016	2015
Category I	Plague	0	0	0	0
	Rabies	0	0	0	0
	SARS	0	0	0	0
	Smallpox	0	0	0	0
Category II	Acute Flaccid Paralysis	0	1	5	3
	Acute Viral Hepatitis type A	5	0	42	12
	Amoebiasis	1	6	30	46
	Anthrax	0	0	0	0
	Chikungunya Fever	0	0	2	1
	Cholera	0	0	0	0
	Dengue Fever	9	14	466	132
	Diphtheria	0	0	0	0
	Enterohemorrhagic E. coli Infection	0	0	0	0
	Epidemic Typhus Fever	0	0	0	0
	Hantavirus Pulmonary Syndrome	0	0	0	0
	Hemorrhagic Fever with Renal Syndrome	0	0	0	0
	Malaria	0	0	3	2
	Measles	0	0	0	0
	Meningococcal Meningitis	0	0	0	0
	Paratyphoid Fever	0	0	0	3
	Poliomyelitis	0	0	0	0
Rubella	0	0	1	1	
Shigellosis	3	5	16	41	
Typhoid fever	0	0	1	3	
West Nile Fever	0	0	0	0	
Category III	Acute Viral Hepatitis type B	2	4	8	15
	Acute Viral Hepatitis type C ⁵	0	5	14	25
	Acute Viral Hepatitis type D	0	0	0	0
	Acute Viral Hepatitis type E	0	0	4	1
	Acute Viral Hepatitis untype	0	0	0	0
	Congenital Rubella Syndrome	0	0	0	0
	Enteroviruses Infection with Severe Complications	0	1	1	1
	Haemophilus Influenza type b Infection	0	0	0	1
	Japanese Encephalitis	0	0	0	0
	Legionellosis	0	4	17	29
	Mumps ²	5	13	66	83
	Neonatal Tetanus	0	0	0	0
	Pertussis	0	2	1	27
	Tetanus ²	0	0	1	0
Category IV	Botulism	0	0	0	1
	Brucellosis	0	0	0	0
	Complicated Influenza	30	24	265	70
	Complicated Varicella ⁴	0	1	5	7
	Endemic Typhus Fever	0	0	2	0
	Herpesvirus B Infection	0	0	0	0
	Invasive Pneumococcal Disease	21	10	96	101
	Leptospirosis	2	1	6	11
	Lyme Disease	0	0	0	0
	Melioidosis	0	0	0	7
	Q Fever	0	0	3	3
	Scrub Typhus	1	9	64	82
	Toxoplasmosis	0	0	1	0
Tularremia	0	0	0	0	
Category V	Ebola Virus Disease	0	0	0	0
	Ebola-Marburg Hemorrhagic Fever	0	0	0	0
	Novel Influenza A Virus Infections ⁶	0	0	0	0
	Lassa Fever	0	0	0	0
	Rift Valley Fever	0	0	0	0
	Middle East Respiratory Syndrome Coronavirus	0	0	0	0
Yellow Fever	0	0	0	0	

1. The following 8 chronic diseases are excluded from the table: MDR-TB, Tuberculosis, Syphilis, Gonorrhoea, HIV Infection, AIDS, Hansen Disease and Creutzfeldt-Jakob Disease.
2. Reported cases.
3. Since 2014/1/1, "Varicella" was modified to "Complicated Varicella".
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5. Since 2014/7/1, various subtypes of human cases of avian influenza are reported as "novel influenza A virus infections", a Category V Notifiable Infectious Disease. The original "H5N1 flu" and "H7N9 flu", which were respectively listed as a Category I Notifiable Infectious Disease and a Category V Notifiable Infectious Disease were removed from the list on the same day.

Suspected Clusters

- Fourteen clusters were reported, including 11 diarrhea clusters, 2 tuberculosis clusters, and 1 upper respiratory tract infection cluster.

Imported Infectious Diseases

- 12 confirmed cases were imported from 7 countries during Week 6 of 2016.

Country Disease	Indonesia	Vietnam	Malaysia	Japan	Singapore	Myanmar	Philippines	Total
Dengue Fever	4	2	2		1	1	1	11
FluSC				1				1
Total	4	2	2	1	1	1	1	12

Note: The statistics listed in this table include imported cases that were either confirmed or updated* in the previous week.

- A total of 76 confirmed cases were imported from 15 countries in 2016.
- Top 3 imported diseases : Dengue fever (46), Amoebiasis (10), Hepatitis A (6).
- Top 3 countries responsible for most imported cases : Indonesia (23), Philippines (11), Vietnam (10).

Summary of Epidemic

- **Influenza** : The influenza activity was high. During week 6, which coincided with the Chinese Lunar New Year holiday, the number of emergency visits for influenza-like illness was reach a peak, and approximately 10,000 patients visit ER on February 9. Since July 1, 2015, a cumulative total of 452 cases of severe complicated influenza have been confirmed. Among these cases, 55 died. H1N1 is currently the dominant strain circulating in the community. Thus far, none of the viruses identified has shown drug resistance.
- **Zika Virus Infection** : According to the recent evidence, there have been reports of congenital microcephaly in babies were associated with mothers who were infected with Zika virus while pregnant. On February 2, 2016, the World Health Organization (WHO) declared the Zika virus infection a Public Health Emergency of International Concern (PHEIC).Taiwan CDC advises pregnant women to postpone their trips to areas affected by Zika virus. Travelers visiting affected areas are urged to take precautions against mosquito bites and use condoms for at least 28 days after returning from Zika-affected areas.

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