

Reducing *Escherichia coli* O157 risk in rural communities

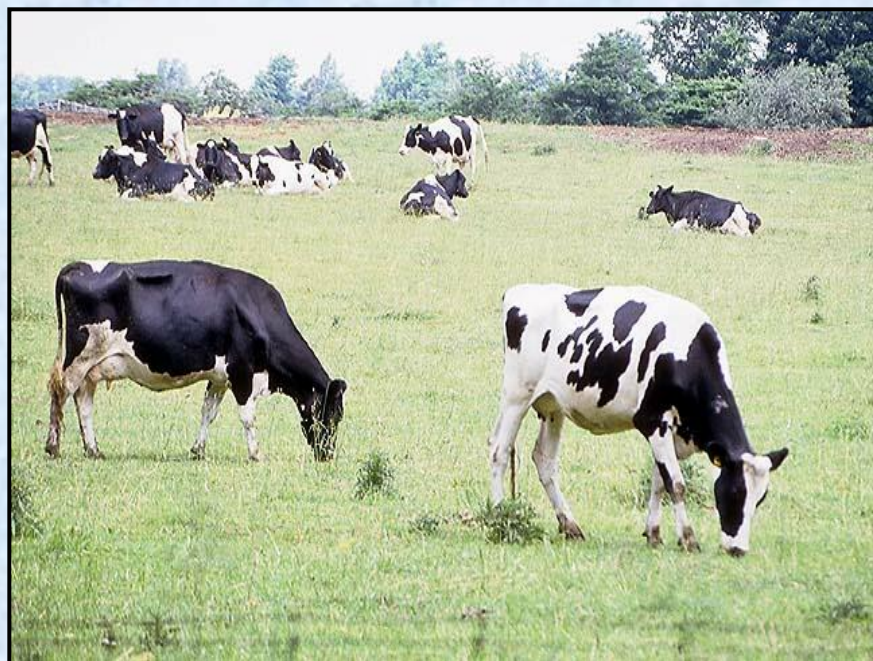
Microbial persistence, public awareness,
immunity, risk assessment, cost of infection
and acceptability of interventions

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on behalf of the RELU team

Aims of the talk

- Present an overview of findings from the RELU *E. coli* O157 risk research project
- Discuss in more detail findings of particular interest to ACMSF

The problem as we saw it 2007



- *E. coli* O157:H7 resides in the gut of ruminants without effect.
- Excretion rates $1 - 10^5 \text{ cfu g}^{-1}$ faeces
- About 200 cases/yr in Scotland and 1,000 in England & Wales
- Disease can be severe: bloody diarrhoea, Haemolytic Uraemic Syndrome, death
- Young children, the elderly and people living in rural areas are at greatest risk

Research approach

- Six discrete work packages
- Integration of social and natural sciences
- Comparison of north Wales and Grampian
- Engagement of stakeholders
- Intervention focus

Survival in soil

No differences between soil types (8 tested)

Survival

Decreased rapidly during first 7d
then relatively constant until end of experiment
(120d)

Reactivates

within 9 hours
more strongly at lower temperatures

Public awareness

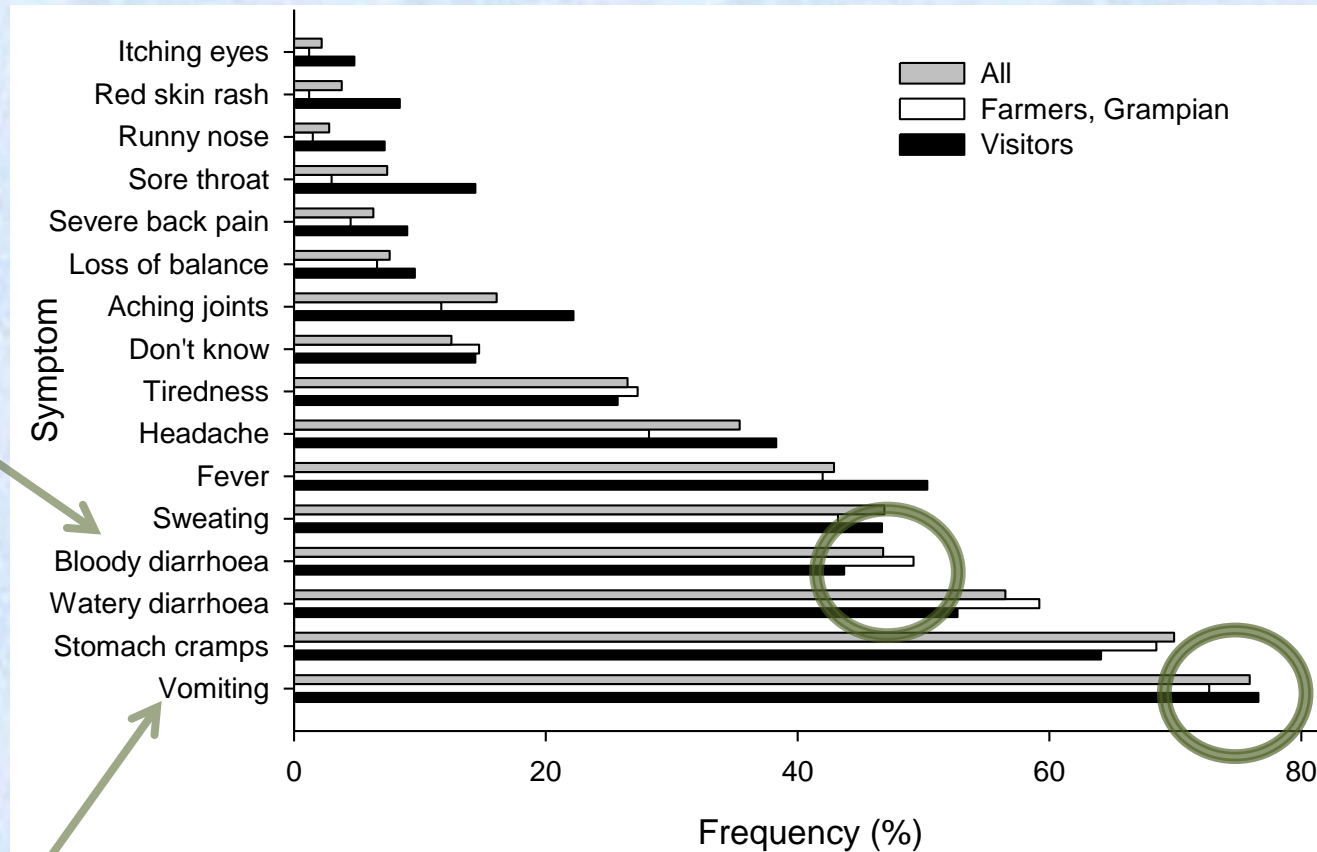


- Survey by questionnaire: 2031 respondents
- 2 study areas: Grampian and north Wales
- 4 groups: farmers, residents, visitors, abattoir
- 53 interviews with stakeholders

Relative importance of infection source by approach

Region	Source:	Risk Factor Model	QMRA	Attitude and Awareness Survey	
		%cases (95% CI)	% cases (95% CI)	Source:	% likely (95% CI)
GRAMPIAN	environment	65.8 (49.6 – 82.0)	56.1 (52.2 – 60.4)	contact with animal faeces	62.1 (56.0 – 68.3)
				handling farm animals	35.8 (30.3 – 41.3)
				contact with soil and mud	28.6 (23.5 – 33.8)
				streams, rivers, ponds, lakes	23.7 (19.0 – 28.4)
				contact with household pets	13.8 (10.1 – 17.4)
	food	26.9 (11.0 – 42.8)	34.0 (28.7 – 39.4)	breathing outside air	2.5 (1.0 – 4.1)
				eating undercooked meat	55.9 (49.7 – 62.1)
				eating raw vegetables	12.3 (8.9 – 15.8)
	water	7.3 (0.0 – 16.0)	9.9 (0.0 – 11.1)	using private water supplies	24.6 (19.9 – 29.4)
				using mains water	3.5 (1.7 – 5.3)
NORTH WALES	environment	21.9 (9.3 – 34.5)		toilets & wash hand basins	28.3 (23.3 – 33.3)
				contact with other people	10.1 (6.9 – 13.3)
				contact with animal faeces	56.4 (49.8 – 62.9)
				handling farm animals	33.9 (28.2 – 39.6)
				contact with soil and mud	27.3 (21.9 – 32.8)
	food	62.6 (48.0 – 77.2)		streams, rivers, ponds, lakes	25.3 (20.1 – 30.5)
				contact with household pets	17.9 (13.4 – 22.3)
				breathing outside air	2.6 (0.9 – 4.2)
	water	15.5 (9.7 – 21.3)		eating undercooked meat	66.7 (60.3 – 73.0)
				eating raw vegetables	17.0 (12.8 – 21.3)
NORTH WALES	person to person			using private water supplies	18.6 (14.1 – 23.2)
				using mains water	8.0 (5.0 – 10.9)
				toilets & wash hand basins	37.2 (31.3 – 43.0)
NORTH WALES	person to person			contact with other people	17.9 (13.6 – 22.3)

Public awareness



Being ill from *E. coli* O157

Are you concerned about *E. coli* O157?

☒ Yes ☐ No

If you are concerned about *E. coli* O157 please explain what concerns you

What concerns me as a livestock producer most is, the fact that we can't detect by looking at a heart whether it has O157 or not, and yet we are expected by the F.S.A. and others to endanger our lives belly clipping etc for purely Cosmetic reasons as there must be trillions of the ECOLI Bugs still on the hide after we have clipped and in fact we make it worse by clipping as the hearts get worked up and start shivering and covering them selves with white. No one at F.S.A or HSE gives a damn.

How seriously ill do you think you would be if you were infected with *E. coli* O157? (tick one only)

☒ not at all ill ☐ mild illness ☐ serious ☐ very serious ☐ don't know

Which of the following do you think are symptoms of an *E. coli* O157 infection? (tick all that apply)

<input type="checkbox"/> severe back pain	<input type="checkbox"/> headache	<input checked="" type="checkbox"/> aching joints	<input type="checkbox"/> loss of balance
<input type="checkbox"/> vomiting	<input type="checkbox"/> sweating	<input type="checkbox"/> red skin rash	<input type="checkbox"/> runny nose
<input type="checkbox"/> sore throat	<input type="checkbox"/> tiredness	<input type="checkbox"/> itching eyes	<input checked="" type="checkbox"/> fever
<input checked="" type="checkbox"/> stomach cramps	<input checked="" type="checkbox"/> bloody diarrhoea	<input type="checkbox"/> watery diarrhoea	<input type="checkbox"/> don't know

Describe your attitude to *E. coli* O157

a very serious problem that is being attacked from the wrong place as usual, why are we so bloody back-word in this country that we don't insist on steam sterilization of carcasses in our Abattoirs?? Why do the F.S.A. so called experts not check clean heart hides for ECOLI? they will find that they can have it to!

WHY was PROF Pennington not challenged ^{over} his stupid and misguided Belly-Clipping report??

Communicating *E. coli* O157 rural risk

Last Updated: Thursday, 27 July 2006, 15:54 GMT 16:54 UK

E-mail this to a friend

Printable version

Child dies from E.coli infection

A two-year-old child has died after contracting the E.coli O157 infection.

The girl, from Ballantrae, in South Ayrshire, died at the weekend after being taken to the Royal Hospital for Sick Children in Glasgow.



The girl who died had been



Wishaw 1996

New Deer 2000

VIRULENCE

Toxin genes - *vt1*, *vt2*

Attaching genes *eae*

Non O157 VTEC

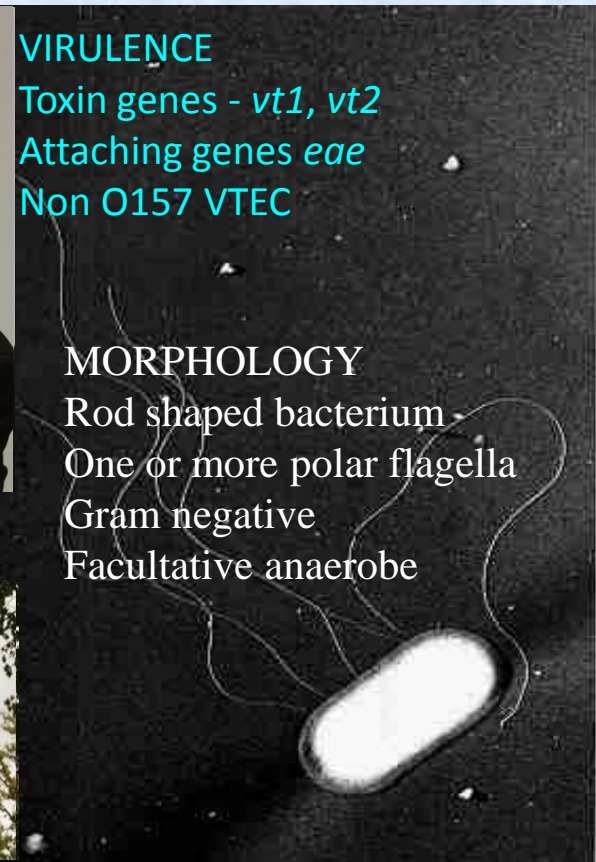
MORPHOLOGY

Rod shaped bacterium

One or more polar flagella

Gram negative

Facultative anaerobe



SOUTH WALES E.COLI OUTBREAK



Guilty plea 'long overdue'

Mother of victim welcomes butcher's guilty pleas

LATEST

- ▶ Meat butcher pleads guilty
- ▶ No prosecution over death

Who do you think should be responsible

*A Bloody stupid question
we cannot see with*



Immunity

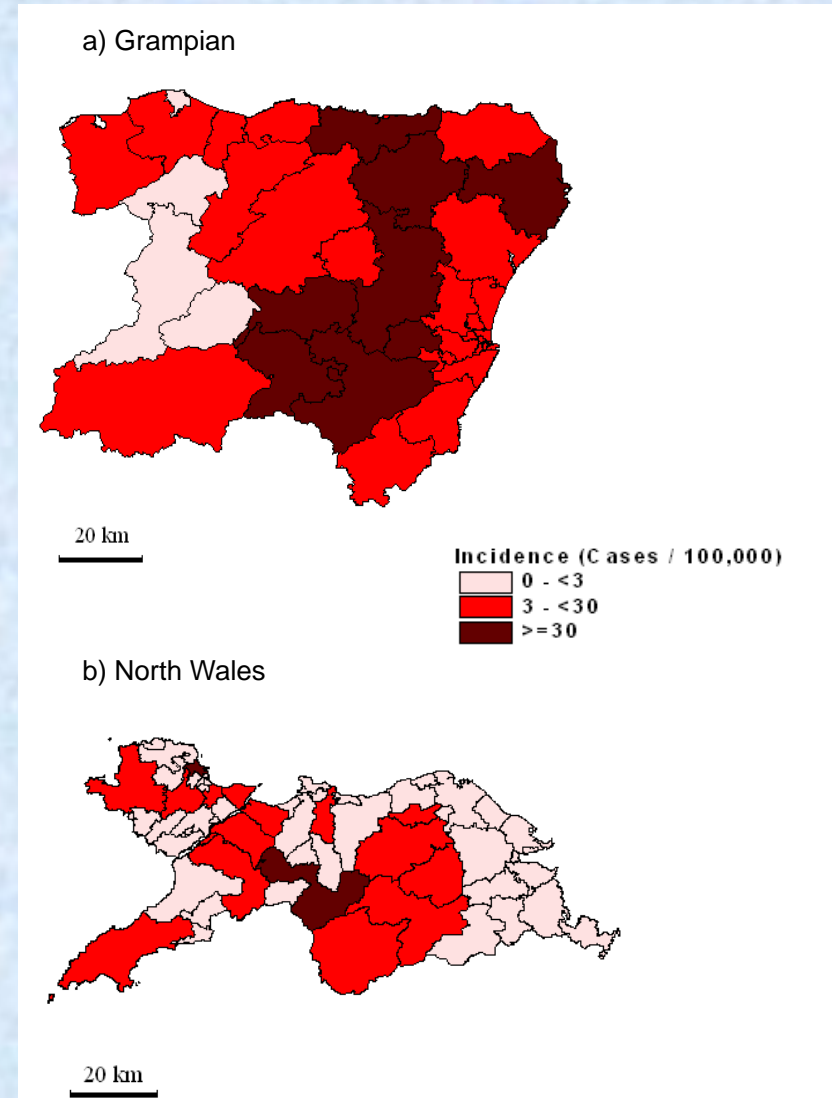
Serum antibody levels to *E. coli* O157

- Farm workers and their families from Norwich, Hereford, Preston (2000): 3%
- RELU study (2010) four groups (farmers, abattoir workers, rural and urban residents)
541 tested of which 27 were positive.



Risk assessment

1. The human incidence of *E. coli* O157 infection is 4.3 fold higher in Grampian than North Wales.
2. The ratio of rural to urban cases is the same in Grampian (2.0) as it is in North Wales (2.3).
3. The relative proportion of cases associated with Food or Environment is higher than for Water.



The predicted mean number of cases attributed annually by transmission pathway in Grampian*.

Risk Factors	Percent cases attributed (95% CIs)		
	Food	Env	Water
Regression	26.9	65.8	7.3
Model	(11.0 – 42.8)	(49.6 – 82.0)	(0 -16.0)
Risk	56.1	34.0	9.9
Assessments	(52.2 – 60.4)	(28.7 – 39.4)	(0.0 – 11.1)

***Important caveats**

- model assumptions
- over-prediction by risk assessment

The efficacy of risk mitigation strategies suggest that:

Food (burgers)

- Proper cooking is required
- Removal of high shedding animals from the food chain

Environment

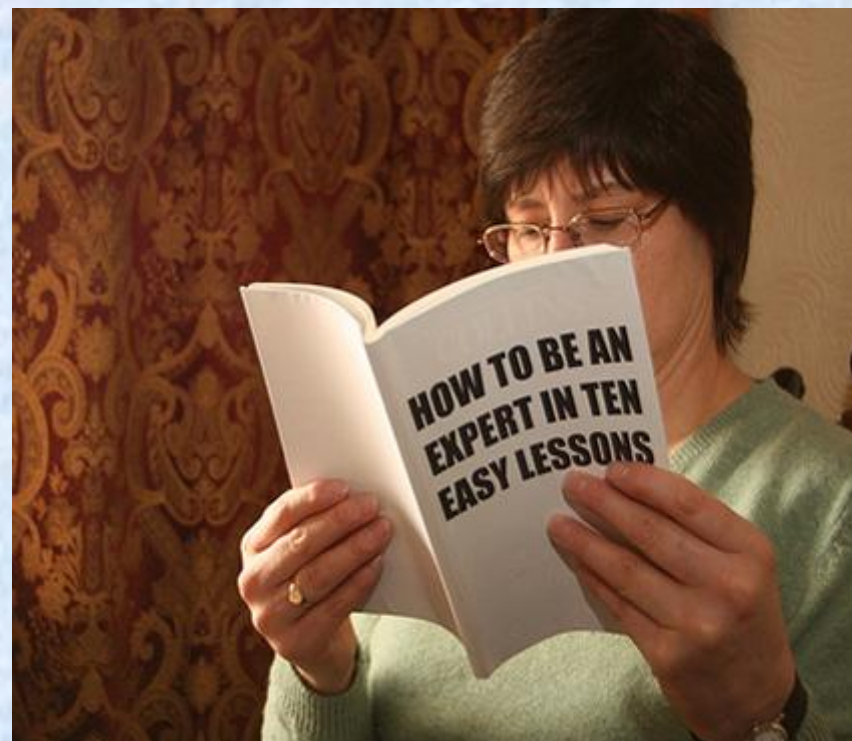
- Banning camping on fields recently grazed by cattle.
- Mitigations involving hand washing, reducing prevalence/concentration shed, keeping animals off pasture prior to visit

Water

- increasing proportion of PWSs treated
- Banning PWSs in areas with high cattle & sheep densities

Combining lay and technical views of risk.

1. Higher level of lay knowledge of *E. coli* O157 was claimed in high incidence disease areas.
2. Personal likelihood of infection was the same in high and low disease incidence areas.
3. Food and environment ranked as higher risk than water in agreement with technical risk assessment.



RELU Economic Costs



So far, we have collected data from 42 cases. The costs estimated from those who participated in the questionnaire survey were (cost per case):

- NHS costs: £4,413
- Personal costs (direct out-of-pocket): £38
- Lost employment costs (opportunity costs): £1,543
- **Total cost for Acute Phase: £5,994**
- Total estimated cost for England and Wales: £7.2 million

There was one HUS case amongst recruited cases – not necessarily representative of HUS cases; costs of this were added to total;

We have estimated the number of severe cases from the literature and estimated the cost of £17,661 (discounted value) over 30 years per cohort case by up dating costs of cases in Roberts and Upton, 2000 to present day prices

Costs of E.coli O157 to public and environmental establishments is being investigated and will be reported later

Is E coli a significant concern?

Consultation process with farmers and public

Low Control
High Worry

High Worry
High Control

Worry

Control

Heart Attack

House Fire

Burglary

E coli

Run Over

Diabetes

Depression

Salmonella

Pesticides

Hormones

Climate Change

BSE

Swine Flu

Bird Flu

Allergy

Cloned

GM

Mobile Phones

Additives

Lightning

Low Control
Low Worry

High Control
Low Worry

Practicality & Effectiveness of Measures to Reduce E coli O157 risk

many potential measures

+

absence of hard evidence on measures

+

a (perceived) need to act

= a problem

Practicality & Effectiveness of Measures to Reduce E coli O157 risk

Identify best candidate measures :

highly effective

+

highly practical

Consultation & Elicitation Process

Round 1

Identified 100 measures

Contacted 53 experts

Shortlist of 30 measures

Round 2

Contacted 70 experts

Survey on 30 measures' **Practicality & Effectiveness**

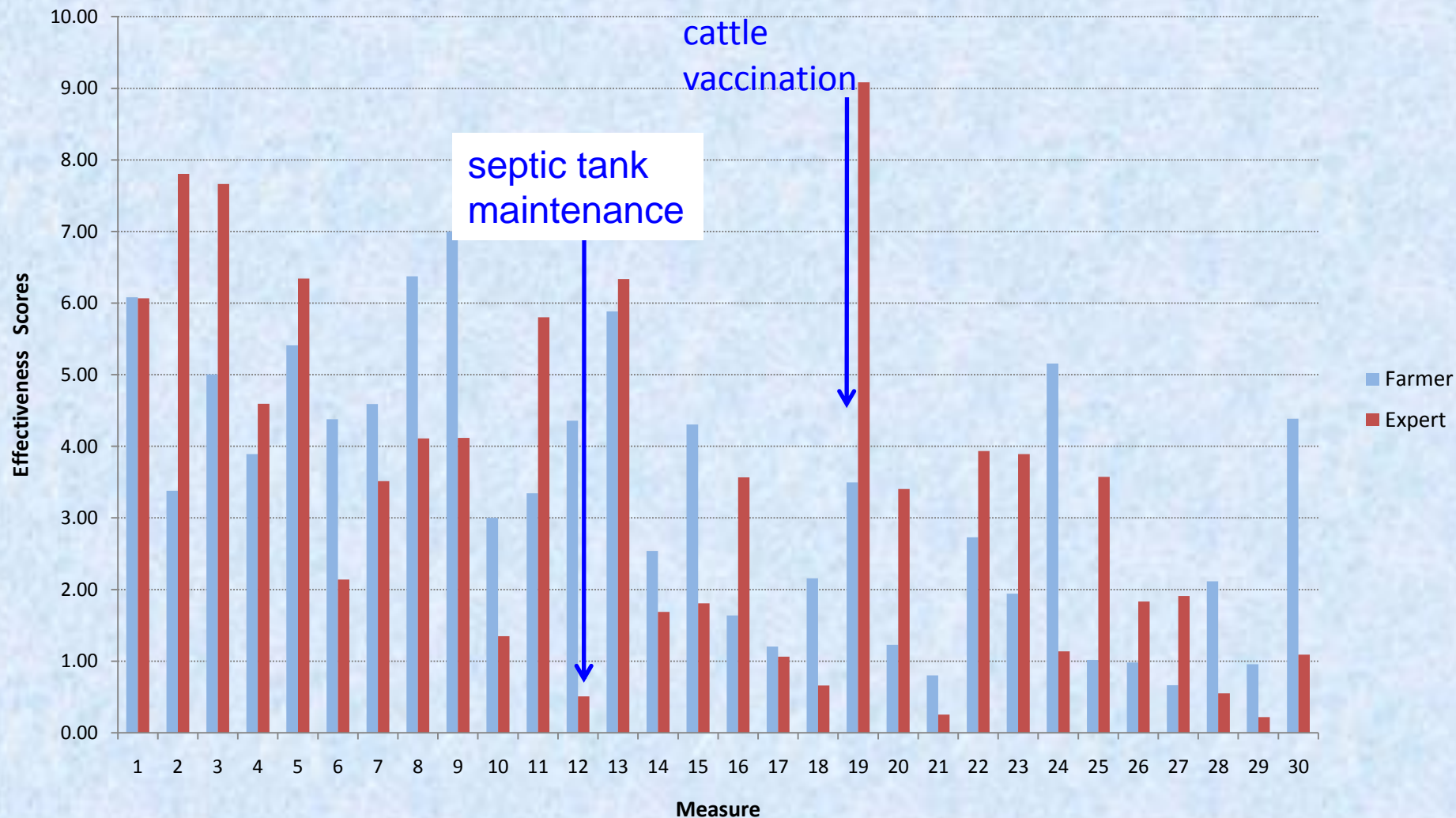
Round 3

Farmers complete surveys:

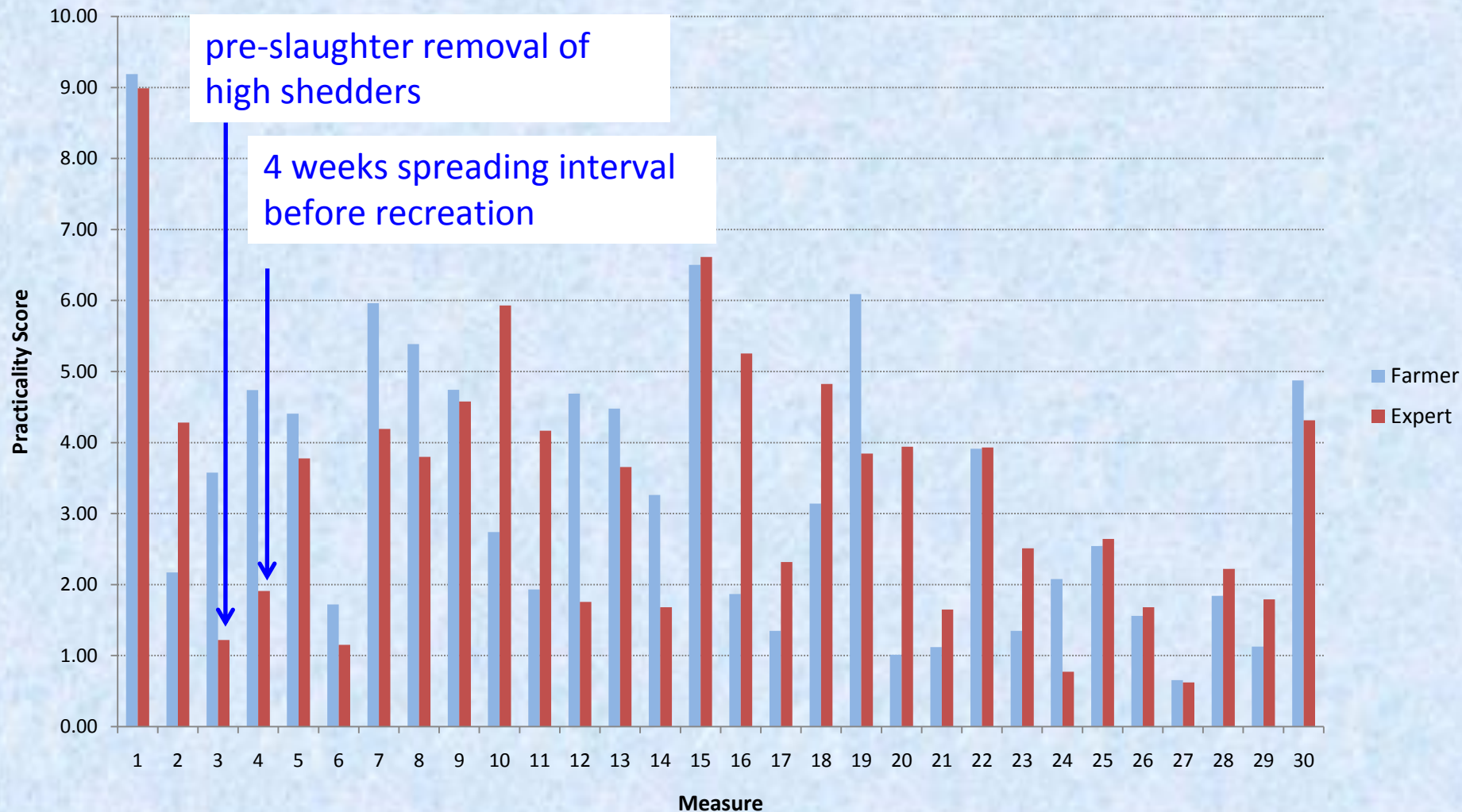
Practicality: 112 Farmers

Effectiveness : 90 Farmers

Effectiveness of Measures to Reduce O157 Risk



Practicality of Measures to Reduce O157 Risk



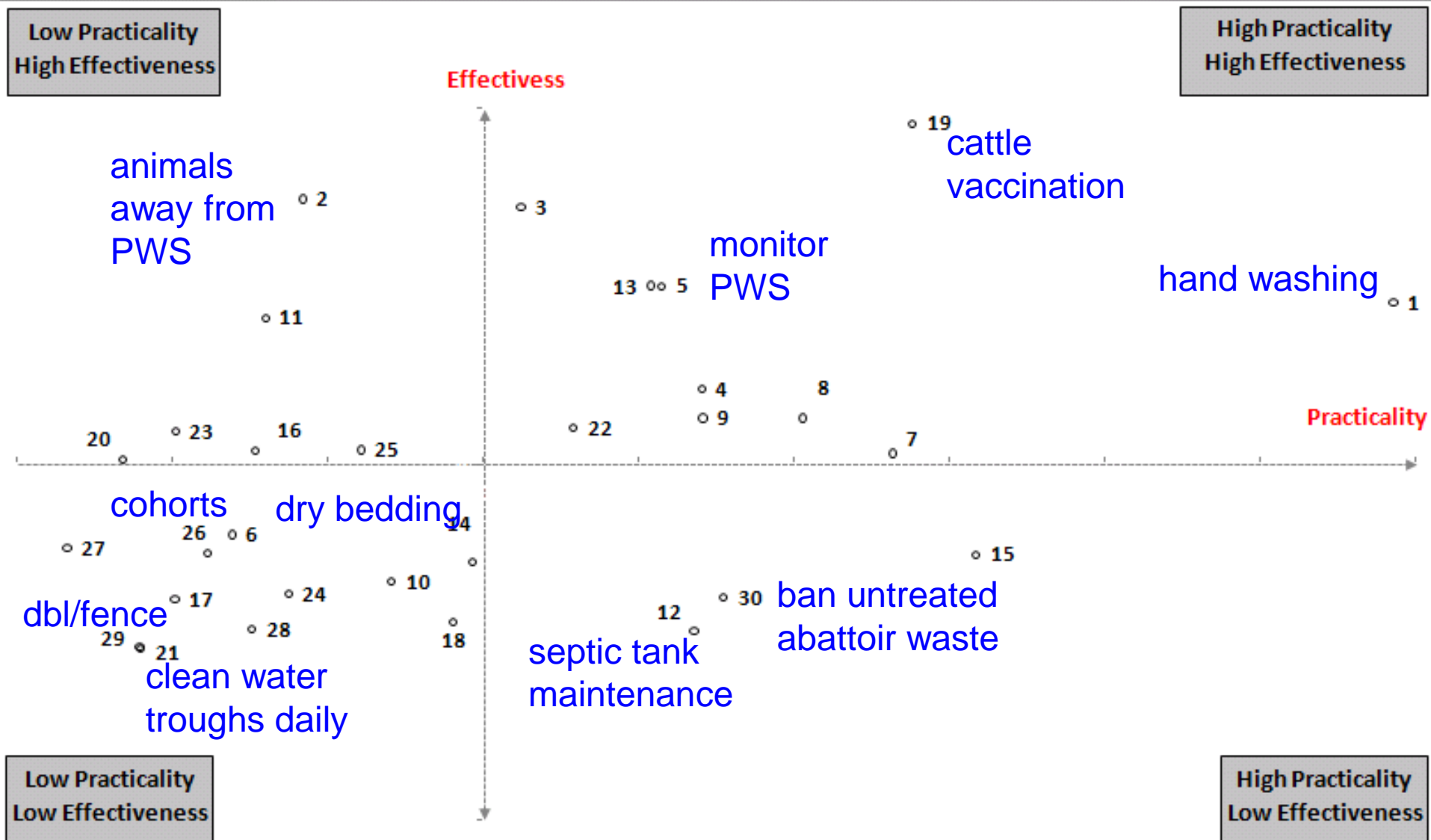
Consultation & Elicitation Process

Combine

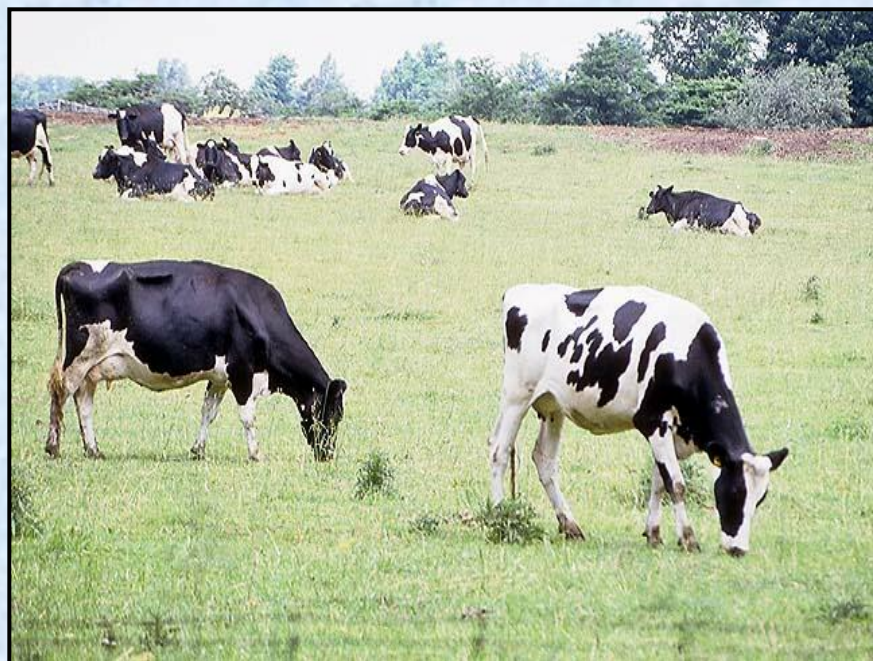
Experts' Effectiveness scores

with

Farmers' Practicality scores



The situation as we see it 2010



- Environment and food are more significant sources than private water supplies
- Public awareness of bloody diarrhoea as a symptom is low
- No single ideal intervention identified by expert elicitation
- Working on costs of infection versus costs of mitigation
- Young children could be focus for risk governance

The RELU team



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