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Original Article

Status of Laboratory Diagnosis on Tuberculosis, Taiwan, 2015

Wan-Hsuan Lin, Chuan-Hsu Wang, Ruwen Jou*

Abstract

Tuberculosis (TB) has the highest annual mortality and incidence among the National Notifiable Communicable Diseases in Taiwan. Timely diagnosis, proper treatment and effective public health management are essential components for TB control. Taiwan Centers for Diseases Control (Taiwan CDC) implemented the "Mobilization Plan to Halve Tuberculosis Incidence in Ten Years". The incidence of new TB cases has declined from 72.5 to 45.7 per 100,000 populations from 2005 to 2015. Approximately 40% of the annual new cases' sputum smear was positive for TB and 80% of that has bacteriological evidence. The laboratory service for TB diagnosis is organized in a 3-tiered infrastructure: the Taiwan CDC reference laboratory, accredited laboratories, and primary laboratories. Taiwan CDC implemented an authorization policy and 33 clinical laboratories were accredited in 2015. Of the 33 laboratories, 31 and 26 laboratories provide drug susceptibility testing and molecular testing, respectively. Based on a questionnaire survey conducted at hospitals above the regional level in 2015, 7 Taiwan CDC contracted TB laboratories examined approximately 30% of all specimens. Furthermore, by monitoring external quality indicators, conducting training, carrying out on-site visits, implementing internal quality control and self-management in clinical laboratories, the laboratory service system has made great progress and can serve as cornerstone for future TB elimination.

Keywords: Tuberculosis, Mycobacterial laboratory examination, Accredited laboratory, Quality management indicators

Center for Diagnostics and Vaccine Development Centers for Disease Control, Ministry of Health and Welfare, Taiwan
Corresponding author: Ruwen Jou*
E-mail: rwj@cdc.gov.tw
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Epidemiology and Molecular Diagnosis of Leprosy, Taiwan, 2002–2016

Wei-Lun Huang*, Ruwen Jou

Abstract

The World Conference on Leprosy, held in 2016, reaffirmed the importance of stopping transmission, preventing disability, and detecting cases early in eradicating the disease. In Taiwan, leprosy is rare and the prevalence rate has reached the eradication criteria. Among the 133 confirmed cases in 2002–2016, 79(59.4%) were female, with 61(72.6%) imported, and the proportion of imported female cases was significant higher than that of the indigenous female cases ($p < 0.0001$). Since *M.leprae* cannot be cultured i*n vitro*, bacilli should be inoculated in BALB/c mouse's foot pads. For drug resistance testing, quantitative bacilli are inoculated within a foot pad, and the mice were fed with drug-containing food for 30 weeks. After that, the mice were sacrificed, and the amounts of bacteria were calculated. In order to improve the effectiveness of laboratory diagnosis, we establish an algorithm with molecular tests to identify *M.leprae* and its drug resistance since 2013. During 2013– 2016, of the 47 suspected cases, 27(57.4%) cases were analyzed using the molecular tests. The sensitivity, specificity, positive predictive value, negative predictive value and accuracy were 95.2%, 100%, 100%, 85.7% and 96.3%, respectively. The laboratory tests can strengthen the disease control and management.

Keywords: Leprosy, *Mycobacterium leprae*, Molecular diagnosis, Drug-resistance analysis

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Corresponding author: Wei-Lun Huang*
E-mail: hwl@cdc.gov.tw
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Weekly Data of Notifiable Infectious Diseases（by week of diagnosis）

Case diagnosis year		Week 39★		Week 1-39			
				2017		2016	
Classification	Disease Diagnosed	2017	2016	Total cases★	Imported cases	Total cases★	Imported cases
Category I	Plague	0	0	0	0	0	0
	Rabies	0	0	0	0	0	0
	SARS	0	0	0	0	0	0
	Smallpox	0	0	0	0	0	0
Category II	Acute Flaccid Paralysis	0	2	25	0	31	0
	Acute Viral Hepatitis type A	3	18	339	43	849	70
	Amoebiasis	9	10	277	146	233	118
	Anthrax	0	0	0	0	0	0
	Chikungunya Fever	1	0	11	11	8	8
	Cholera	1	0	1	0	7	0
	Dengue Fever	10	3	246	241	708	268
	Diphtheria	0	0	0	0	0	0
	Enterohemorrhagic E. coli Infection	0	0	0	0	0	0
	Epidemic Typhus Fever	0	0	0	0	0	0
	Hantavirus Pulmonary Syndrome	0	0	0	0	0	0
	Hemorrhagic Fever with Renal Syndrome	0	0	1	0	3	0
	Malaria	1	0	7	6	10	10
	Measles	0	0	5	5	13	7
	Meningococcal Meningitis	0	1	11	0	4	0
	Paratyphoid Fever	0	0	4	3	5	2
	Poliomyelitis	0	0	0	0	0	0
	Rubella	0	0	3	2	4	3
	Shigellosis	1	5	127	46	159	79
	Typhoid fever	0	1	16	14	4	2
	West Nile Fever	0	0	0	0	0	0
Category III	Acute Viral Hepatitis type B	2	1	120	6	77	2
	Acute Viral Hepatitis type C	3	5	219	1	162	2
	Acute Viral Hepatitis type D	0	0	1	0	1	0
	Acute Viral Hepatitis type E	0	0	13	3	13	4
	Acute Viral Hepatitis untype	0	0	0	0	0	0
	Congential Rubella Syndrome	0	0	0	0	0	0
	Enteroviruses Infection with Severe Complications	0	0	9	0	22	0
	Haemophilus Influenza type b Infection	0	0	4	0	13	0
	Japanese Encephalitis	0	1	23	0	19	0
	Legionellosis	3	3	120	12	81	1
	Mumps	16	15	503	8	452	7
	Neonatal Tetanus	0	0	0	0	0	0
	Pertussis	0	0	28	0	16	0
	Tetanus	0	0	8	0	9	0
Category IV	Botulism	0	0	0	0	5	0
	Brucellosis	0	0	0	0	0	0
	Complicated Influenza	13	6	1250	5	1875	2
	Complicated Varicella	1	0	22	1	31	0
	Endemic Typhus Fever	0	0	33	1	13	0
	Herpesvirus B Infection	0	0	0	0	0	0
	Invasive Pneumococcal Disease	7	7	358	2	443	0
	Leptospirosis	0	6	71	1	80	2
	Lyme Disease	0	1	0	0	2	2
	Melioidosis	1	3	21	0	23	1
	Q Fever	0	2	14	0	40	3
	Scrub Typhus	12	7	337	0	341	3
	Toxoplasmosis	1	0	15	0	8	0
	Tularremia	0	0	0	0	0	0
Category V	Ebola Virus Disease	0	0	0	0	0	0
	Marburg Hemorrhagic Fever	0	0	0	0	0	0
	Novel Influenza A Virus Infections	0	0	1	1	0	0
	Lassa Fever	0	0	0	0	0	0
	Rift Valley Fever	0	0	0	0	0	0
	Middle East Respiratory Syndrome Coronavirus	0	0	0	0	0	0
	Yellow Fever	0	0	0	0	0	0
	Zika Virus Infection	0	1	4	4	9	9

1. ★The weekly and cumulative total numbers include indigenous and imported cases of notifiable infectious diseases.
2. The following 8 chronic diseases are excluded from the table: MDR-TB, Tuberculosis, Syphilis, Gonorrhea, HIV Infection, AIDS, Hansen Disease and Creutzfeldt-Jakob Disease.
3. Numbers of mumps and tetanus cases are summed up by the week of report.
4. Since 2016/1/22, "Zika Virus Infection" was listed as a Notifiable Infectious Disease.

Suspected Clusters

●Thirty-five clusters were reported, including 10 tuberculosis clusters, 13 diarrhea clusters, 1 upper respiratory tract infection clusters, 5 influenza-like illness clusters, 3 enterovirus clusters and 3 varicella cluster.

Imported Infectious Diseases

●17 confirmed cases were imported from 8 countries during Week 39 of 2017.

Country / Disease	Indonesia	Philippines	Vietnam	India	Thailand	Malaysia	Myanmar	Singapore	Total
DF		1	3		1	1	1	1	8
Amoebiasis	3	1							4
Hepatitis A				1	1				2
Typhoid fever				1					1
Chikungunya Fever		1							1
Shigellosis	1								1
Total	4	3	3	2	2	1	1	1	17

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

●A total of 554 confirmed cases were imported from 30 countries in 2017.

●Top 3 imported diseases：Dengue fever (241), Amoebiasis (146), Shigellosis (46).

●Top 3 countries responsible for most imported cases：Indonesia (187), Vietnam (88), Philippines (71).

Summary of Epidemic

●**Enterovirus**：The enterovirus epidemic season has begun. Most reported cases experience mild symptoms. EV71 virus is still circulating in the community.

●**Scrub Typhus**：The scrub typhus epidemic season has begun. The high risk areas include Hualien County, Taitung County, Kinmen County and Penghu County.

●**Dengue Fever**：The epidemic has continuously increased in Southeast Asian countries. Recently, an indigenous dengue fever cluster was confirmed in northern Taiwan. As the temperature has remained high and rain has continued to occur, the risk of imported and indigenous epidemics remains elevated.

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

Case diagnosis year		Week 40★		Week 1-40			
				2017		2016	
Classification	Disease Diagnosed	2017	2016	Total cases★	Imported cases	Total cases★	Imported cases
Category I	Plague	0	0	0	0	0	0
	Rabies	0	0	0	0	0	0
	SARS	0	0	0	0	0	0
	Smallpox	0	0	0	0	0	0
Category II	Acute Flaccid Paralysis	1	1	26	0	32	0
	Acute Viral Hepatitis type A	1	23	340	43	872	71
	Amoebiasis	7	10	284	151	243	123
	Anthrax	0	0	0	0	0	0
	Chikungunya Fever	0	0	11	11	8	8
	Cholera	0	1	1	0	8	0
	Dengue Fever	11	10	257	250	718	278
	Diphtheria	0	0	0	0	0	0
	Enterohemorrhagic E. coli Infection	0	0	0	0	0	0
	Epidemic Typhus Fever	0	0	0	0	0	0
	Hantavirus Pulmonary Syndrome	0	0	0	0	0	0
	Hemorrhagic Fever with Renal Syndrome	0	0	1	0	3	0
	Malaria	0	0	7	7	10	10
	Measles	0	0	5	5	13	7
	Meningococcal Meningitis	0	1	11	0	5	0
	Paratyphoid Fever	0	0	4	3	5	2
	Poliomyelitis	0	0	0	0	0	0
	Rubella	0	0	3	2	4	3
	Shigellosis	0	1	127	46	160	79
	Typhoid fever	0	0	16	14	4	2
	West Nile Fever	0	0	0	0	0	0
Category III	Acute Viral Hepatitis type B	2	2	121	7	79	2
	Acute Viral Hepatitis type C	8	2	227	1	164	2
	Acute Viral Hepatitis type D	0	0	1	0	1	0
	Acute Viral Hepatitis type E	0	1	13	3	14	5
	Acute Viral Hepatitis untype	0	0	0	0	0	0
	Congential Rubella Syndrome	1	0	1	1	0	0
	Enteroviruses Infection with Severe Complications	0	1	9	0	23	0
	Haemophilus Influenza type b Infection	1	0	5	0	13	0
	Japanese Encephalitis	0	1	23	0	20	0
	Legionellosis	2	0	122	12	81	1
	Mumps	11	14	514	8	466	7
	Neonatal Tetanus	0	0	0	0	0	0
	Pertussis	1	0	29	0	16	0
	Tetanus	0	0	8	0	9	0
Category IV	Botulism	0	0	0	0	5	0
	Brucellosis	0	0	0	0	0	0
	Complicated Influenza	4	4	1254	5	1879	2
	Complicated Varicella	0	0	22	1	31	0
	Endemic Typhus Fever	0	0	33	1	13	0
	Herpesvirus B Infection	0	0	0	0	0	0
	Invasive Pneumococcal Disease	5	10	363	2	453	0
	Leptospirosis	3	0	74	1	80	2
	Lyme Disease	1	0	1	1	2	2
	Melioidosis	0	4	21	0	27	1
	Q Fever	0	0	14	0	40	3
	Scrub Typhus	6	9	343	0	350	3
	Toxoplasmosis	0	0	15	0	8	0
	Tularremia	0	0	0	0	0	0
Category V	Ebola Virus Disease	0	0	0	0	0	0
	Marburg Hemorrhagic Fever	0	0	0	0	0	0
	Novel Influenza A Virus Infections	0	0	1	1	0	0
	Lassa Fever	0	0	0	0	0	0
	Rift Valley Fever	0	0	0	0	0	0
	Middle East Respiratory Syndrome Coronavirus	0	0	0	0	0	0
	Yellow Fever	0	0	0	0	0	0
	Zika Virus Infection	0	0	4	4	9	9

1. ★The weekly and cumulative total numbers include indigenous and imported cases of notifiable infectious diseases.
2. The following 8 chronic diseases are excluded from the table: MDR-TB, Tuberculosis, Syphilis, Gonorrhea, HIV Infection, AIDS, Hansen Disease and Creutzfeldt-Jakob Disease.
3. Numbers of mumps and tetanus cases are summed up by the week of report.
4. Since 2016/1/22, "Zika Virus Infection" was listed as a Notifiable Infectious Disease.

Suspected Clusters

●Twenty-three clusters were reported, including 7 tuberculosis clusters, 11 diarrhea clusters, 3 upper respiratory tract infection clusters and 2 influenza-like illness clusters.

Imported Infectious Diseases

●18 confirmed cases were imported from 7 countries during Week 40 of 2017.

Country / Disease	Thailand	Indonesia	Myanmar	South Africa	Unknown	Hungary	Philippines	Vietnam	Total
DF	4		4				1		9
Amoebiasis		5							5
CRS					1				1
Lyme Disease						1			1
Malaria				1					1
Hepatitis B								1	1
Total	4	5	4	1	1	1	1	1	18

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

●A total of 572 confirmed cases were imported from 32 countries in 2017.

●Top 3 imported diseases：Dengue fever (250), Amoebiasis (151), Shigellosis (46).

●Top 3 countries responsible for most imported cases：Indonesia (192), Vietnam (89), Philippines (72).

Summary of Epidemic

●**Enterovirus**：The enterovirus epidemic season has begun. Most reported cases experience mild symptoms. EV71 virus is still circulating in the community.

●**Scrub Typhus**：The scrub typhus epidemic season has begun. The high risk areas include Hualien County, Taitung County, Kaohsiung City, Kinmen County and Penghu County.

●**Dengue Fever**：The epidemic has continuously increased in Southeast Asian countries. New indigenous dengue cases related to the previously reported cluster were confirmed in northern Taiwan. As it is still the vector mosquito season, the risk of imported and indigenous epidemics remains elevated.

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

Case diagnosis year		Week 41★		Week 1-41			
				2017		2016	
Classification	Disease Diagnosed	2017	2016	Total cases★	Imported cases	Total cases★	Imported cases
Category I	Plague	0	0	0	0	0	0
	Rabies	0	0	0	0	0	0
	SARS	0	0	0	0	0	0
	Smallpox	0	0	0	0	0	0
Category II	Acute Flaccid Paralysis	0	0	26	0	32	0
	Acute Viral Hepatitis type A	2	21	342	44	893	71
	Amoebiasis	1	9	285	153	252	128
	Anthrax	0	0	0	0	0	0
	Chikungunya Fever	0	0	11	11	8	8
	Cholera	0	0	1	0	8	0
	Dengue Fever	13	6	270	261	724	284
	Diphtheria	0	0	0	0	0	0
	Enterohemorrhagic E. coli Infection	0	0	0	0	0	0
	Epidemic Typhus Fever	0	0	0	0	0	0
	Hantavirus Pulmonary Syndrome	0	0	0	0	0	0
	Hemorrhagic Fever with Renal Syndrome	0	0	1	0	3	0
	Malaria	0	1	7	7	11	11
	Measles	0	0	5	5	13	7
	Meningococcal Meningitis	0	0	11	0	5	0
	Paratyphoid Fever	1	0	5	3	5	2
	Poliomyelitis	0	0	0	0	0	0
	Rubella	0	0	3	2	4	3
	Shigellosis	4	8	131	46	168	85
	Typhoid fever	0	0	16	14	4	2
	West Nile Fever	0	0	0	0	0	0
Category III	Acute Viral Hepatitis type B	1	8	122	7	87	4
	Acute Viral Hepatitis type C	9	1	235	1	165	2
	Acute Viral Hepatitis type D	0	0	1	0	1	0
	Acute Viral Hepatitis type E	0	0	13	3	14	5
	Acute Viral Hepatitis untype	0	0	0	0	0	0
	Congential Rubella Syndrome	0	0	1	1	0	0
	Enteroviruses Infection with Severe Complications	0	0	9	0	23	0
	Haemophilus Influenza type b Infection	0	0	5	0	13	0
	Japanese Encephalitis	1	3	24	0	23	0
	Legionellosis	2	3	124	12	84	1
	Mumps	9	11	523	8	477	7
	Neonatal Tetanus	0	0	0	0	0	0
	Pertussis	0	1	29	0	17	0
	Tetanus	0	0	8	0	9	0
Category IV	Botulism	0	0	0	0	5	0
	Brucellosis	0	0	0	0	0	0
	Complicated Influenza	6	4	1260	5	1883	2
	Complicated Varicella	0	0	22	1	31	0
	Endemic Typhus Fever	0	0	33	1	13	0
	Herpesvirus B Infection	0	0	0	0	0	0
	Invasive Pneumococcal Disease	4	8	367	4	461	0
	Leptospirosis	2	3	76	1	83	2
	Lyme Disease	0	0	1	1	2	2
	Melioidosis	0	6	21	0	33	1
	Q Fever	0	0	14	0	40	3
	Scrub Typhus	7	9	350	0	359	3
	Toxoplasmosis	1	0	16	0	8	0
	Tularremia	0	0	0	0	0	0
Category V	Ebola Virus Disease	0	0	0	0	0	0
	Marburg Hemorrhagic Fever	0	0	0	0	0	0
	Novel Influenza A Virus Infections	0	0	1	1	0	0
	Lassa Fever	0	0	0	0	0	0
	Rift Valley Fever	0	0	0	0	0	0
	Middle East Respiratory Syndrome Coronavirus	0	0	0	0	0	0
	Yellow Fever	0	0	0	0	0	0
	Zika Virus Infection	0	3	4	4	12	12

1. ★The weekly and cumulative total numbers include indigenous and imported cases of notifiable infectious diseases.
2. The following 8 chronic diseases are excluded from the table: MDR-TB, Tuberculosis, Syphilis, Gonorrhea, HIV Infection, AIDS, Hansen Disease and Creutzfeldt-Jakob Disease.
3. Numbers of mumps and tetanus cases are summed up by the week of report.
4. Since 2016/1/22, "Zika Virus Infection" was listed as a Notifiable Infectious Disease.

Suspected Clusters

●Fifteen clusters were reported, including 4 tuberculosis clusters, 9 diarrhea clusters and 2 varicella clusters.

Imported Infectious Diseases

●16 confirmed cases were imported from 9 countries during Week 41 of 2017.

Country / Disease	Vietnam	Philippines	Myanmar	China	Colombia	Bangladesh	Indonesia	Thailand	Germany	Total
DF	4	3	2			1		1		11
IPD				1					1	2
Amoebiasis					1		1			2
Hepatitis A								1		1
Total	4	3	2	1	1	1	1	2	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 588 confirmed cases were imported from 34 countries in 2017.

●Top 3 imported diseases：Dengue fever (261), Amoebiasis (153), Shigellosis (46).

●Top 3 countries responsible for most imported cases：Indonesia (193), Vietnam (94), Philippines (75).

Summary of Epidemic

●**Enterovirus**：The enterovirus epidemic season has begun. Most reported cases experience mild symptoms. EV71 virus is still circulating in the community.

●**Scrub Typhus**：The scrub typhus epidemic season has begun. The high risk areas include Hualien County, Taitung County, Kaohsiung City, Kinmen County and Penghu County.

●**Dengue Fever**：The epidemic has continuously increased in Southeast Asian countries. New indigenous dengue cases related to previously cluster in New Taipei City were confirmed. As the influence of the recent typhoon will bring abundant rainfall that will lead to the accumulation of standing rain water in containers and facilitate the breeding of vector mosquitoes, the risk of imported and indigenous epidemics remains elevated.

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