Outbreak Investigation: the public health aspect

Margaret B. O' Sullivan
Consultant in Public Health Medicine
Department of Public Health
HSE-South, Ireland

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- Food safety primarily about human health
- Basic factors essential to population health
  Clean water
  Plentiful, nutritious, uncontaminated food
  Clean air…. waste disposal … decent housing ……..

Foodborne disease outbreaks undermine public confidence in

Food supply
Systems ensuring safety

- Rapid identification / determining source / limiting scope

Outline

- Burden of foodborne disease?
- Irish surveillance data
- Outbreak detection
- Outbreak response
- A local outbreak investigation
- Some reflections

Burden of Foodborne Disease?

- Global burden?
- England
  1.3 million cases in 2000 (domestically acquired)
  Adak et al, GUT 2002
- USA
  76 million illnesses annually
  5,000 deaths from foodborne diseases each year
  Mead et al, Emerg Inf Dis 1999
- Australia
  5.4 million cases annually (~1/3 of all gastroenteritis)
  Hall et al, Emerg Inf Dis 2005
- Ireland (all island)
  3.2 million episodes gastroenteritis annually

Estimates complicated

Few illness can be definitively linked to food

Often links only made from outbreaks

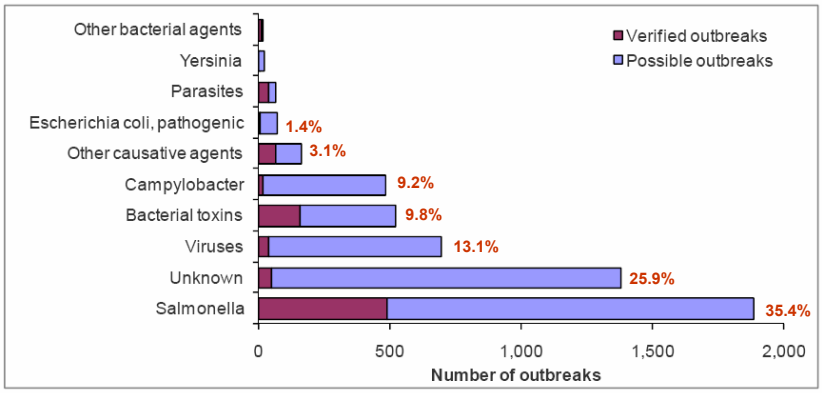
Not all acute gastroenteritis foodborne

Underreporting

European Union 2008

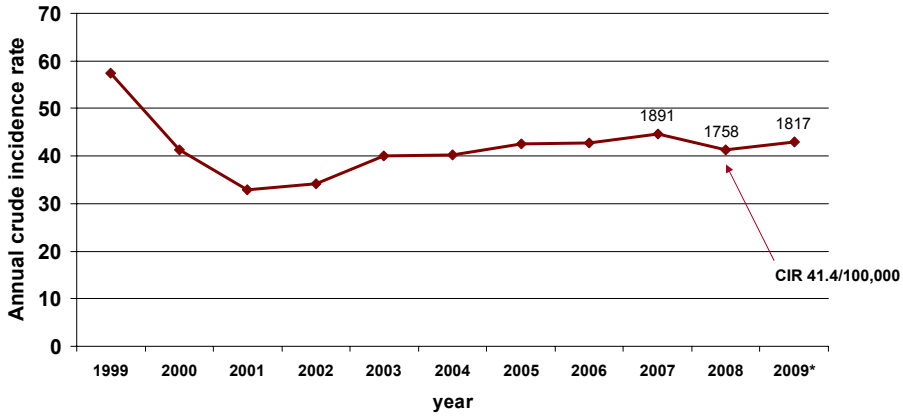
5,322 foodborne outbreaks reported (possible & verified)
45,622 human cases
6,230 hospitalisations
32 deaths

Figure OUT1. Causative agents in food-borne outbreaks in the EU, 2008



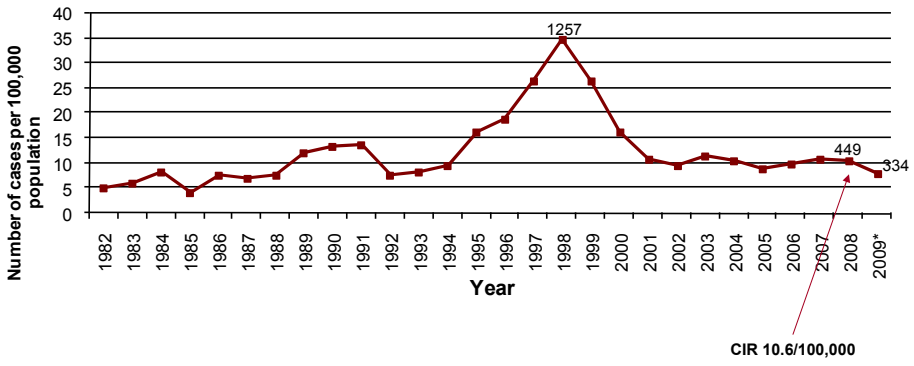
Source: Trends and sources of zoonoses and zoonotic agents and food borne outbreaks in the European Union in 2008. EFSA 2010

Annual Crude Incidence Rates Campylobacteriosis Ireland, 1999-2009*



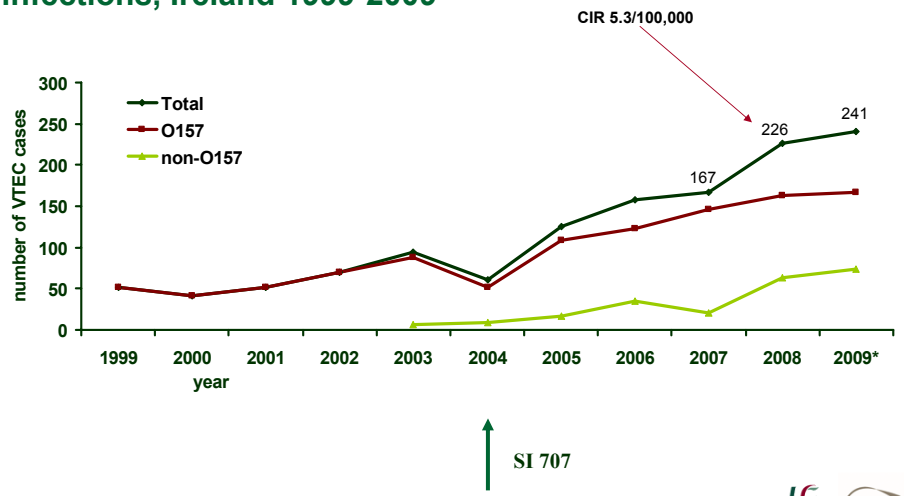
Data sources: CIDR (2004-2009) and annual laboratory survey (1999-2003)
Note: 2009 data provisional

Annual Crude Incidence Rates Salmonellosis, Ireland 1982-2009*



Data source: CIDR
* Data for 2009 is provisional

Annual number of confirmed and probable human VTEC infections, Ireland 1999-2009*



Source of data: HPSC CIDR and DML PHL
Notes: 2009 data provisional ,and 2007 data includes 52 probable O157 cases associated with one outbreak

Annual number of outbreaks (and numbers ill) where food was reported as a transmission route, Ireland 2004-2008

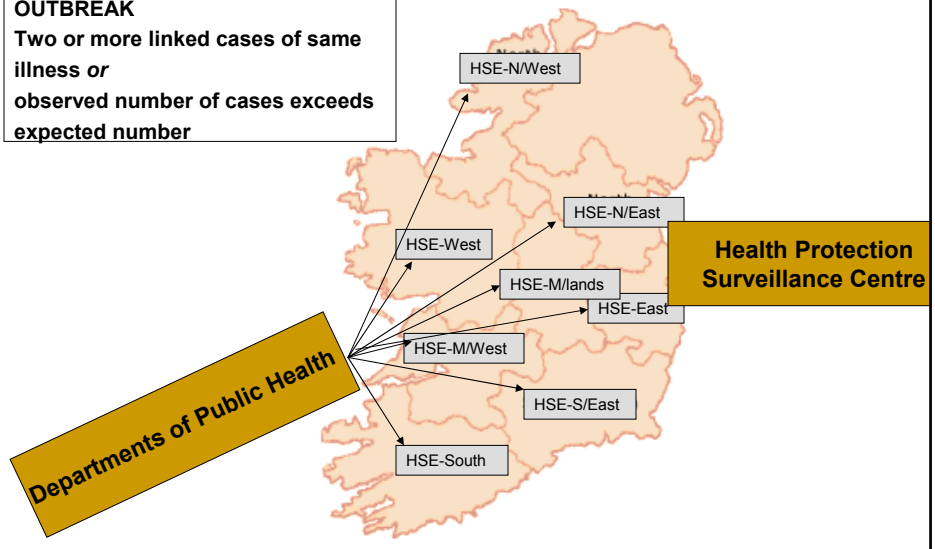
	2004	2005	2006	2007	2008
Acute infectious gastroenteritis	6 (43)	1 (26)	6 (51)	6 (124)	**2** (43)
Campylobacter infection	1 (2)	5 (10)	5 (11)	2 (5)	**1** (2)
Cryptosporidiosis	-	-	1 (28)	-	-
Enterohaemorrhagic Escherichia coli	-	5 (9)	4 (8)	-	**3** (6)
Noroviral infection	-	2 (130)	7 (155)	-	-
Salmonellosis	6 (28)	5 (16)	11 (29)	5 (69)	**9** (49)
Shigellosis	-	1 (3)	-	-	**1** (2)
Trichinosis	-	-	-	1 (2)	-
Sum:	**13** (73)	**19** (194)	**34** (282)	**14** (200)	**16** (102)

Source: HPSC 2010

Includes outbreaks whose transmission routes were reported as: foodborne; foodborne & airborne; foodborne & waterborne; foodborne & person-person; and foodborne, person-person & airborne.
Note: Sixteen of these outbreaks were reported as foreign travel related -13 salmonella, 1 trichinella, 1 acute infectious gastro &1 EHEC

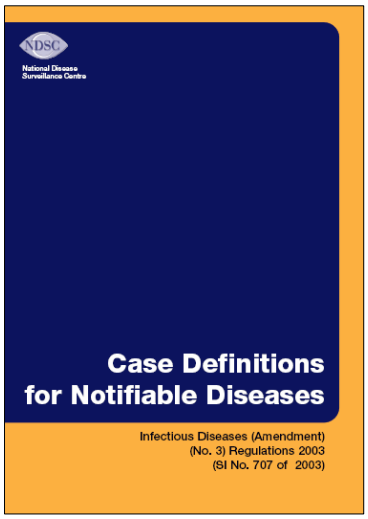
Outbreak detection

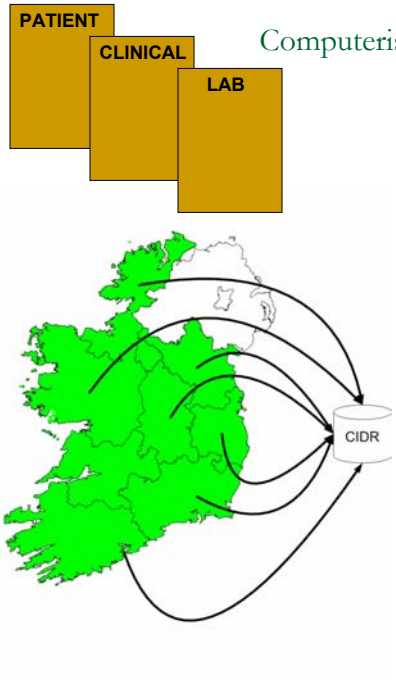
OUTBREAK
Two or more linked cases of same illness *or*
observed number of cases exceeds expected number



- Reports of possible outbreaks / clusters (public / media ….)
- Complaints from consumers
- Reports of absenteeism
- Evidence of population exposure (positive testing of food product / herd or flock disease / alerts)
- **NOTIFICATIONS**
  - Medical practitioners
  - Clinical directors of diagnostic labs

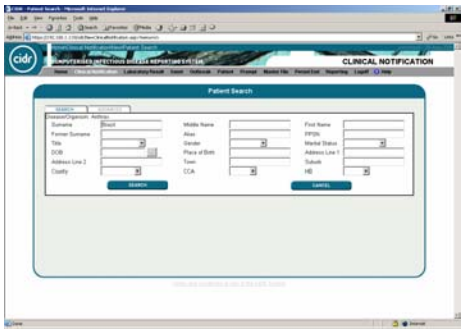
Notified to Depts of Public Health





Computerised Infectious Disease Reporting [CIDR]

- Clinical / epidemiological data (from regional public health departments)
- Laboratory data (from clinical micro labs & national reference labs)
- Collected into single national database
- Web based
- Users can readily retrieve



- Powerful surveillance tool

Outbreak response

- Primary Goal
  - prevent further cases
  - control measures
  - identify cause
  - prevent similar outbreaks
- Outbreak Control Team
  - multidisciplinary (core)
  - interagency

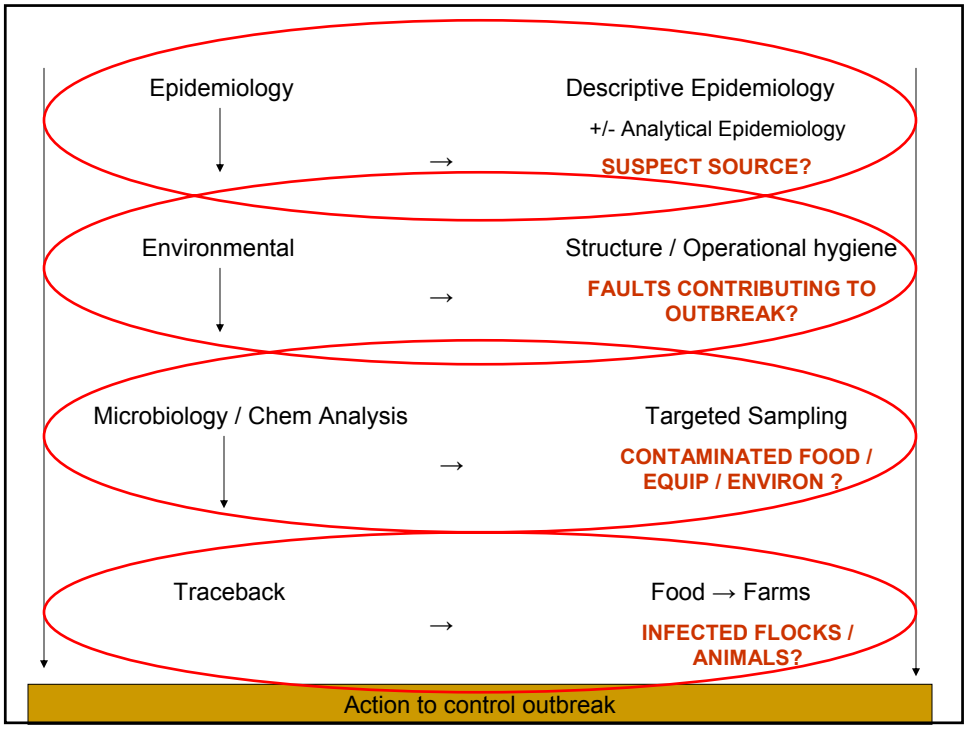
Immediate health threat
Significant no. cases
Disease important
Geographically dispersed
High risk establishment

- Role
  - agree and coordinate activities of agencies involved so that cause can be identified and control measures implemented
- 'Open mind' at start

Steps in Outbreak Management

Logical process
Multiple concurrent steps

- Preliminary investigation
  Initial cases / same illness? / clinical specimens / common factors? / site investigation / food specimens? / preliminary hypothesis
- Communication and early control measures
- Descriptive epidemiology
- Environmental, microbiology and veterinary investigations
- Hypothesis generation
- Analytical studies and interpretation
- Control measures
- Communication & final report



Results of epidemiological, microbiological, environmental and traceback investigations are considered together

Definitive typing may demonstrate that isolates from food or animals / poultry are similar to human isolates, providing further evidence of an association

Salmonella Enteritidis PT4 Outbreak July 2007

- Cluster of *Salmonella* cases notified
  (6 cases / 1 week)

- Outbreak control team convened
  Public health, environmental health, microbiology
  Veterinary (DAFF and LA)
  HPSC
  FSAI

PRELIMINARY INVESTIGATION

- *Salmonella* Enteritidis PT4
- Initial cases – clinical history / food history / other exposures (resident in general area)
- Early food sampling from various premises / inspections
- Early indications of possible link with
  cakes from Bakery X
  cakes from shops supplied by Bakery X
- Active case finding - lab alert / GP alert
- Case definition - confirmed / probable / possible cases

Working hypothesis:
Point source outbreak
Initial findings possible link with Bakery X

MAIN INVESTIGATION

- Epidemiology
  - all cases interviewed (adapted *Salmonella* questionnaire)
  - bakery staff interviewed (12)
- Environmental
  - Bakery X visit, inspection, risk assessment (+ joint veterinary visit)
  - sampling (food / environmental)
  - distribution network – 48 shops
  - egg supplier established / distributor visited
- Microbiological
  - human stool samples (all cases / staff)
  - food samples (Bakery X / outlets / other premises)
  - water samples
  - environmental samples (incl. avian droppings from environs & adjacent aviary) …… and dead pigeons
- Traceback
  - egg supply (supplier-collector-wholesaler-production premises .. *all visited)*
  - dust samples from each egg production house

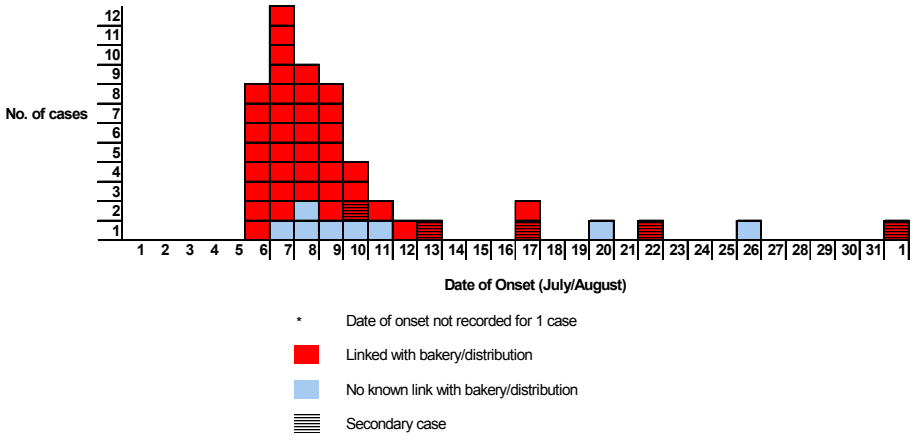
FINDINGS (EPIDEMIOLOGY: CASES)

- 52 cases (41 confirmed, 1 probable, 10 possible)
- M / F = 31% / 69%
- Age: Infant - 97yrs
- Symptoms ….. diarrhoea 92% / pain 52% / fever 44% / vomiting 37%
- Duration: mean 7 days (range: 2-18)
- 50% visited GP
- 31% hospitalised

64% ate product directly from bakery

21% ate product from outlet

Epidemic Curve of cases associated with outbreak of *Salmonella* Enteritidis PT4 (n=52*)



Dated: 04/09/2007

Data source: CIDR

FINDINGS

ENVIRONMENT

- Risk assessment identified deficiencies in overall food safety management system
- Wild pigeons in vicinity of bakery
- Avian droppings ++ adjacent to bakery

MICROBIOLOGY

- 41 cases confirmed *S*.Enteritidis PT4
- 1/12 staff positive (asymptomatic)
- Avian droppings positive for *S*.Enteritidis PT4
- All food samples negative
- All samples from egg supply production houses negative

CASE CONTROL STUDY

- To test hypothesis

  Cases more likely to have eaten cakes / produce from Bakery X or outlets supplied by Bakery X than controls

- 22 cases / 38 controls

  - asked about consumption of ice cream, cakes and bakery products
  - source / amount

- Strong statistical association between illness and eating food from Bakery X and / or eating food from outlets supplied by Bakery X

- Unable to identify association with specific product

CONTROL MEASURES

- Voluntary closure
- Products removed from all retail outlets
- Other food premises advised re pest control
- Advice to cases on prevention of spread

CONCLUSIONS

- Significant point source outbreak
- Epidemiological link to bakery
- Environmental samples positive
  - avian droppings – presumed pigeon
- How introduced into bakery?
  - no contaminated egg supply found
  - pigeons?
  - infected foodhandler? victim?
- Conditions and practices could have contributed to spread within bakery

Reflections

- **Good surveillance key**
  Early detection – early investigation – early controls
- **Improving responses**
  Outbreak plans need to capture best practices – robust learning
- **Improving collaboration**
  Across professional, agency and geographic boundaries
  Zoonoses Committees in Ireland
- **Emerging challenges**
  New pathogens / antimicrobial resistance
  Susceptible population groups
  Same principles – limiting health impact – restoring public confidence