

INCIDENCE OF FOODBORNE DISEASES

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How do we know a disease is foodborne?

Criteria (“food attribution”)

Agent from patient(s) found in food (“fingerprinting”)

Food consumption matches among patients

“Fingerprints” match among patients

Frequently foodborne disease

Gastrointestinal symptoms

Outbreaks vs. sporadic cases — recognition of common-source outbreaks

Acute vs. chronic illnesses — acute vs. chronic exposures

How are foodborne illnesses reported?

Reporting channels — starts with a physician or ?

Levels of government; priorities

Pieces of paper vs electronic channels

FoodNet — data from diagnostic laboratories

Compilation

Structure of information gathering

Structure of information recording

Reporting

Choice of “medium”

Timing

What can we learn from U.S. statistics on foodborne disease? (See tables)

Outbreaks only

Reported incidence: outbreaks, cases, deaths

“Causes”: etiology, contributing factors

Seasonality, place food was eaten, vehicles (identity vs. “ethnicity”)

Undetermined etiology — **FoodNet**

Estimates from CDC in *Emerging Infectious Diseases*

Foodborne illness in California (annual)

- 9 million illnesses (virus > bacterial > parasitic)
- 39,000 hospitalizations (bacterial > viral > parasitic)
- 600 deaths (bacterial > viral > parasitic) (cf. CDC data)

What about other countries? (e.g., Europe)

- Some have no reporting mechanism or central “contact”
- Salmonella* is almost everywhere — may be *presumed* foodborne
- Campylobacter* often not sought
- Viruses rarely reported (international food virology studies in progress in Europe) — hepatitis A presumed foodborne in Germany
- UK's special problem — new variant Creutzfeldt-Jakob disease (vCJD)
- Undetermined etiology less common in some countries, but other-and-unknown and infectious enteritis may be reported
- Some countries seem not to consider foodborne disease from food prepared and eaten at home, whereas others take this very seriously
- Canada similar to U.S., except that foodborne virus disease is rare (government research in progress), and acute illness is sometimes attributed to yeasts and molds
- European Union now has a program; Australia-New Zealand seem to be on the way.
- Pan American Health Organization — Latin America & Caribbean

What might we aspire to?

- More timely reporting
- More complete reporting
- Measures of severity and economic impact
- FoodNet**

Prognosis

- From physicians to national health services, incentives to report are lacking
- FoodNet**
- Undetected problems don't require solutions
- Who speaks for the public?

Summary

- Most of what we know about the incidence of foodborne disease is in the form of “educated” (?) guesses.
- Pervasive ignorance has led to misapplication of limited resources for food safety.
- Ignorance persists because of political expediency.
- The “public” is unlikely to make things better.
- FoodNet may make a difference

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Table 1.

FOODBORNE DISEASE OUTBREAKS, U.S., 1998–2002^a

Etiology	Outbreaks		Cases		Deaths No.
	No.	%	No.	%	
Bacterial	1,184	17.8	37,887	29.5	70
Chemical	221	3.3	1,140	0.9	1
Parasitic	23	0.3	630	0.5	0
Viral	709	10.7	28,274	22.0	5
Multiple	30	0.5	1,060	0.8	0
Confirmed	2,167	32.6	68,991	53.7	76
Unknown	4,480	67.4	59,389	46.2	12
Total	6,647	100.0	128,380	100.0	88

^a Lynch et al., 2000

Table 2.

BACTERIAL FOODBORNE DISEASE OUTBREAKS, U.S., 1998–2002^a

Agent	Outbreaks		Cases		Deaths No.
	No.	%	No.	%	
<i>Bacillus cereus</i>	37	0.6	571	0.4	0
<i>Brucella</i>	1	0.0	4	0.0	0
<i>Campylobacter</i>	61	0.0	1,440	1.1	0
<i>Clostridium botulinum</i>	12	0.2	52	0.0	1
<i>Clostridium perfringens</i>	130	2.0	6,724	5.2	4
<i>Escherichia coli</i> *	140	2.1	4,864	3.0	4
<i>Listeria monocytogenes</i>	11	0.2	256	0.2	38
<i>Salmonella</i>	586	8.9	16,821	13.1	20
<i>Shigella</i>	67	1.0	3,677	2.91	1
<i>Staphylococcus aureus</i>	101	1.5	2,766	2.2	2
<i>Streptococcus</i>	1	0.0	4	0.0	0
<i>Vibrio cholerae</i>	3	0.0	12	0.0	0
<i>Vibrio parahaemolyticus</i>	25	0.4	613	0.5	0
<i>Vibrio</i> , other	1	0.0	2	0.0	0
<i>Yersinia enterocolitica</i>	8	0.1	87	0.1	0
Other bacterial	1	0.0	4	0.0	0
Totals	1,184	17.8	37,887	29.5	70

* Enterohemorrhagic, 132 outbreaks; enterotoxigenic, 7; enteroaggregative, 1

^a Lynch et al., 2000

Table 3.

“CHEMICAL” FOODBORNE DISEASE OUTBREAKS, U.S., 1998–2002^a

Agent	Outbreaks		Cases		Deaths
	No.	%	No.	%	No.
Ciguatoxin	84	1.3	315	0.2	1
Heavy metals	2	0.0	23	0.0	0
Mushroom toxin	2	0.0	6	0.0	0
Scombrototoxin	118	1.8	463	0.4	0
Shellfish toxin	5	0.1	36	0.0	0
Other chemical	10	0.2	297	0.2	0
Totals	221	3.3	1,140	0.9	1

^a Lynch et al., 2000

Table 4.

PARASITIC AND VIRAL FOODBORNE DISEASE OUTBREAKS, U.S., 1998–2002^a

Agent	Outbreaks		Cases		Deaths
	No.	%	No.	%	No.
Parasitic					
<i>Anisakis</i>	1	0.0	14	0.0	0
<i>Cryptosporidium parvum</i>	4	0.1	130	0.1	0
<i>Cyclospora cayetanensis</i>	9	0.1	325	0.3	0
<i>Giardia intestinalis</i>	3	0.0	119	0.1	0
<i>Trichinella spiralis</i>	6	0.1	33	0.0	0
Total parasitic	23	0.3	621	0.5	0
Viral					
Astrovirus	1	0.0	14	0.0	0
Hepatitis A	60	0.8	981	0.8	4
Norovirus	657	9.9	27,171	21.2	1
Rotavirus	1	0.0	108	0.1	0
Total viral	719	10.7	28,274	22.0	5

^a Lynch et al., 2000

Some FoodNet notes from MMWR 55(14):392–395. April 14, 2006 and before:

Preliminary FoodNet Data on the Incidence of Infection with **Pathogens Transmitted Commonly Through Food** — 10 Sites, United States, 2004 [bold added]

Rates of selected pathogens detected by the Foodborne Diseases Active Surveillance Network (FoodNet)^a at the five original sites, by year and organism — United States, 1996–1998, 2005; additional sites added in 2000.

Agent	1996–1998		2005 ^b	
	rate	per	rate	per
<i>Campylobacter</i>	21.7	10 ⁵	12.7	10 ⁵
<i>Cryptosporidium</i>	26.8	10 ⁶	29.5	10 ⁶
<i>Cyclospora</i>	1.6	10 ⁶	1.5	10 ⁶
<i>Escherichia coli</i> O157	2.3	10 ⁵	1.1	10 ⁵
Shigatoxigenic <i>E. coli</i> non-O157			3.3	10 ⁶
<i>Listeria</i>	4.9	10 ⁶	3.0	10 ⁶
<i>Salmonella</i>	13.5	10 ⁵	14.6	10 ⁵
<i>Shigella</i>	7.7	10 ⁵	4.7	10 ⁵
<i>Vibrio</i>	2.4	10 ⁶	2.7	10 ⁶
<i>Yersinia</i>	8.9	10 ⁶	3.6	10 ⁶

^a In 1996, active surveillance began for laboratory-confirmed cases of *Campylobacter*, *Escherichia coli* O157, *Listeria*, *Salmonella*, *Shigella*, *Vibrio*, and *Yersinia* infections in Minnesota, Oregon, and selected counties in California, Connecticut, and Georgia. In 1997, surveillance for laboratory-confirmed cases of *Cryptosporidium* and *Cyclospora* infections began in Connecticut, Minnesota, and Oregon, and selected counties in California.

^b Includes additional study sites

Table 5: Estimated annual foodborne illnesses, hospitalizations and deaths in the U.S. from known pathogens

Pathogen	Illnesses	Hospital-izations	Deaths
Bacterial			
<i>Bacillus cereus</i>	27,360	8	0
<i>Brucella</i> spp.	777	61	6
<i>Campylobacter</i> spp.	1,963,141	10,539	99
<i>Clostridium botulinum</i>	58	46	4
<i>Clostridium perfringens</i>	248,520	41	7
<i>Escherichia coli</i> O157:H7	62,458	18,345	2
<i>E. coli</i> , non-O157 STEC	31,229	921	26
<i>E. coli</i> , enterotoxigenic	55,594	15	0
<i>E. coli</i> , other diarrheogenic	23,826	6	0
<i>Listeria monocytogenes</i>	2,493	2,298	499
<i>Salmonella typhi</i>	659	494	3
<i>Salmonella</i> , nontyphoidal	1,341,873	15,608	553
<i>Shigella</i> spp.	89,648	1,246	14
<i>Staphylococcus</i> spp.	185,060	1,753	2
<i>Streptococcus</i> spp.	50,920	358	0
<i>Vibrio cholerae</i> , toxigenic	49	17	0
<i>Vibrio vulnificus</i>	47	43	18
<i>Vibrio</i> , other	5,122	65	13
<i>Yersinia enterocolitica</i>	86,731	1,105	2
Total bacterial	4,175,565	36,466	1,297
Parasitic			
<i>Cryptosporidium parvum</i>	30,000	199	7
<i>Cyclospora cayetanensis</i>	14,638	15	0
<i>Giardia lamblia</i>	200,000	500	1
<i>Toxoplasma gondii</i>	112,500	2,500	375
<i>Trichinella spiralis</i>	52	4	0
Total parasitic	357,190	3,219	383
Viral			
Astrovirus	39,000	125	0
Hepatitis A	4,170	90	4
Norovirus	9,200,000	20,000	124
Rotavirus	39,000	500	0
Total viral	9,282,170	21,167	128
GRAND TOTAL	13,814,924	60,854	1,809

Adapted from Mead, P.S., Slutsker, L., Dietz, V., McCaig, L. F., Bresee, J. S., Shapiro, C., Griffin, P.M. and Tauxe, R.V. 1999. Food-Related Illness and Death in the United States. *Emerging Infectious Diseases*. 5(5), 607-625.

Foodborne outbreaks, California

Year	Outbreaks (cases)	Increase (%)	Confirmed No. (%)	Suspected No. (%)
1999	121 (3325)	20	37 (31)	55 (46)
2000	141 (3716)	17	45 (32)	71 (50)
2001	177 (2806)	25	39 (22)	103(58)
2002	207 (3355)	17	40 (20)	143 (69)

Confirmed etiologic agents, California

Etiology	<u>1999</u> No. (%)	<u>2000</u> No. (%)	<u>2001</u> No. (%)	<u>2002</u> No. (%)
Bacterial	35 (95)	27 (60)	21 (54)	20 (48)
Parasitic	1 (3)	1 (2)	3 (8)	0 (0)
Chemical	0 (0)	2 (4)	4 (10)	4 (10)
Viral	1 (3)	15 (33)	12 (31)	18 (43)
Totals	37 (100)	45 (100)	39 (100)	43 (100)

Specific agents in foodborne outbreaks, California

Etiology	<u>1999</u> No. (%)	<u>2000</u> No. (%)	<u>2001</u> No. (%)	<u>2002</u> No. (%)
<i>Norovirus</i>	1 (3)	14 (31)	12 (31)	18 (45)
<i>Salmonella</i> (non SE)	9 (24)	13 (29)	5 (13)	8 (20)
<i>Salmonella</i> Enteritidis	14 (38)	6 (17)	1 (3)	1 (3)
<i>E. coli</i> O157	2 (5)	1 (3)	5 (13)	5 (13)
<i>Shigella</i>	5 (14)	3 (9)	7 (18)	2 (5)

Food vehicle by year of outbreak, California

Vehicle	1991-1995 No. (%)	1996-2000 No. (%)
Produce	1 (2)	29 (30)
Meats	17 (30)	14 (15)
Dairy	3 (5)	2 (2)
Eggs	12 (21)	17 (18)
Seafood	4 (7)	7 (7)
Multiple	7 (13)	16 (17)
Other	12 (21)	11 (11)

Deaths from Creutzfeldt-Jakob disease in the U.K.:

Year	Form			Total
	Sporadic	New variant (confirmed)	Other ^a	
1990	28	–	5	33
1991	32	–	4	36
1992	45	–	8	53
1993	37	–	9	46
1994	53	–	8	61
1995	35	3	9	47
1996	40	10	10	60
1997	60	10	11	81
1998	63	18	8	89
1999	62	15	8	85
2000	50	28	4	82
2001	58	20	9	87
2002	72	17	5	94
2003	79	18	11	108
2004	51	9	6	67
2005	65	5	13	80
2006	57	5	10	72
Total	887	158	143	1188

^a Includes iatrogenic and familial CJD plus Gerstmann-Straussler-Scheinker syndrome

<<http://www.cjd.ed.ac.uk/figures.htm>>