



Outbreaks of *Escherichia coli* on Open Farms

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Background.

Vero cytotoxin-producing *Escherichia coli* (VTEC):

First described in 1977;

- strains produce toxins which kills vero (green monkey kidney) cells;
- the toxins are designated VT 1, VT2, VT2c etc;
- VT2 is the same as the toxin produced by *Shigella dysenteriae*, hence the US designation of shiga-toxins;
- Many strains of *E. coli* are able to produce vero cytotoxins;
- *E. coli* O157 is the most common VTEC serogroup in the UK and USA but not in Europe;

Background.

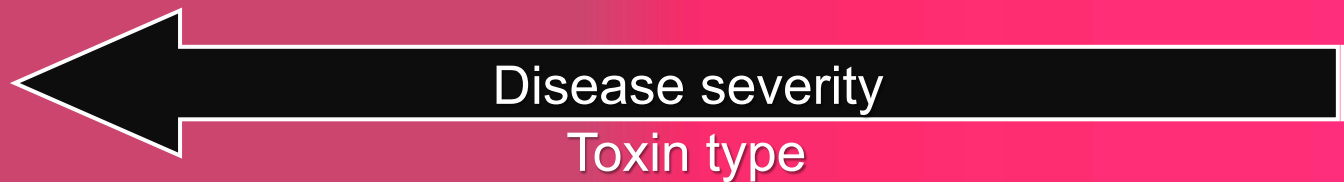


Escherichia coli

Vero cytotoxin-producing *E. coli* (VTEC)

Enterohaemorrhagic *E. coli* (EHEC)

Produce VT and have the intimin gene



O157 PT21/28

O157 PT8

Background.

Vero cytotoxin-producing *Escherichia coli* (VTEC):

- Ruminants are the principal reservoir for VTEC;
- Many other animal species can carry VTEC;
- VTEC do not cause illness in species other than humans;
- The infections dose is extremely low, <100 cfu.

General outbreaks of VTEC O157.



England and Wales 1992 - 2010

| | Number of outbreaks | Number of people affected | Number of lab confirmed cases |
|------------------|---------------------|---------------------------|-------------------------------|
| Animal contact | 42 | 295 | 280 |
| Foodborne | 93 | 1396 | 1029 |
| Other | 4 | 28 | 25 |
| Person to person | 64 | 666 | 457 |
| Unknown | 19 | 129 | 102 |
| Water | 5 | 46 | 38 |
| Total | 227 | 2,560 | 1,931 |

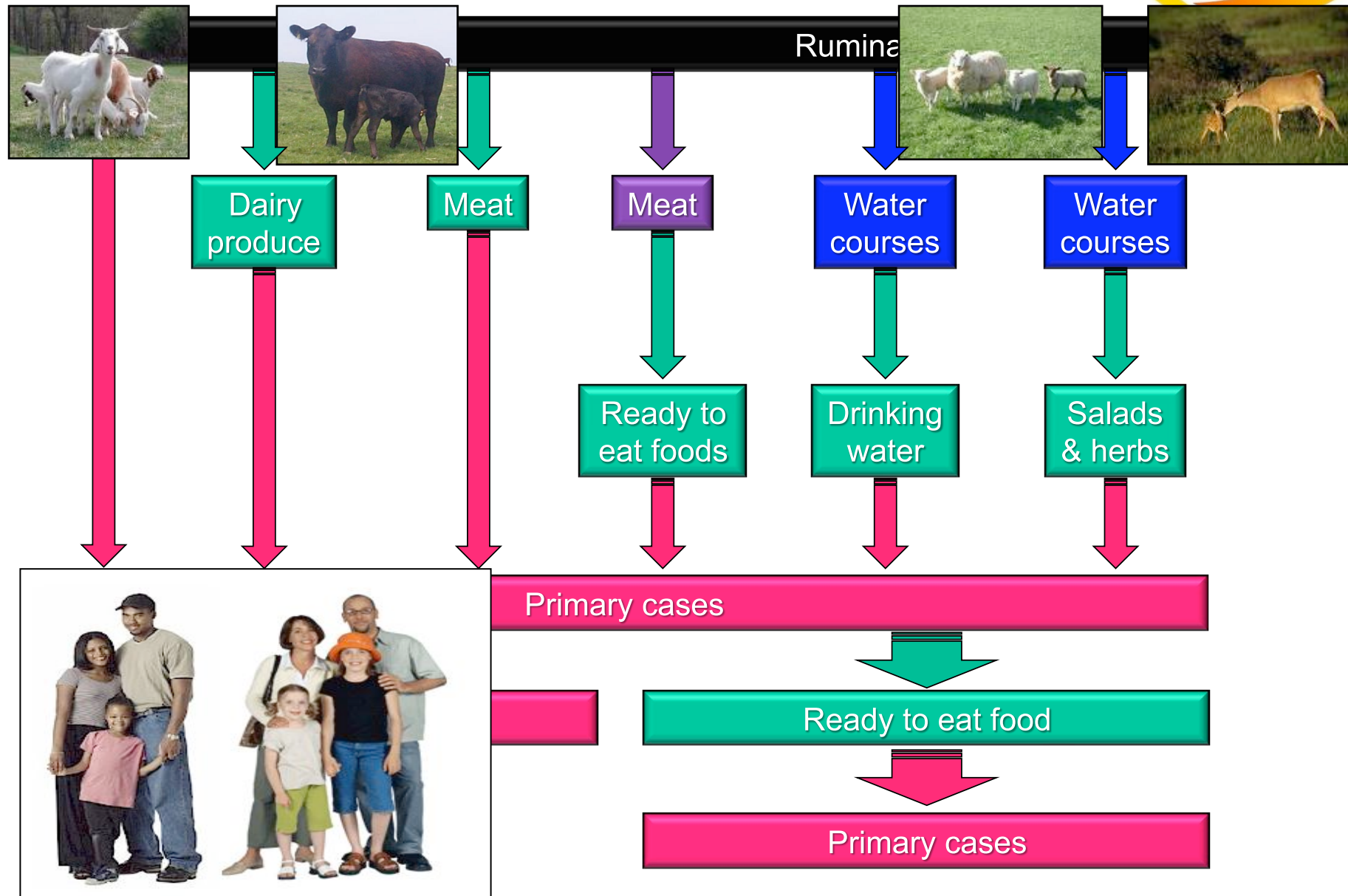
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Transmission.



VTEC O157 and animal contact.



Michael F. Easley
Governor

De

For Release: IMMEDIATE
Date: November 8, 2000

State

Public health

RALEIGH – State health officials stressed that while a special investigation can now assist with public health

“More than 90 percent of the time period of the large majority of the people attended the state fair, sources of the outbreak

At the time this news was reported earlier have been Laboratory of Public Health



Suffered brain damage after he caught the E.coli bug on a school trip

Brain-damaged E.coli boy wins £2.6m in damages

A BOY of four left brain damaged after he caught the E.coli bug on a school trip was yesterday awarded £2.6million damages. Tom Dowling was fit and well before the trip from Edgware Infants School in North London to Bowman's Open Farm near St Albans, Hertfordshire, in 1997. He contracted a severe form of the bug and suffered kidney failure, damage to his central nervous system and went into a coma for 12 days. Now aged seven, he is wheelchair-bound

and needs 24-hour care. Bowman's Farms and Barnet Council had already admitted 95 per cent blame and damages were settled minutes before a High Court hearing was due to start yesterday. An earlier hearing heard Tom had been the third child to contract E.coli at the farm within the space of a few months. The bug was traced to a goat on the farm. Lord Brennan QC, for the family, said the farm should have been closed straight away.

Godstone Farm.



- Location – Surrey, South of London.
- Well established – opened over 30 years ago.
- Received 1,500 – 2,000 visitors per day during the summer.
- Children are encouraged to touch and feed the animals.

Godstone Farm.



Godstone Farm.



The large animal barn

Godstone Farm.



The large animal barn

Godstone Farm.



The top barn

Godstone Farm.



The top barn

Godstone Farm.



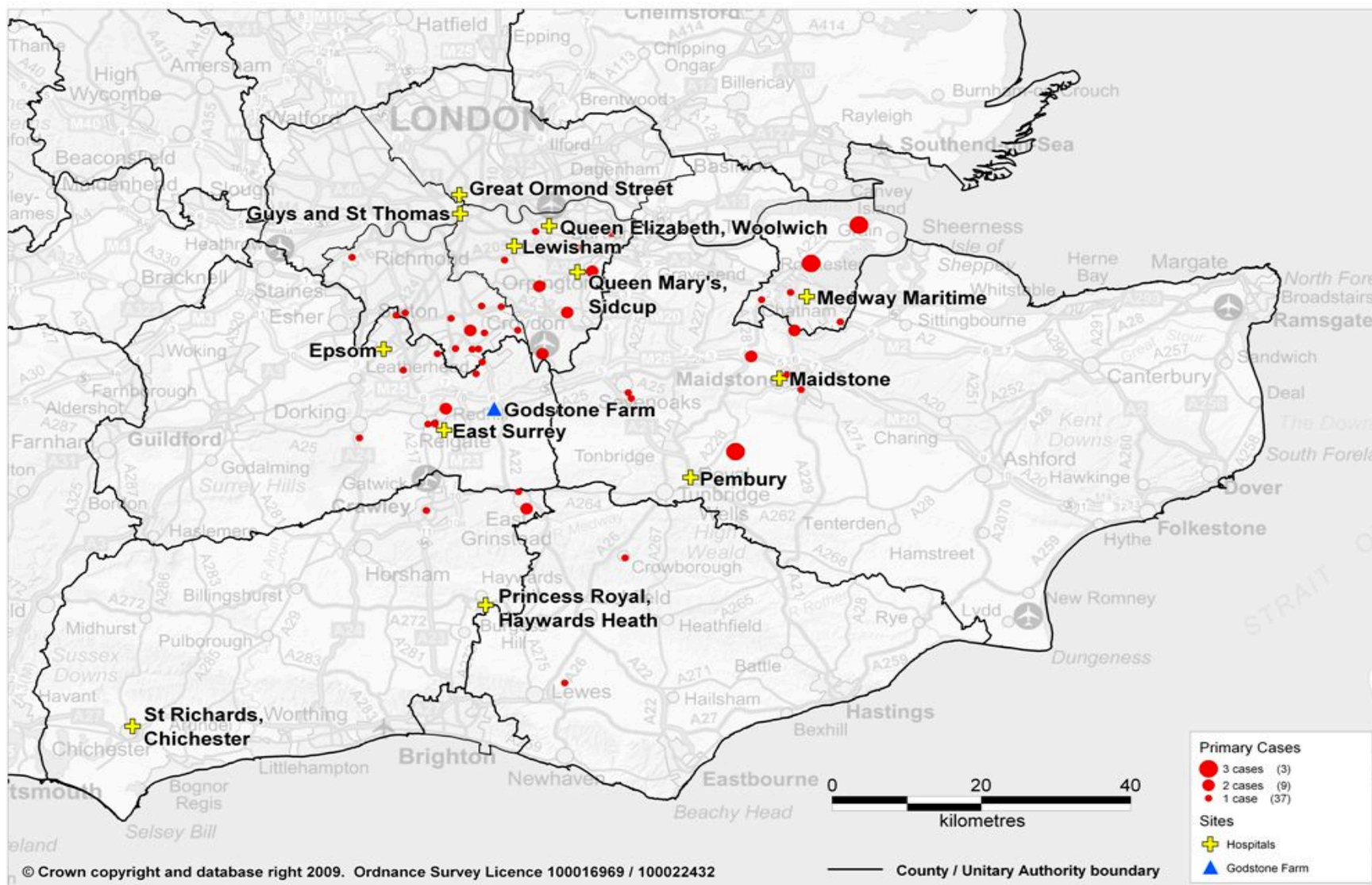
The top barn – hand washing facilities

Godstone Farm outbreak.

Ninety three cases:

- outbreak strain - VTEC O157 PT 21/28 VT2 with a specified molecular fingerprint (VNTR);
- primary – 65 (70%);
- secondary – 13 (14%);
- asymptomatic – 15 (16%);
- male – 47 (51%);
- age <10 years – 76 (82%);
- admitted to hospital – 27 (29%);
- haemolytic uraemic syndrome – 17 (18%).

Geographical distribution.

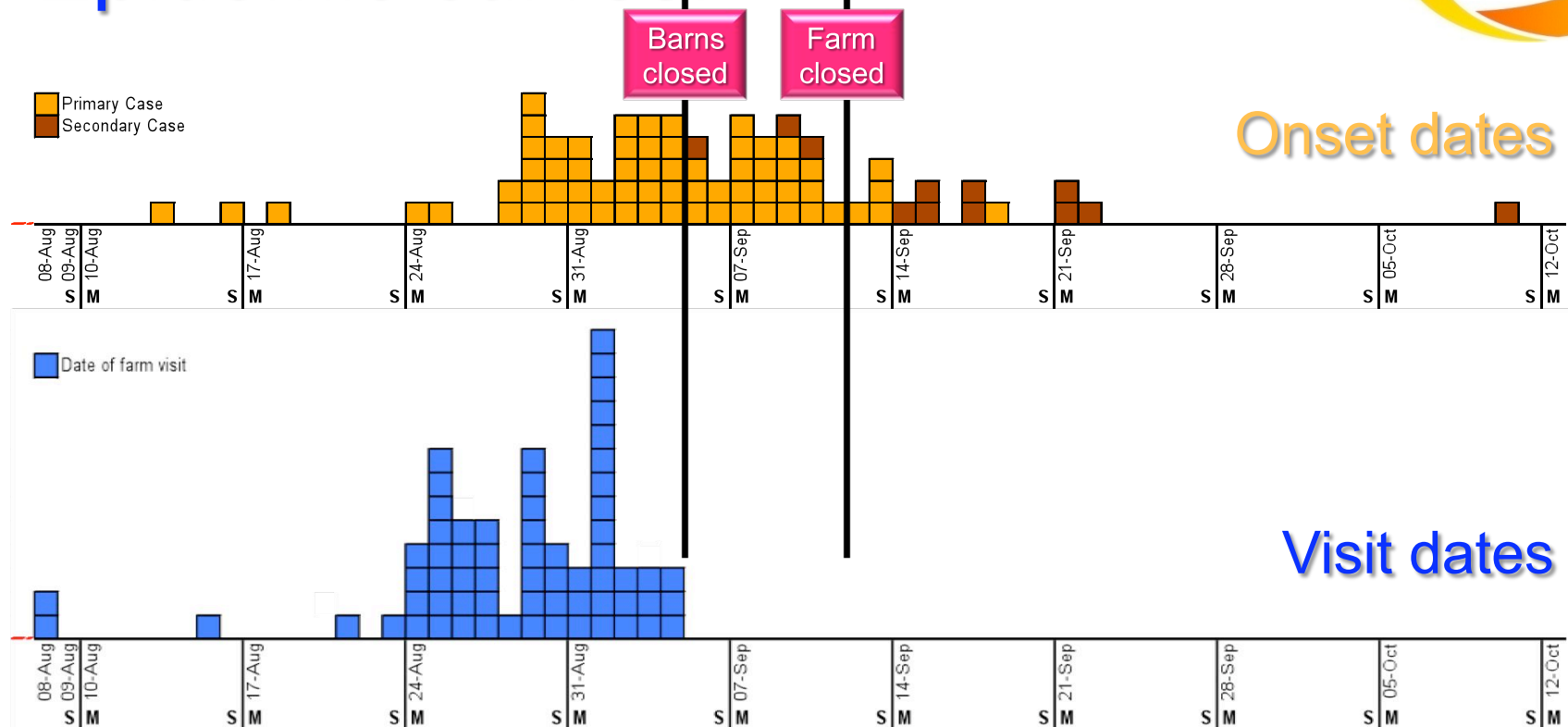


Epidemic curves.



Primary Case
Secondary Case

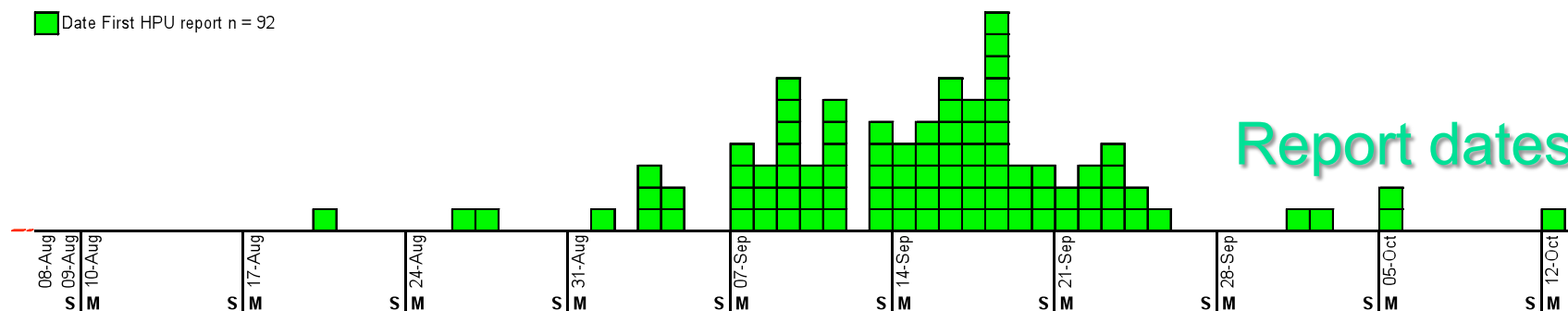
Onset dates



Visit dates

Date First HPU report n = 92

Report dates



Asymptomatic cases (N=15) are not shown.

Animal sampling.



| Farm Area | Animal | Positive for the outbreak strain (total) |
|---------------------------|---------------------|--|
| Large animal barn | Sheep (ewes) | 8(8) |
| | Lambs | 7(7) |
| | Pigs (sow & litter) | 2(2) |
| | Calf | 1(1) |
| | Kid | 6(6) |
| | Shetland pony | 3(3) |
| Top barn | Goats | 2(5) |
| | Pig | 2(5) |
| | Sussex cattle | 1(3) |
| Climb in rabbit enclosure | Rabbits | 1(32) |
| | | |

Case-control study.

Aim:

To determine risk factors for infection with VTEC O157 at Godstone Farm.

Population at risk:

Children < 11, who visited farm 23 August to 4 September.

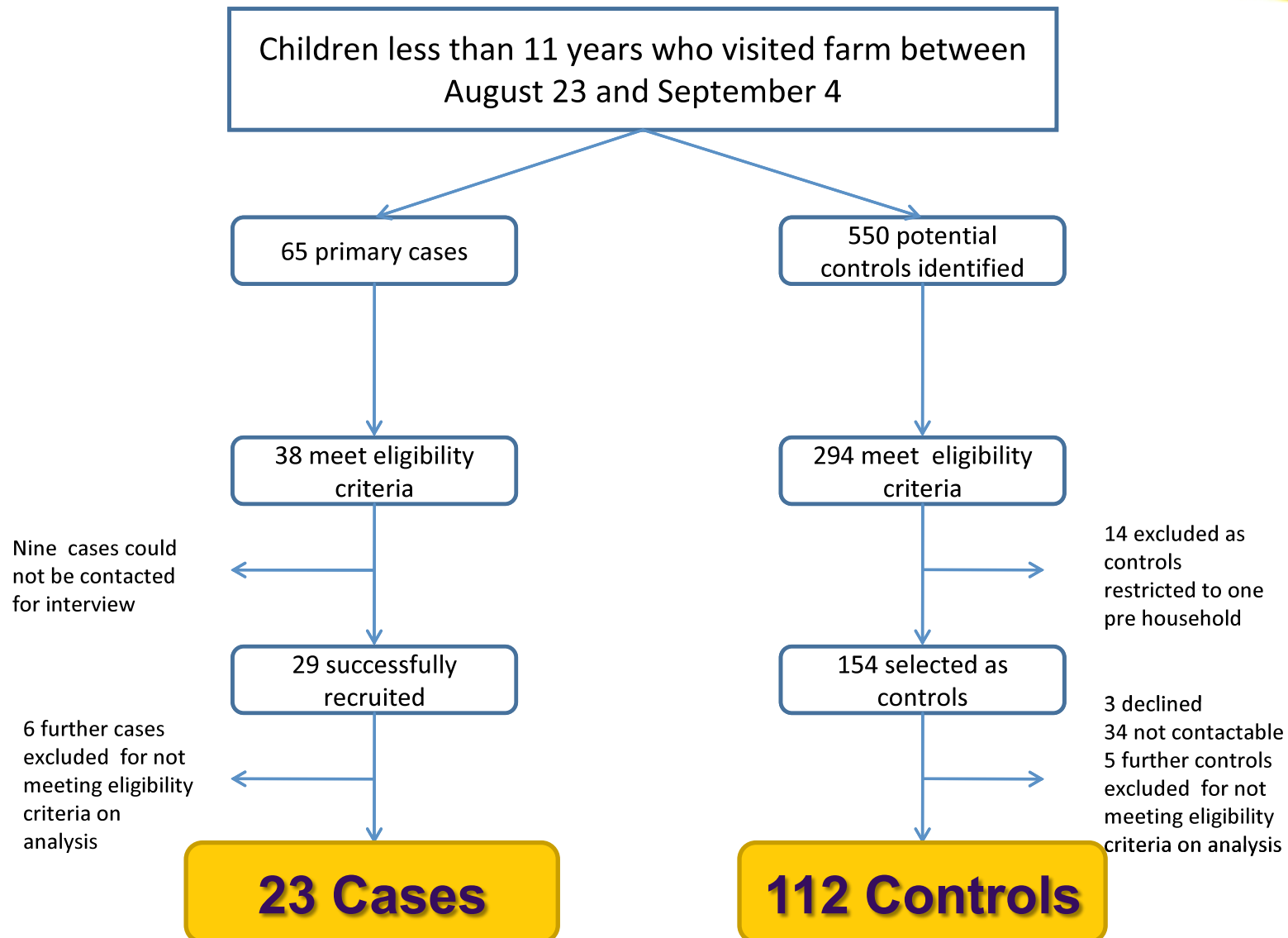
Case definition:

Primary case from the population at risk, with an onset date within six days of visiting farm *and* confirmed carriage of the outbreak strain of VTEC O157.

Control definition:

A child from population at risk with a history of no gastrointestinal disease in the 14 day period after visiting Godstone Farm.

Case-control study - methods.



Case-control study – analytical strategy.

Person:

- gender*;
- age*;
- ethnicity;
- underlying conditions.

* variables that were
controlled for.

Case-control study – analytical strategy.

Behaviour:

- time at farm;
- organised group*;
- day of visit*;
- entrance/exit;
- buggy;
- collect food pellets;
- collect straw;
- dummy use;
- bottle feeding;
- soft toys;
- thumb sucking;
- oral fixation;
- changing shoes/clothes;
- previous visits to petting farms.

Case-control study – analytical strategy.

Premises:

- large animal barn;
- rabbit enclosure;
- top barn;
- Shetland pony paddock;
- animal courtyard;
- maternity pens.



- pigs;
- cows/calves;
- goats/kids;
- sheep/lambs.



- washed hands after animal contact;
- washed hands before eating.

Case-control study – analytical strategy.

Activities:

- modelling;
- making felt animals;
- making grass heads;
- playing in sand pits;
- visiting play barn;
- playing on ride on toys;
- adventure playground;
- aerial slide;
- spinning room;
- tractor rides.

Case-control study – analytical strategy.

Food/water:

- drinking water;
- eating food bought at farm;
- eating picnic food bought elsewhere.

Case-control study – results single variable analysis.

Behaviour:

- Being part of an organised group;
- Visiting on Tuesdays or Thursdays;
- Staying more than five hours;
- Less likely to be a frequent visitor.

Premises:

- Rabbit enclosure;
- Large animal barn;
 - feeding goats;
 - petting sheep.

Case-control study – results single variable analysis.

Activities:

- Hand feeding animals;

Food and Water:

- Eating ice lollies.

Case-control study – results logistic regression analysis.

| Exposure | Odds ratio | Confidence intervals | p-Value |
|---|-----------------|------------------------------------|---------|
| Visiting the large animal barn | 4×10^8 | $2 \times 10^7 - 5 \times 10^9$ | <0.001 |
| Visiting the large animal barn and petting sheep | 1×10^9 | $9 \times 10^7 - 2 \times 10^{10}$ | <0.001 |
| Staying at Godstone Farm for more than five hours | 6 | 1 – 26 | <0.001 |
| Less than five previous visits to Godstone Farm | 40 | 5 – 300 | <0.001 |

Conclusions.

1. Epidemiological studies showed that illness was associated with coming into contact with animals in petting barns.
2. Animals in petting barns were shown to be excreting the outbreak strain.
3. We don't know why this outbreak was so much larger than others associated with open farms in England and Wales:
 - other farms have high visitor numbers;
 - hand washing facilities were available;
 - no new introductions;
 - same weather in other farms in the area.

Acknowledgements.



- Surrey and Sussex Health Protection Unit;
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