
E/S/R
Science for Communities

Ki uta ki tai - from the mountains to the sea

- Recognise and manage the interconnectedness of the whole environment
- Acknowledging the connections between:
- people and communities,
- people and the land,
- people and water.

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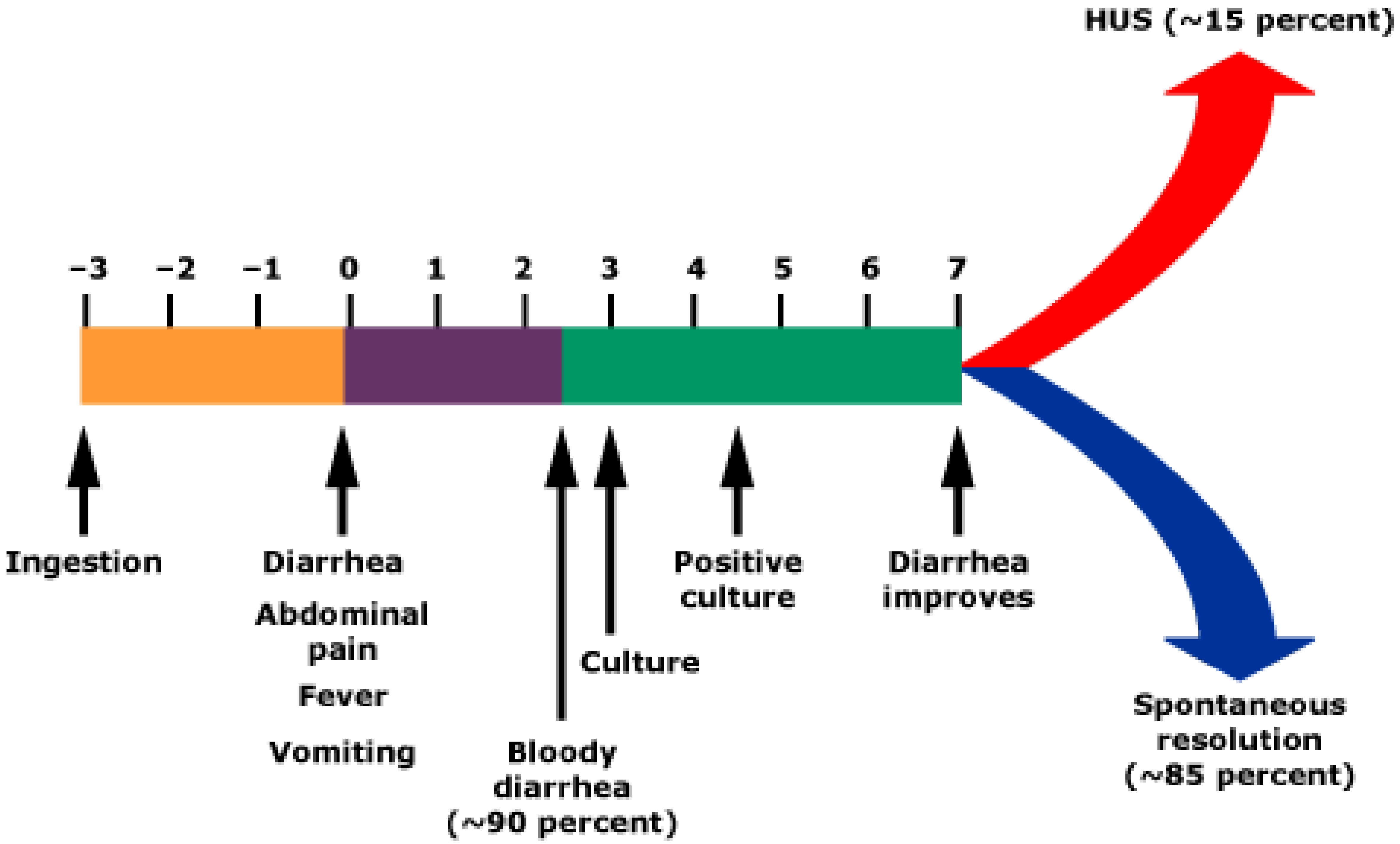
Escherichia coli

- Normal bowel flora
- Protective
- Causative agent of urinary tract infections, biliary infections (cholecystitis/cholangitis) and septicaemia
- AMR emergence
- virulence factors allow good bowel bugs to become bad bowel bugs
- EIEC, EPEC, ETEC, EAEC, DAEC

VTEC AKA STEC

- Verocytotoxin producing *E coli* = Shiga toxin producing *E coli*
- *stx*1 and / or *stx*2
- O157 – sorbitol non fermenter, tellurite and cefixime resistant
- And the rest: up to 187 different O types which are mainly sorbitol fermenting and not so tellurite resistant making them more difficult to find



Actually more like 2% in NZ

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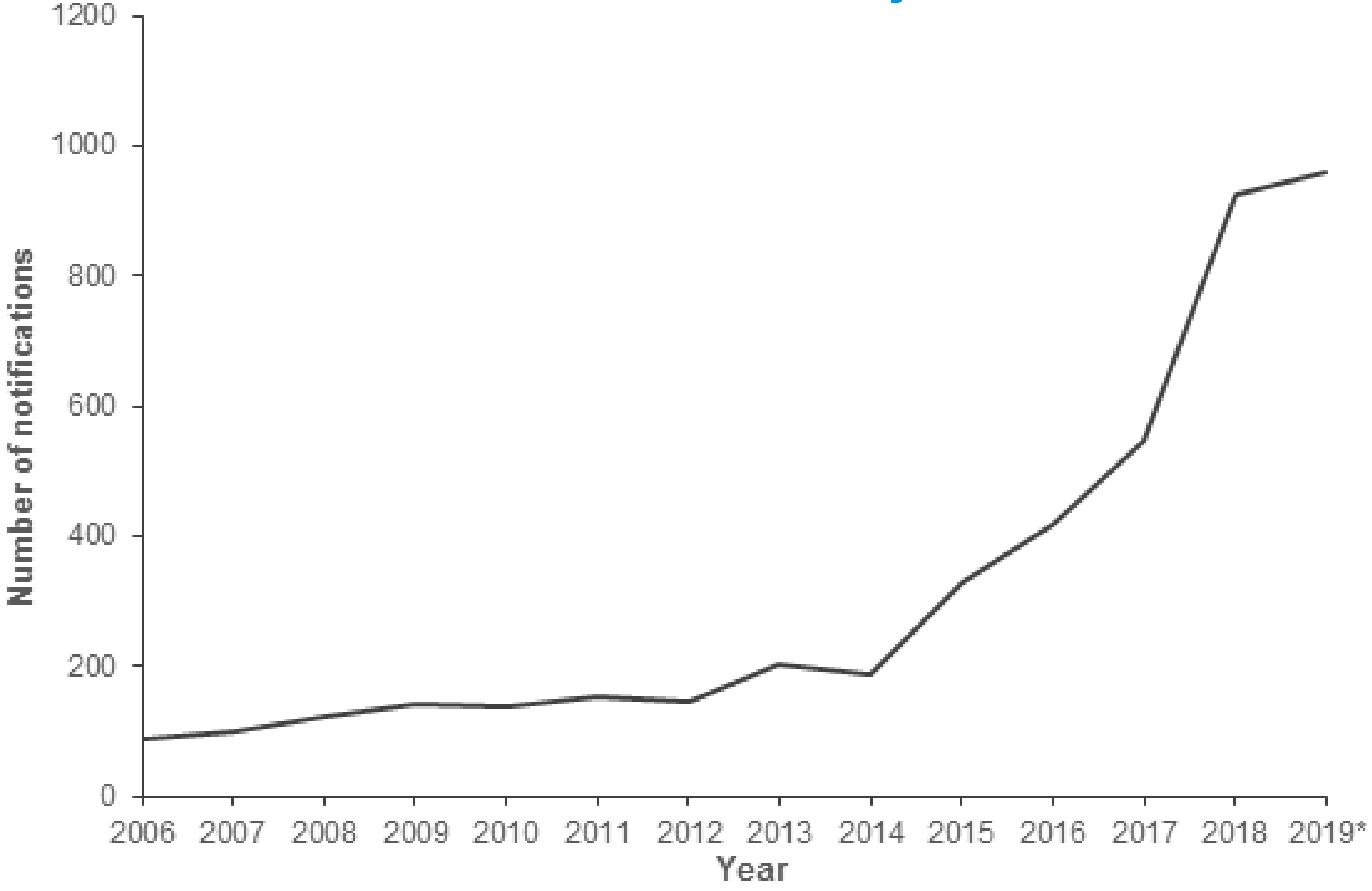
STEC notifications by year.

Note: 2019 data to 31 Oct 2019 only



Source: EpiSurv 18 November 2019

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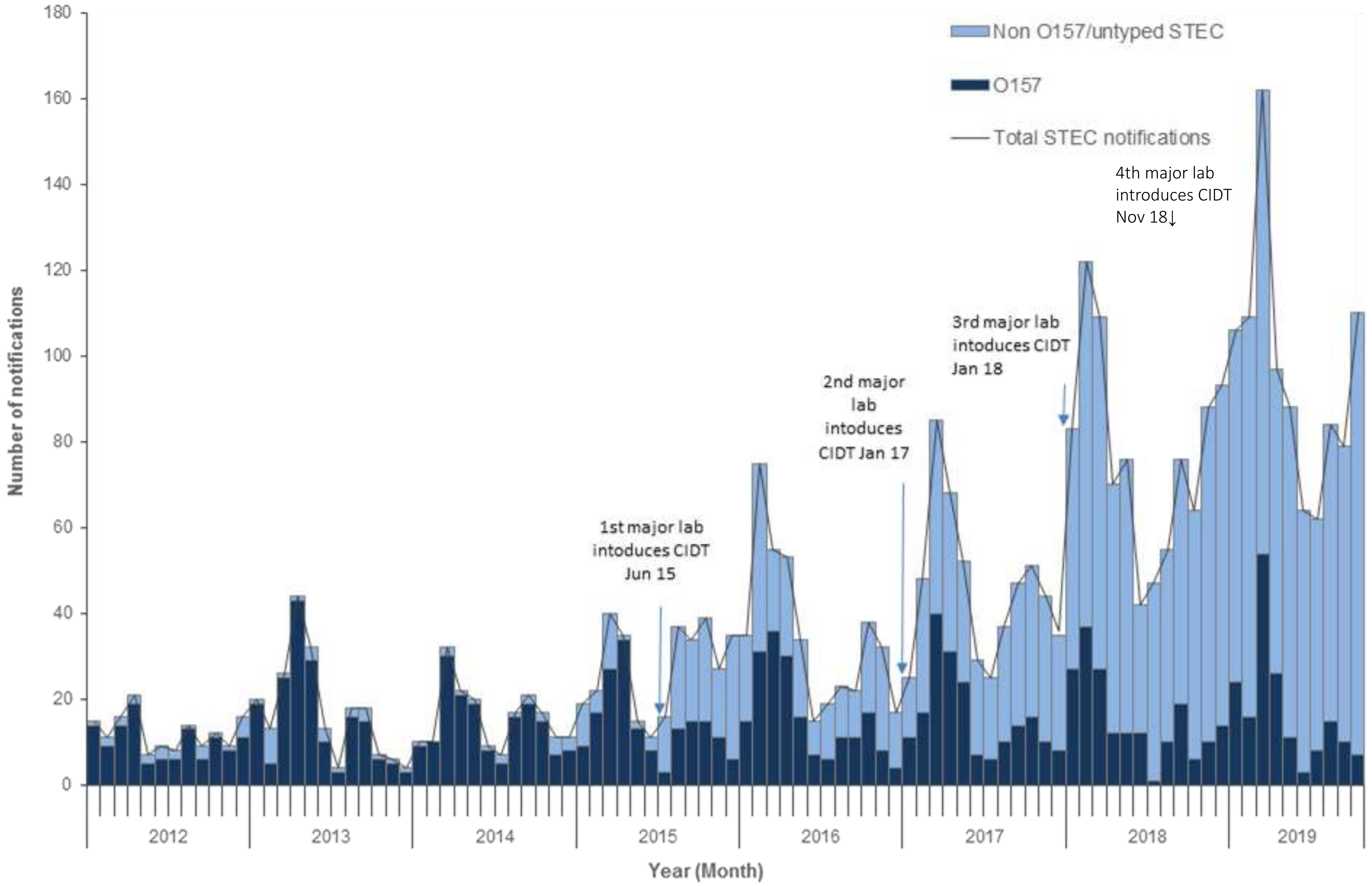
STEC notifications by month and year, Jan 2012 to Oct 2019



(Source: EpiSurv 18 November 2019)

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FAO/WHO STEC Expert Group

- Complex pathogenicity
- Adherance essential for pathogenicity
- Serotype does not predict pathotype
- Host factors play a significant role
- Order of significance:
- *stx*2a + *eae* or *agg*R
- *stx*2d + *eae*
- *stx*2c + *eae*
- *stx*1a + *eae*
- rest

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US Top 7 vs EU Top 6

US Top 7 *eae* +	EU Top 6 *eae*/*aai*C /*agg*R
O157	O157
O26	O26
O45	
O103	O103
O111	O111
O121	O104:H4
O145	O145

"Serotype does not predict pathotype"……………………………….

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Which serotypes elsewhere?

- O146 emerging in Japan
- O91 emerging in Argentina
- O55 emerging in Britain
- Many types associated with serious illness ……………………
- Danish have seen 117 different VTEC serotypes in the last 17 years
- Emergence worldwide of *stx*2 +ve O26
- Emergence of hybrid strains – ETEC + VTEC

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The most common STEC O types confirmed in NZ human clinical samples in 2018 were:

Serotype	*Stx*1	*Stx*2	*eae*
O157:H7	+/- 1a	+/- 2a or 2c	+
O26:H11	+/- 1a	+/- 2a	+
O128:H2	+/- 1c	+/- 2b	-
O146:H21 or H28	-	+ 2b	-
O38:H26	+ 1c	+/- 2b	-
O123/186:H2 or H10	+/- 1c	+/- 2b	-
O103:H2 or H25	+ 1a	+/- 2c	+
O174:H8	+ 1c	+/- 2b	-
O176:H4	+ 1c	+/- 2b	-
O91:H14 or H21	+/- 1a	+/- 2b	-

+/- = variable – positives and negatives seen

Purple = US Top 7/ EU Top 6

Note: *agg*R and *aai*C not noted in NZ isolates to-date

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NZ Haemorrhagic Colitis cases January 2016 – October 2019

O types represented	*Stx1*	*Stx2*	*eae*	total
O157, O165	+	+	+	108
O157, O26, ONT	-	+	+	278
O103, O111, O123/186, O145, O152, O153, O157, O182, O26, O45, O5, O84, O85, O87, ONT	+	-	+	81
O12, O128, O130 O176, O123/186, O38, O80, O91, ONT	+	+	-	30
O113, O128, O130, O146, O153, O158, O163, O171, O64, O8, O91, Onovel32, ONT	-	+	-	36
O104, O117, O128, O174, O176, O187, O38, O78, O88, ONT	+	-	-	16

Red = NZ top 10 only, Purple = NZ top 10 and US or EU Top 6/7, Green = US or EU Top 6/7 only

NT = Organism isolated in pure culture but not able to be O typed by phenotypic methods

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NZ STEC-associated Haemolytic Uraemic Syndrome January 2016 – October 2019

- 59 cases
- Age range 9 months – 89 years
- 42 cases < 16 years old (ie 29% adults)
- STEC isolate confirmed in 47 cases
- O157:H7 n = 33
- O26:11 n = 8
- O130:H11 n = 2
- O38:H26, O91:H21, O128:H2, O171:H2 1 case each

Red = NZ top 10 only,
Purple = NZ top 10 and US or EU Top 6/7,
Black = relatively uncommon in NZ (based on current information)

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STEC associated with HUS NZ January 2016 – October 2019

Serotype	*Stx1*	*Stx2*	*eae*
O157:H7 n = 30	-	2a	+
O157:H7 n = 2	1a	2a	+
O157:H7 n = 1	-	2c	+
O26:H11 n = 7	-	2a	+
O26:H11 n = 1	1a	-	+
O130:H11 n = 2	-	2a	-
O128:H2 n = 1	1c	2b	-
O38:H26	1c	2b	-
O171:H2	-	2c	-
O91:H21	-	2a	-

FAO/WHO STEC Expert Group
Order of significance:
*Stx*2a + *eae* or *agg*R
*Stx*2d + *eae*
*Stx*2c + *eae*
*stx*1a + *eae*
rest

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STEC sources and vehicles

- Large ruminants
- Small ruminants
- Undercooked mincemeat
- Water
- Flies
- Cider (likes a low pH)
- Flour
- Leafy vegetables
- Sexual transmission

NZ 2000

Table 2 Source, serotype, Stx/*stx* type and enter
(Ehly) production in Shiga toxin-producing *Escherichi*
isolated from retail meat

Source of STEC	Serotype	Stx/*stx*
Beef:		
mince	O128:H2	stx_1 stx_2
mince	O128:H2	stx_1 stx_2
mince	Ont:H21	stx_2
mince	O128.H2	stx_1 stx_2
stir-fry	O144.H2	stx_1 stx_2
pet-food	O27:H21	stx_2
hamburger	Ont.H–	stx_1 stx_2
hamburger	O8:H–	stx_2
hamburger	O15:H27	stx_1 stx_2
hamburger	O81:H26	stx_1
Lamb		
steak	O91.H–	stx_1 stx_2
stir-fry	O171.H2	stx_2
steak	Ont.H4	stx_2
mince	O128:H–	stx_1 stx_2
mince	O81:H26	stx_1 stx_2
mince	O5: H–	stx_1

H.J.L. Brooks B.D. Mollison K.A. Bettelheim K. Matejka K.A. Paterson VK. Ward. Occurrence and virulence factors of non-O157 Shiga toxin-producing *Escherichia coli* in retail meat in Dunedin, New Zealand
Letters in Applied Microbiology 2001,32, 118-22

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NZ 2006

- 21 different STEC serotypes were detected
- Cattle: O5:H–, O9:H51, O26:H11, O84:H–/H2 and O149:H8
- Sheep: O26:H11, O65:H–, O75:H8, O84:H–, O91:H–, O128:H2 and O174:H8

- If nationally representative, this study confirms that cattle and sheep in New Zealand may be a major reservoir of STEC serotypes that have been recognised as causative agents of diarrhoeal disease in humans.

Cookson, AL; Taylor, SCS; Bennett, J; Thomson-Carter, F; Attwood, GT

Serotypes and analysis of distribution of Shiga toxin-producing Escherichia coli from cattle and sheep in the lower North Island, New Zealand
New Zealand Veterinary Journal, Volume 54, Number 2, April 2006, pp. 78-84(7)

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NZ 2011-12

- National prospective case–control study from July 2011 to July 2012
- 113 eligible cases and 506 controls were analysed
- Environmental and animal contact, but not food, = significant exposure pathways

A prospective case–control and molecular epidemiological study of human cases of Shiga toxin-producing Escherichia coli in New Zealand. Jaros et al. BMC Infectious Diseases 2013, 13:450 http://www.biomedcentral.com/1471-2334/13/450

What we do know for NZ

- Cows and sheep known reservoirs
- Large range of sero and toxin types associated with clinical disease including serious presentations
- Organisms present in surface water
- Surface pathogens have potential to enter ground water (Havelock North)

What can we do right now

- Limit spread from known reservoirs to known vehicles in the environment
- Riparian planting of rural streams and waterways
- Work together to extend our collective NZ knowledge beyond the US/EU Top 7 to identify all reservoirs, vectors and transmission pathways to develop strategies to interrupt the infection path and improve personal and public health

What we don’t know for NZ

- Carriage rates in other animal sources including rodents
- Asymptomatic carriage rates in humans in NZ
- Role of person-person spread
- Role of irrigation water from surface sources
- Insects
- Birds
- Additional pathways from source to human

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Jackie Wright on behalf of ESR

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