

### Serosurveillance on Poultry-Related Workers at Highly Pathogenic Avian Influenza-Infected Farms/Slaughterhouse in Taiwan, 2017

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#### Abstract

In order to investigate the extent and risk factors of avian-to-human transmission by highly-pathogenic avian influenza (HPAI) viruses, we conducted a nation-wide serological survey targeting poultry workers who exposed to HPAI in poultry farms and slaughterhouses outbreaks in 2017.

A retrospective survey was conducted between January and April 2018. Trained interviewers surveyed the poultry workers with a questionnaire and collected their blood samples. A H5N8 virus strain A/goose/Taiwan/01003/2015 was selected as the representative antigen, and hemagglutination inhibition (HI) assay was used to analyze serum samples. Presence of acute respiratory symptoms within 10 days after the last poultry exposure was also recorded by local health authorities.

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A total of 241 participants were enrolled and the majority were poultry farm (27.4%) or slaughterhouse (22%) workers. The mean age was 44.8 years, and 63.5% were male. Masks (88.4%) and gloves (85.9%) were the most commonly used personal protective equipment (PPE) at work. None of them had acute respiratory symptoms during the follow-up period. Six (2.5%), 85(35.3%) and 150 (62.2%) had HI titer of 1:40, 1:20 and  $\leq 1:10$ , respectively. Workers with HI titer of 1:40 were less likely to wear masks at work ( $p = 0.02$ ).

We conclude that the risk of avian-to-human infection of HPAI among poultry workers in Taiwan were low in 2017. Adherence to proper PPE use at work and annual seasonal influenza vaccination should be encouraged to minimize the risk of infection. Routine seroepidemiological survey among high-risk groups is of optimal importance.

**Keywords:** Avian influenza, poultry-related workers, seroepidemiological survey

week 33–35( Aug. 15–Sep. 4, 2021)

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

Case diagnosis year		Week 33★		Week 1-33			
Classification	Disease Diagnosed	2021	2020	2021		2020	
				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	0	20	0	18	0
	Acute Viral Hepatitis type A	2	1	46	0	53	7
	Amoebiasis	7	3	126	46	153	91
	Anthrax	0	0	0	0	0	0
	Chikungunya Fever	0	0	1	1	3	3
	Cholera	0	0	0	0	0	0
	Dengue Fever	1	0	6	6	76	62
	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	9	0	8	0
	Malaria	0	0	1	1	1	1
	Measles	0	0	0	0	2	2
	Meningococcal Meningitis	0	0	2	0	5	0
	Paratyphoid Fever	0	0	2	0	0	0
	Poliomyelitis	0	0	0	0	0	0
	Rubella	0	0	0	0	0	0
Shigellosis	3	5	88	0	101	21	
Typhoid fever	0	0	1	0	5	3	
West Nile Fever	0	0	0	0	0	0	
Zika virus infection	0	0	0	0	2	2	
Category III	Acute Viral Hepatitis type B	3	2	95	2	60	2
	Acute Viral Hepatitis type C	10	9	370	0	399	4
	Acute Viral Hepatitis type D	0	0	0	0	0	0
	Acute Viral Hepatitis type E	0	0	5	0	7	0
	Congenital Syphilis	0	0	0	0	0	0
	Congenital Rubella Syndrome	0	0	0	0	0	0
	Enteroviruses Infection with Severe Complications	0	0	1	0	7	0
	Haemophilus Influenza type b Infection	0	0	1	0	3	0
	Japanese Encephalitis	4	1	24	0	21	0
	Legionnaires' Disease	12	5	226	0	169	8
	Mumps	15	11	280	1	306	6
	Neonatal Tetanus	0	0	0	0	0	0
Pertussis	0	0	0	0	8	0	
Tetanus	0	0	3	0	7	0	
Category IV	Botulism	0	0	0	0	1	0
	Brucellosis	0	0	0	0	0	0
	Complicated Varicella	0	0	33	0	30	0
	Endemic Typhus Fever	0	1	24	0	13	0
	Herpesvirus B Infection	0	0	0	0	0	0
	Influenza Case with Severe Complications	0	0	1	0	548	6
	Invasive Pneumococcal Disease	2	2	154	0	167	0
	Leptospirosis	1	1	30	0	33	0
	Listeriosis	5	1	117	0	91	0
	Lyme Disease	0	0	0	0	0	0
	Melioidosis	0	0	10	0	9	1
	Q Fever	0	0	8	0	12	0
	Scrub Typhus	6	24	167	0	254	1
Toxoplasmosis	1	0	10	0	5	0	
Tularemia	0	0	0	0	0	0	
Category V	Ebola Virus Disease	0	0	0	0	0	0
	Lassa Fever	0	0	0	0	0	0
	Marburg Hemorrhagic Fever	0	0	0	0	0	0
	Middle East Respiratory Syndrome	0	0	0	0	0	0
	Coronavirus Infections	0	0	0	0	0	0
	Novel Influenza A Virus Infections	0	0	1	0	0	0
	Rift Valley Fever	0	0	0	0	0	0
Severe Pneumonia with Novel Pathogens	74	3	15118	672	482	427	
Yellow Fever	0	0	0	0	0	0	

- ★The weekly and cumulative total numbers include indigenous and imported cases of notifiable infectious diseases.
- MDR-TB, Tuberculosis, Syphilis, Gonorrhoea, HIV Infection, AIDS, Hansen's Disease and Creutzfeldt-Jakob Disease are excluded from the table.
- Numbers of mumps and tetanus cases are summed up by the week of report.
- Since 2020/1/15, "Severe Pneumonia with Novel Pathogens" was listed as a Notifiable Infectious Disease.

## Suspected Clusters

- Thirteen clusters related to tuberculosis (9) and diarrhea (4) were reported during week 33.

## Imported Infectious Diseases

- There were 13 imported cases from 6 countries during week 30.
- There were 27 imported cases from 15 countries during week 33.

**Severe Pneumonia with Novel Pathogens** : 25 (USA 4, Indonesia 3, India 3, South Africa 2, UAE 2, Japan 2, Vietnam 1, France 1, Lithuania 1, Albania 1, Iran 1, Romania 1, UK 1, Bangladesh 1, Germany 1 ).

**Amoebiasis** : 1 ( Indonesia 1 ).

**Dengue Fever** : 1 ( Vietnam 1 ).

- During week 1-33, there were 729 imported cases from 66 countries. The top three countries are the Philippines (168), Indonesia (156), and USA (90).
- During week 1-33, the three notifiable diseases with the highest number of imported cases are Severe Pneumonia with Novel Pathogens (672), Amoebiasis (46), and Dengue Fever (6).

## Summary of Epidemic

- **Severe Pneumonia with Novel Pathogens** : The epidemic continues in the low level.
- **Japanese Encephalitis** : Taiwan is in the midst of Japanese Encephalitis season. Individuals living in all counties/cities in Taiwan are at risk of infection.

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

Case diagnosis year		Week 34★		Week 1-34			
Classification	Disease Diagnosed	2021	2020	2021		2020	
				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	2	0	22	0	18	0
	Acute Viral Hepatitis type A	1	2	47	0	55	7
	Amoebiasis	9	6	135	49	159	93
	Anthrax	0	0	0	0	0	0
	Chikungunya Fever	0	0	1	1	3	3
	Cholera	0	0	0	0	0	0
	Dengue Fever	1	1	7	7	77	63
	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	9	0	8	0
	Malaria	0	0	1	1	1	1
	Measles	0	0	0	0	2	2
	Meningococcal Meningitis	0	0	2	0	5	0
	Paratyphoid Fever	0	0	2	0	0	0
	Poliomyelitis	0	0	0	0	0	0
Rubella	0	0	0	0	0	0	
Shigellosis	3	1	91	0	102	21	
Typhoid fever	0	0	1	0	5	3	
West Nile Fever	0	0	0	0	0	0	
Zika virus infection	0	0	0	0	2	2	
Category III	Acute Viral Hepatitis type B	3	2	98	2	62	2
	Acute Viral Hepatitis type C	12	9	382	0	408	4
	Acute Viral Hepatitis type D	0	0	0	0	0	0
	Acute Viral Hepatitis type E	0	0	5	0	7	0
	Congenital Syphilis	0	0	0	0	0	0
	Congenital Rubella Syndrome	0	0	0	0	0	0
	Enteroviruses Infection with Severe Complications	0	0	1	0	7	0
	Haemophilus Influenza type b Infection	0	0	1	0	3	0
	Japanese Encephalitis	1	0	25	0	21	0
	Legionnaires' Disease	9	12	235	0	181	8
	Mumps	13	9	293	1	315	6
	Neonatal Tetanus	0	0	0	0	0	0
	Pertussis	0	0	0	0	8	0
Tetanus	0	0	3	0	7	0	
Category IV	Botulism	0	0	0	0	1	0
	Brucellosis	0	0	0	0	0	0
	Complicated Varicella	1	0	34	0	30	0
	Endemic Typhus Fever	0	0	24	0	13	0
	Herpesvirus B Infection	0	0	0	0	0	0
	Influenza Case with Severe Complications	0	0	1	0	548	6
	Invasive Pneumococcal Disease	4	5	158	0	172	0
	Leptospirosis	4	1	34	0	34	0
	Listeriosis	3	4	120	0	95	0
	Lyme Disease	0	0	0	0	0	0
	Melioidosis	2	0	12	0	9	1
	Q Fever	0	0	8	0	12	0
	Scrub Typhus	8	6	175	0	260	1
Toxoplasmosis	0	0	10	0	5	0	
Tularemia	0	0	0	0	0	0	
Category V	Ebola Virus Disease	0	0	0	0	0	0
	Lassa Fever	0	0	0	0	0	0
	Marburg Hemorrhagic Fever	0	0	0	0	0	0
	Middle East Respiratory Syndrome	0	0	0	0	0	0
	Coronavirus Infections	0	0	0	0	0	0
	Novel Influenza A Virus Infections	0	0	1	0	0	0
	Rift Valley Fever	0	0	0	0	0	0
Severe Pneumonia with Novel Pathogens	57	5	15175	709	487	432	
Yellow Fever	0	0	0	0	0	0	

1. ★The weekly and cumulative total numbers include indigenous and imported cases of notifiable infectious diseases.  
2. MDR-TB, Tuberculosis, Syphilis, Gonorrhoea, HIV Infection, AIDS, Hansen's Disease and Creutzfeldt-Jakob Disease are excluded from the table.  
3. Numbers of mumps and tetanus cases are summed up by the week of report.  
4. Since 2020/1/15, "Severe Pneumonia with Novel Pathogens" was listed as a Notifiable Infectious Disease.

## Suspected Clusters

- Eight clusters related to tuberculosis (5) and diarrhea (3) were reported during week 34.

## Imported Infectious Diseases

- There were 33 imported cases from 12 countries during week 34.
  - Severe Pneumonia with Novel Pathogens** : 29 (USA 6, Myanmar 4, Indonesia 3, Cambodia 3, Vietnam 2, China 2, India 2, Pakistan 2, Japan 2, Sweden 1, South Africa 1, France 1).
  - Amoebiasis** : 3 ( Indonesia 3 ).
  - Dengue Fever** : 1 ( Vietnam 1 ).
- During week 1-34, there were 770 imported cases from 67 countries. The top three countries are the Philippines (168), Indonesia (162), and USA (96).
- During week 1-34, the three notifiable diseases with the highest number of imported cases are Severe Pneumonia with Novel Pathogens (709), Amoebiasis (49), and Dengue Fever (7).

## Summary of Epidemic

- **Severe Pneumonia with Novel Pathogens** : The epidemic continues in the low level.
- **Japanese Encephalitis** : Taiwan is in the midst of Japanese Encephalitis season. Individuals living in all counties/cities in Taiwan are at risk of infection.

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

Case diagnosis year		Week 35★		Week 1-35			
Classification	Disease Diagnosed	2021	2020	2021		2020	
				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	22	0	18	0
	Acute Viral Hepatitis type A	3	5	50	0	60	7
	Amoebiasis	5	4	140	50	163	95
	Anthrax	0	0	0	0	0	0
	Chikungunya Fever	0	0	1	1	3	3
	Cholera	0	0	0	0	0	0
	Dengue Fever	0	0	7	7	77	63
	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	9	0	8	0
	Malaria	0	0	1	1	1	1
	Measles	0	0	0	0	2	2
	Meningococcal Meningitis	0	0	2	0	5	0
	Paratyphoid Fever	0	0	2	0	0	0
	Poliomyelitis	0	0	0	0	0	0
	Rubella	0	0	0	0	0	0
Shigellosis	0	3	91	0	105	21	
Typhoid fever	0	0	1	0	5	3	
West Nile Fever	0	0	0	0	0	0	
Zika virus infection	0	0	0	0	2	2	
Category III	Acute Viral Hepatitis type B	0	5	97	2	67	2
	Acute Viral Hepatitis type C	12	11	393	0	419	4
	Acute Viral Hepatitis type D	0	0	0	0	0	0
	Acute Viral Hepatitis type E	0	0	5	0	7	0
	Congenital Syphilis	0	0	0	0	0	0
	Congenital Rubella Syndrome	0	0	0	0	0	0
	Enteroviruses Infection with Severe Complications	0	0	1	0	7	0
	Haemophilus Influenza type b Infection	0	0	1	0	3	0
	Japanese Encephalitis	1	0	26	0	21	0
	Legionnaires' Disease	7	9	242	0	190	8
	Mumps	8	12	301	1	327	6
	Neonatal Tetanus	0	0	0	0	0	0
	Pertussis	0	0	0	0	8	0
Tetanus	0	0	3	0	7	0	
Category IV	Botulism	0	0	0	0	1	0
	Brucellosis	0	0	0	0	0	0
	Complicated Varicella	1	0	35	0	30	0
	Endemic Typhus Fever	1	0	25	0	13	0
	Herpesvirus B Infection	0	0	0	0	0	0
	Influenza Case with Severe Complications	0	0	1	0	548	6
	Invasive Pneumococcal Disease	3	3	161	0	175	0
	Leptospirosis	9	3	43	0	37	0
	Listeriosis	1	2	121	0	97	0
	Lyme Disease	0	0	0	0	0	0
	Melioidosis	1	0	13	0	9	1
	Q Fever	0	0	8	0	12	0
	Scrub Typhus	6	7	181	0	267	1
Toxoplasmosis	0	0	10	0	5	0	
Tularemia	0	0	0	0	0	0	
Category V	Ebola Virus Disease	0	0	0	0	0	0
	Lassa Fever	0	0	0	0	0	0
	Marburg Hemorrhagic Fever	0	0	0	0	0	0
	Middle East Respiratory Syndrome	0	0	0	0	0	0
	Coronavirus Infections	0	0	0	0	0	0
	Novel Influenza A Virus Infections	0	0	1	0	0	0
	Rift Valley Fever	0	0	0	0	0	0
Severe Pneumonia with Novel Pathogens	35	1	15210	734	488	433	
Yellow Fever	0	0	0	0	0	0	

5. ★The weekly and cumulative total numbers include indigenous and imported cases of notifiable infectious diseases.  
6. MDR-TB, Tuberculosis, Syphilis, Gonorrhoea, HIV Infection, AIDS, Hansen's Disease and Creutzfeldt-Jakob Disease are excluded from the table.  
7. Numbers of mumps and tetanus cases are summed up by the week of report.  
8. Since 2020/1/15, "Severe Pneumonia with Novel Pathogens" was listed as a Notifiable Infectious Disease.

## Suspected Clusters

- Ten clusters related to tuberculosis (6) and diarrhea (4) were reported during week 35.

## Imported Infectious Diseases

- There were 24 imported cases from 15 countries during week 35.  
**Severe Pneumonia with Novel Pathogens** : 24 (USA 7, Thailand 2, Indonesia 2, UAE 2, Nigeria 1, UK 1, South Africa 1, Nicaragua 1, Burkina Faso 1, Japan 1, Netherlands 1, Russia 1, Serbia 1, Philippines 1, Australia 1).
- During week 1-35, there were 796 imported cases from 70 countries. The top three countries are the Philippines (169), Indonesia (164), and USA (103).
- During week 1-35, the three notifiable diseases with the highest number of imported cases are Severe Pneumonia with Novel Pathogens (734), Amoebiasis (50), and Dengue Fever (7).

## Summary of Epidemic

- **Severe Pneumonia with Novel Pathogens** : There have been new clusters linked to the SARS-COV-2 Delta variant in northern Taiwan, the risk of locally-acquired cases is expected to increase.
- **Japanese Encephalitis** : Taiwan is in the midst of Japanese Encephalitis season. Individuals living in all counties/cities in Taiwan are at risk of infection.

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