

***Salmonella* Enteritidis Outbreak Linked to a Bakery in Kinmen, Taiwan, November 2016**

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Abstract

On November 25, 2016, over 70 people were reported having gastroenteritis after consuming products from Bakery A in Kinmen. We conducted an investigation to determine outbreak scale and infection source. We defined cases as patients visiting emergency department of Kinmen County Hospital during November 24–29 who met one of the designated ICD-10 codes (K52.9/R19.7/A09/R50.9) and consumed products from Bakery A within three days before illness onset. We interviewed cases, inspected Bakery A and collected leftovers and stool samples of cases and food handlers for enteropathogens testing and pulsed-field gel electrophoresis (PFGE) genotyping of isolates. Among 235 cases, 176 (75%) reported consuming mayonnaise-contained products, 28 (12%) consumed mayonnaise-free products, and 22 (9%) consumed both. Stools (n = 18), leftovers with/without mayonnaise (n = 20), workbench and bread knife (n = 2), all yielded *Salmonella* Enteritidis with identical PFGE patterns. Environmental investigations implicated possible cross-contamination by using the same bread knife and workbenches for products with/without mayonnaise and baked products, and cleaning bread knife and workbenches with the same rag. We identified

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this *Salmonella* Enteritidis outbreak as associated with environmental cross-contamination, possibly from mayonnaise. We recommend food handlers to use separate tools and workbenches for baked and unbaked products/ingredients and make mayonnaise with sanitized eggs.

Keywords: *Salmonella*, pulsed-field gel electrophoresis, molecular epidemiology, gastroenteritis

Outbreak of *Salmonella* Enteritidis Infection Linked to Tiramisu Cakes Contaminated by Liquid Eggs in Taiwan, 2014

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Pei-Chen Chen⁴, Yu-Chieh Chien⁵, Hung-Wei Kuo¹

Abstract

Taiwan CDC identified a cluster of *Salmonella enterica* serovar Enteritidis in northern Taiwan on May 15, 2014, which had an indistinguishable, novel pulsed-field gel electrophoresis (PFGE) subtyping pattern. We conducted a case-control study using structured hypothesis-generating interviews, and environmental and trace-back investigations. We defined confirmed cases as patients with culture-confirmed of *S. Enteritidis* (SEX.238) infection and whose illness onset were during April–May, 2014. The presumptive control cases were recruited from a pilot survey in September 2013 to February 2014 for locally-acquired hepatitis A patients using the similar questionnaire. We identified 6 confirmed cases in 3 households. Illness was significantly associated with tiramisu cakes consumption from bakery X ($P < 0.01$). Bacterial culture of liquid egg yolk used for tiramisu cakes, which were prepared manually without pasteurization, yielded *salmonella* spp. We identified tiramisu cakes as a vehicle for *S. Enteritidis* (SEX.238) outbreak. We recommended bakers should use pasteurized liquid eggs for lightly cooked egg-associated products.

Keywords: *Salmonella* Enteritidis, PFGE, case-control study, tiramisu cakes, liquid eggs

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

Case diagnosis year		Week 15★		Week 1–15			
Classification	Disease Diagnosed	2018	2017	2018		2017	
				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	32	0	13	0
	Acute Viral Hepatitis type A	0	14	22	9	212	19
	Amoebiasis	7	7	86	32	103	57
	Anthrax	0	0	0	0	0	0
	Chikungunya Fever	0	0	1	1	5	5
	Cholera	0	0	0	0	0	0
	Dengue Fever	3	2	30	30	72	72
	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	1	0
	Malaria	0	0	0	0	0	0
	Measles	0	2	12	6	5	5
	Meningococcal Meningitis	1	0	5	1	5	0
	Paratyphoid Fever	0	0	0	0	2	2
	Poliomyelitis	0	0	0	0	0	0
	Rubella	1	0	1	1	0	0
	Shigellosis	2	7	42	12	61	22
Typhoid fever	1	0	5	3	6	5	
West Nile Fever	0	0	0	0	0	0	
Category III	Acute Viral Hepatitis type B	3	3	39	2	50	2
	Acute Viral Hepatitis type C	9	4	129	2	68	1
	Acute Viral Hepatitis type D	0	0	0	0	1	0
	Acute Viral Hepatitis type E	0	2	3	0	7	2
	Acute Viral Hepatitis untype	0	0	0	0	0	0
	Congenital Rubella Syndrome	0	0	0	0	0	0
	Enteroviruses Infection with Severe Complications	0	0	8	0	1	0
	Haemophilus Influenza type b Infection	0	0	1	0	2	0
	Japanese Encephalitis	0	0	0	0	0	0
	Legionellosis	1	2	46	0	32	5
	Mumps	21	15	162	3	178	2
	Neonatal Tetanus	0	0	0	0	0	0
	Pertussis	3	1	9	0	7	0
	Tetanus	1	0	4	0	2	0
	Category IV	Botulism	0	0	0	0	0
Brucellosis		0	0	0	0	0	0
Complicated Influenza		3	0	12	0	6	1
Complicated Varicella		0	0	5	0	6	1
Endemic Typhus Fever		0	0	0	0	0	0
Herpesvirus B Infection		13	16	186	0	185	2
Invasive Pneumococcal Disease		0	1	10	0	24	0
Leptospirosis		11	0	38	0	0	0
Lyme Disease		0	0	0	0	0	0
Melioidosis		0	1	4	0	7	0
Q Fever		0	2	2	0	4	0
Scrub Typhus		2	5	86	0	93	0
Toxoplasmosis		22	10	619	4	167	3
Tularremia		0	0	5	0	6	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	0	0	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	1	1
	Yellow Fever	0	0	0	0	0	0
	Zika Virus Infection	0	0	0	0	0	0

- ★The weekly and cumulative total numbers include indigenous and imported cases of notifiable infectious diseases.
- The following chronic diseases are excluded from the table: MDR-TB, Tuberculosis, Syphilis, Gonorrhoea, HIV Infection, AIDS, Hansen Disease and Creutzfeldt-Jakob Disease.
- Numbers of mumps, neonatal tetanus and tetanus cases are summed up by the week of report.
- Since 2016/1/22, "Zika Virus Infection" was listed as a Notifiable Infectious Disease.
- Since 2018/1/1, "Listeriosis" was listed as a Notifiable Infectious Disease.

Suspected Clusters

- Twenty-eight clusters were reported, including 13 tuberculosis cluster, 7 diarrhea clusters, 5 upper respiratory tract infection clusters and 3 influenza-like illness clusters.

Imported Infectious Diseases .

Disease \ Country	Indonesia	Cambodia	Chile	Vietnam	India	Philippines	Total
Amoebiasis	2			1			3
DF	1	1				1	3
Shigellosis	1	1					2
Typhoid fever					1		1
Rubella	1						1
Acute Hepatitis A			1				1
Total	5	2	1	1	1	1	11

Note: The table summarized the number of imported cases that were either **confirmed** or **updated** in the given week.

- There were 11 confirmed imported cases from 6 countries during week 15 of 2018.
- There are 102 confirmed imported cases from 16 different countries in 2018. The top 3 countries are Indonesia (36), Philippines (14), Vietnam (9) and Malaysia (9).
- Top 3 imported diseases are Amoebiasis (32), Dengue Fever (30) and Shigellosis (12).

Summary of Epidemic

- **Influenza** : The epidemic has decreased and is below the national baseline; however, the influenza activity is likely to fluctuate due to temperature drop.
- **Enterovirus** : Currently, enterovirus activity in the community remains low, and most cases experienced mild symptoms. EV71 is still circulating in the community.

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

Case diagnosis year		Week 16★		Week 1-16			
Classification	Disease Diagnosed	2018	2017	2018		2017	
				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	33	0	13	0
	Acute Viral Hepatitis type A	2	7	24	9	219	22
	Amoebiasis	8	7	94	34	110	61
	Anthrax	0	0	0	0	0	0
	Chikungunya Fever	0	0	1	1	5	5
	Cholera	0	0	0	0	0	0
	Dengue Fever	5	3	35	35	75	75
	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	1	0
	Malaria	0	0	0	0	0	0
	Measles	10	0	22	7	5	5
	Meningococcal Meningitis	0	0	5	1	5	0
	Paratyphoid Fever	0	0	0	0	2	2
	Poliomyelitis	0	0	0	0	0	0
	Rubella	1	0	2	1	0	0
	Shigellosis	1	6	43	12	67	26
	Typhoid fever	1	1	6	4	7	6
West Nile Fever	0	0	0	0	0	0	
Category III	Acute Viral Hepatitis type B	4	2	43	2	52	2
	Acute Viral Hepatitis type C	8	3	137	2	71	1
	Acute Viral Hepatitis type D	0	0	0	0	1	0
	Acute Viral Hepatitis type E	0	0	3	0	7	2
	Acute Viral Hepatitis untype	0	0	0	0	0	0
	Congenital Rubella Syndrome	0	0	0	0	0	0
	Enteroviruses Infection with Severe Complications	0	0	8	0	1	0
	Haemophilus Influenza type b Infection	0	0	1	0	2	0
	Japanese Encephalitis	0	0	0	0	0	0
	Legionellosis	1	2	47	0	34	5
	Mumps	9	14	171	3	192	2
	Neonatal Tetanus	0	0	0	0	0	0
	Pertussis	0	1	9	0	8	0
	Tetanus	0	1	4	0	3	0
	Category IV	Botulism	0	0	0	0	0
Brucellosis		0	0	0	0	0	0
Complicated Influenza		1	0	13	0	6	1
Complicated Varicella		0	1	5	0	7	1
Endemic Typhus Fever		0	0	0	0	0	0
Herpesvirus B Infection		7	4	193	0	189	2
Invasive Pneumococcal Disease		1	0	11	0	24	0
Leptospirosis		2	0	40	0	0	0
Lyme Disease		0	0	0	0	0	0
Melioidosis		0	0	4	0	7	0
Q Fever		0	0	2	0	4	0
Scrub Typhus		0	0	86	0	93	0
Toxoplasmosis		9	9	628	4	176	3
Tularremia		0	0	5	0	6	0
Category V		Ebola Virus Disease	0	0	0	0	0
	Marburg Hemorrhagic Fever	0	0	0	0	0	0
	Novel Influenza A Virus Infections	0	0	0	0	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	1	1
	Yellow Fever	0	0	0	0	0	0
	Zika Virus Infection	0	0	0	0	0	0

1. ★The weekly and cumulative total numbers include indigenous and imported cases of notifiable infectious diseases.
2. The following chronic diseases are excluded from the table: MDR-TB, Tuberculosis, Syphilis, Gonorrhoea, HIV Infection, AIDS, Hansen Disease and Creutzfeldt-Jakob Disease.
3. Numbers of mumps, neonatal tetanus 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.
5. Since 2018/1/1, "Listeriosis" was listed as a Notifiable Infectious Disease.

Suspected Clusters

- Eighteen clusters were reported, including 3 tuberculosis cluster, 8 diarrhea clusters, 4 upper respiratory tract infection clusters, and 3 varicella clusters.

Imported Infectious Diseases

Country Disease	Maldives	Indonesia	Vietnam	Malaysia	Cambodia	Thailand	Unknown	Total
DF	3		1	1				5
Measles						1	1	2
Amoebiasis		2						2
Typhoid fever					1			1
Total	3	2	1	1	1	1	1	10

Note: The table summarized the number of imported cases that were either **confirmed** or **updated** in the given week.

- There were 10 confirmed imported cases from 6 countries during week 16 of 2018.
- There are 112 confirmed imported cases from 16 different countries in 2018. The top 3 countries are Indonesia (38), Philippines (14), Vietnam (10) and Malaysia (10).
- Top 3 imported diseases are Dengue Fever (35), Amoebiasis (34) and Shigellosis (12).

Summary of Epidemic

- **Measles** : The number of cases in the cluster is expected to increase. However, the public and medical institutions have raised their awareness of measles symptoms. In addition, with a high vaccination completion rate of MMR in Taiwan, the outbreak unlikely continue to spread.

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

Case diagnosis year		Week 17★		Week 1-17			
Classification	Disease Diagnosed	2018	2017	2018		2017	
				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	1	33	0	14	0
	Acute Viral Hepatitis type A	4	6	28	9	225	22
	Amoebiasis	6	4	100	36	114	62
	Anthrax	0	0	0	0	0	0
	Chikungunya Fever	0	0	1	1	5	5
	Cholera	0	0	0	0	0	0
	Dengue Fever	4	1	39	39	76	76
	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	1	0
	Malaria	0	0	0	0	0	0
	Measles	3	0	25	7	5	5
	Meningococcal Meningitis	0	0	5	1	5	0
	Paratyphoid Fever	1	0	1	0	2	2
	Poliomyelitis	0	0	0	0	0	0
	Rubella	0	0	2	1	0	0
	Shigellosis	5	3	48	13	70	29
	Typhoid fever	0	0	6	4	7	6
West Nile Fever	0	0	0	0	0	0	
Category III	Acute Viral Hepatitis type B	4	1	47	2	53	2
	Acute Viral Hepatitis type C	10	5	147	2	76	1
	Acute Viral Hepatitis type D	0	0	0	0	1	0
	Acute Viral Hepatitis type E	0	0	3	0	7	2
	Acute Viral Hepatitis untype	0	0	0	0	0	0
	Congenital Rubella Syndrome	0	0	0	0	0	0
	Enteroviruses Infection with Severe Complications	1	0	9	0	1	0
	Haemophilus Influenza type b Infection	1	0	2	0	2	0
	Japanese Encephalitis	0	0	0	0	0	0
	Legionellosis	3	3	50	0	37	6
	Mumps	12	14	183	3	206	2
	Neonatal Tetanus	0	0	0	0	0	0
	Pertussis	0	1	9	0	9	0
	Tetanus	0	0	4	0	3	0
	Category IV	Botulism	0	0	0	0	0
Brucellosis		0	0	0	0	0	0
Complicated Influenza		3	0	16	0	6	1
Complicated Varicella		0	0	5	0	7	1
Endemic Typhus Fever		0	0	0	0	0	0
Herpesvirus B Infection		12	5	205	0	194	2
Invasive Pneumococcal Disease		2	0	13	0	24	0
Leptospirosis		0	0	40	0	0	0
Lyme Disease		0	0	0	0	0	0
Melioidosis		1	0	5	0	7	0
Q Fever		0	0	2	0	4	0
Scrub Typhus		4	4	90	0	97	0
Toxoplasmosis		6	10	634	4	186	3
Tularremia		0	0	5	0	6	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	0	0	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	1	1
	Yellow Fever	0	0	0	0	0	0
	Zika Virus Infection	0	0	0	0	0	0

1. ★The weekly and cumulative total numbers include indigenous and imported cases of notifiable infectious diseases.
2. The following 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, neonatal tetanus 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.
5. Since 2018/1/1, "Listeriosis" was listed as a Notifiable Infectious Disease.

Suspected Clusters

- Twenty-four clusters were reported, including 6 tuberculosis cluster, 10 diarrhea clusters, 1 influenza-like illness cluster, and 7 varicella clusters.

Imported Infectious Diseases

Country Disease	Indonesia	Philippines	Cambodia	India	Total
DF	1	2	1		4
Shigellosis	2	1			3
Amoebiasis	1			1	2
Total	4	3	1	1	9

Note: The table summarized the number of imported cases that were either **confirmed** or **updated** in the given week.

- There were 9 confirmed imported cases from 4 countries during week 17 of 2018.
- There are 120 confirmed imported cases from 16 different countries in 2018. The top 3 countries are Indonesia (41), Philippines (17), Vietnam (10) and Malaysia (10).
- Top 3 imported diseases are Dengue Fever (39), Amoebiasis (36) and Shigellosis (14).

Summary of Epidemic

- **Measles** : There are currently more than 2,600 contacts being monitored. The number of confirmed cases in the cluster is expected to increase. However, the public and medical institutions have raised their awareness of measles symptoms. In addition, with a high vaccination completion rate of MMR in Taiwan, the outbreak unlikely continue to spread.

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