

E/S/R

Science for Communities



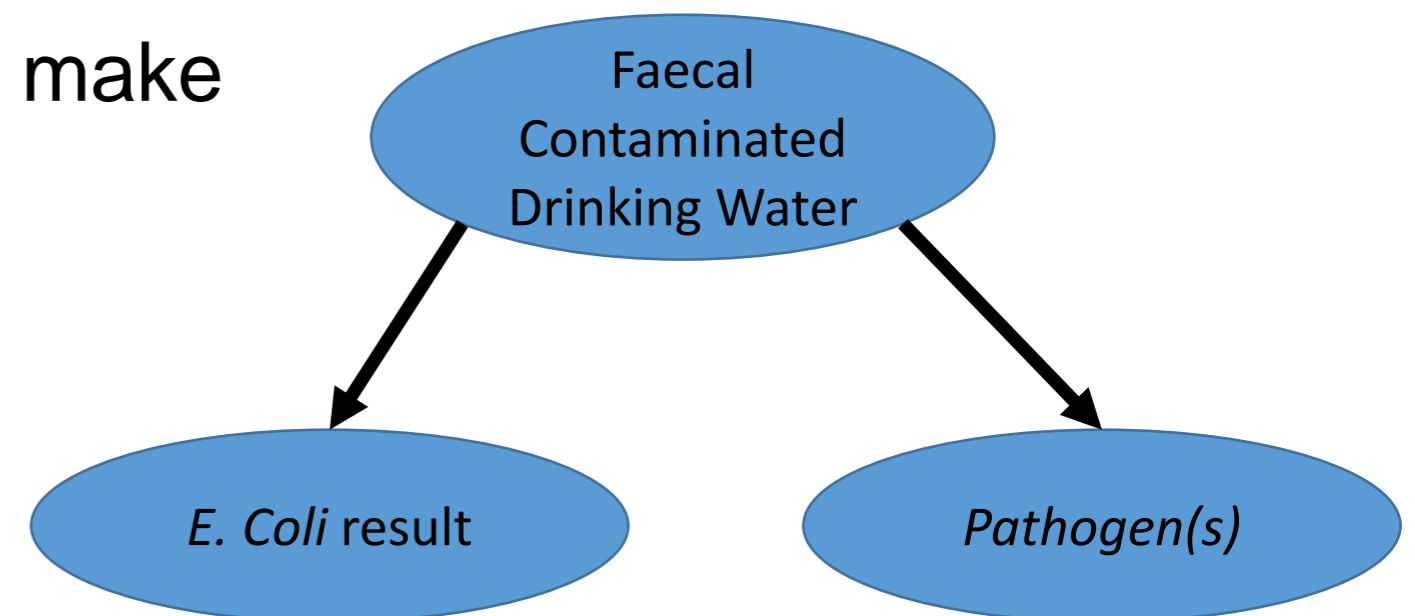
Learning from the past *E. coli* transgressions

David Wood, Chris Nokes, Barry Mattingley
Water NZ 19th September 2018

What are *E. coli* transgressions?

Why should we care?

- [*E. coli*] A bacterium used as an indicator that faecal contamination of the water has almost certainly occurred, so pathogens may be present in the water.
- [Transgression] Of the Drinking-water Standards for New Zealand (DWSNZ), occurs when a determinand [*E. coli*]... is present in the sample exceeds the maximum acceptable value (MAV).
- Pathogens in drinking water have the potential to make people ill.
- Generally consumers cannot detect faecal contaminated water through taste or smell.



Background

- Analysis showed that too many *E.coli* transgression are a significant cause for failing the bacteriological drinking-water standards.
- Even though suppliers take corrective action in response to transgressions a number of supply experienced repeat transgressions, suggesting corrective action many not have addressed the root cause.
- We have an extensive information on drinking water supplies and compliance with the standards from the annual survey of drinking water quality.

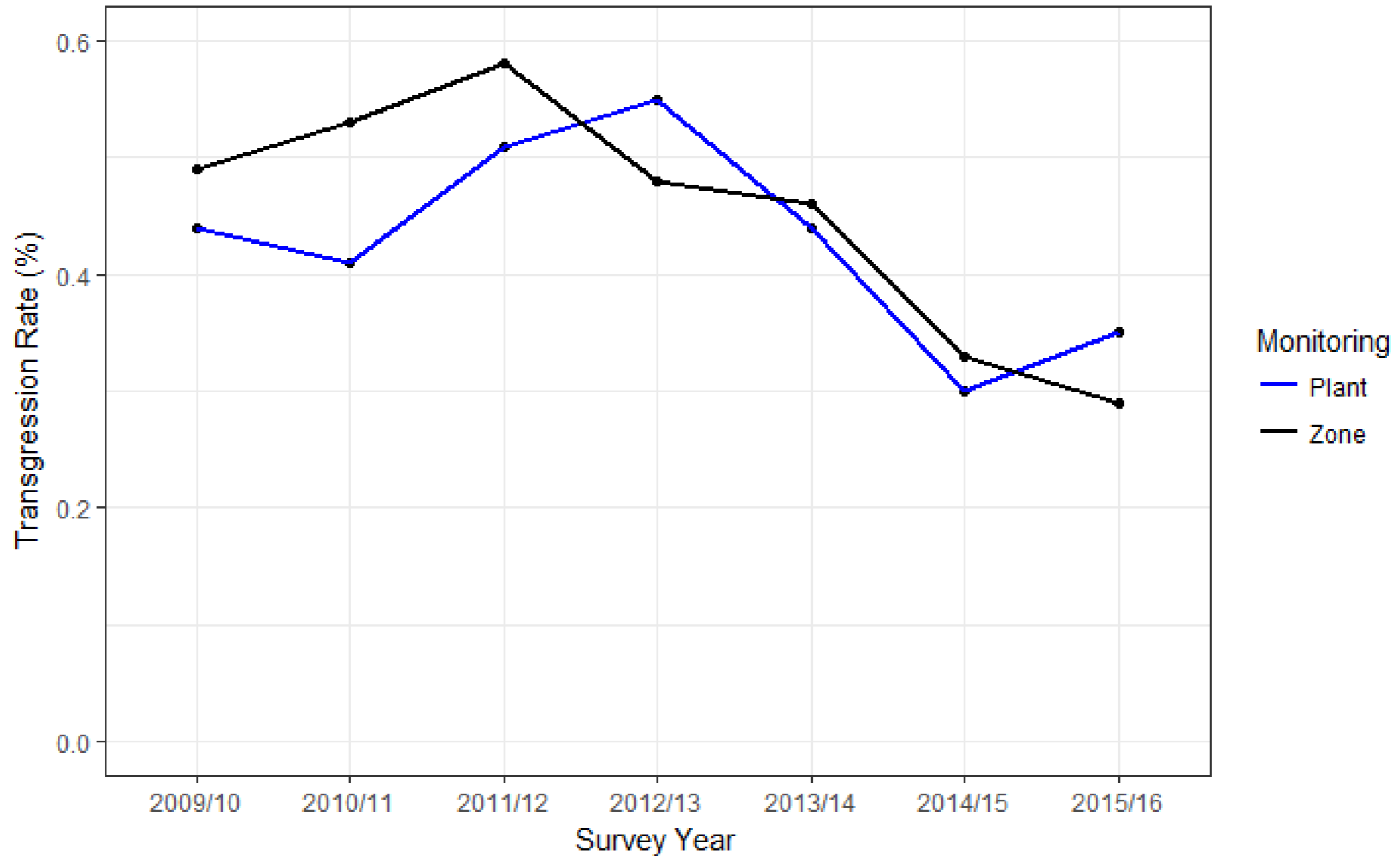
Question

- What are the causes of intermittent *E. coli* transgressions and what part does disinfection play?

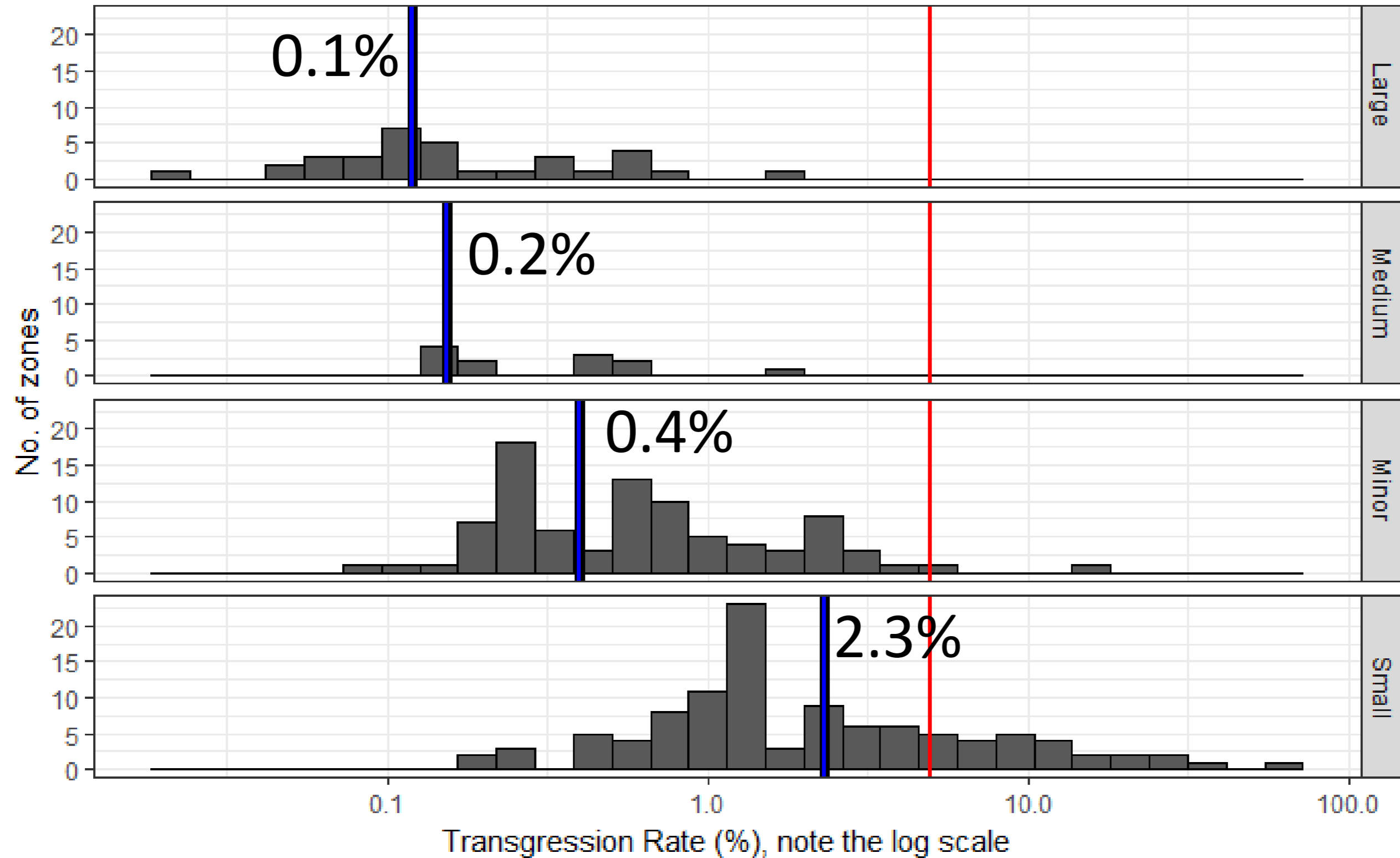
The approach

- Two pronged multimethod approach:
 - Statistical analysis of seven years annual survey of drinking water quality data.
 - Targeted semi structured interviews.

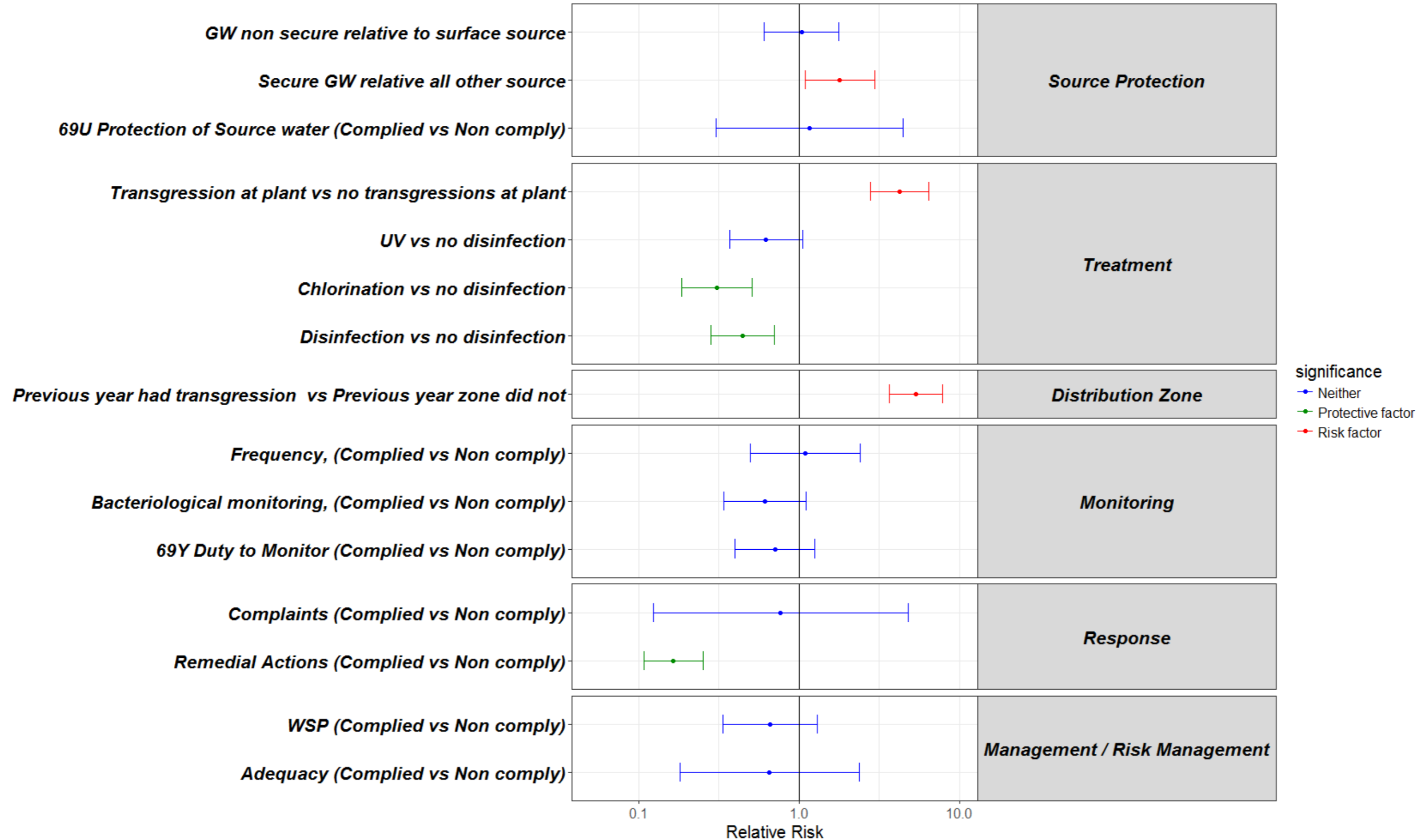
Transgression rates over time



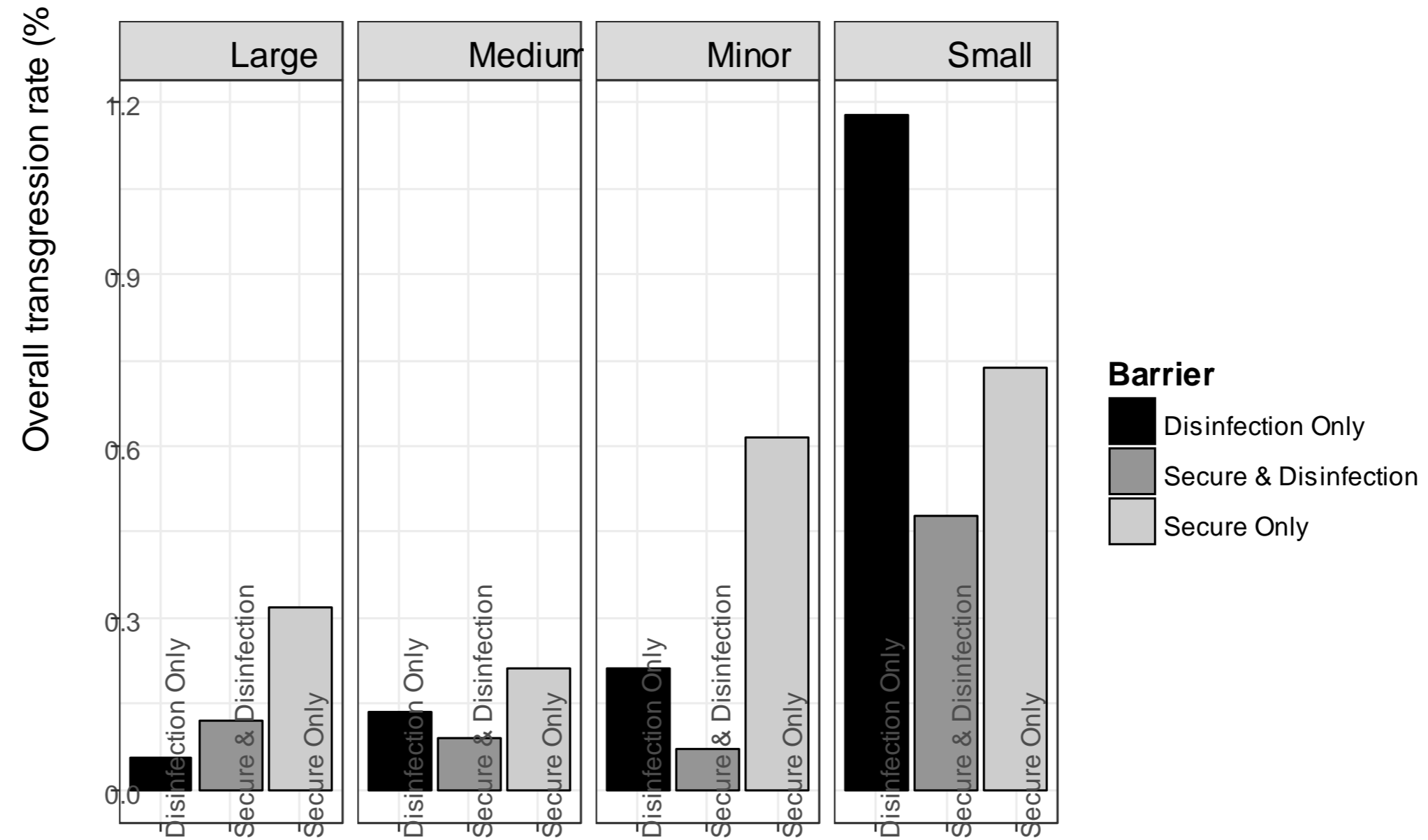
Transgression rate by zone



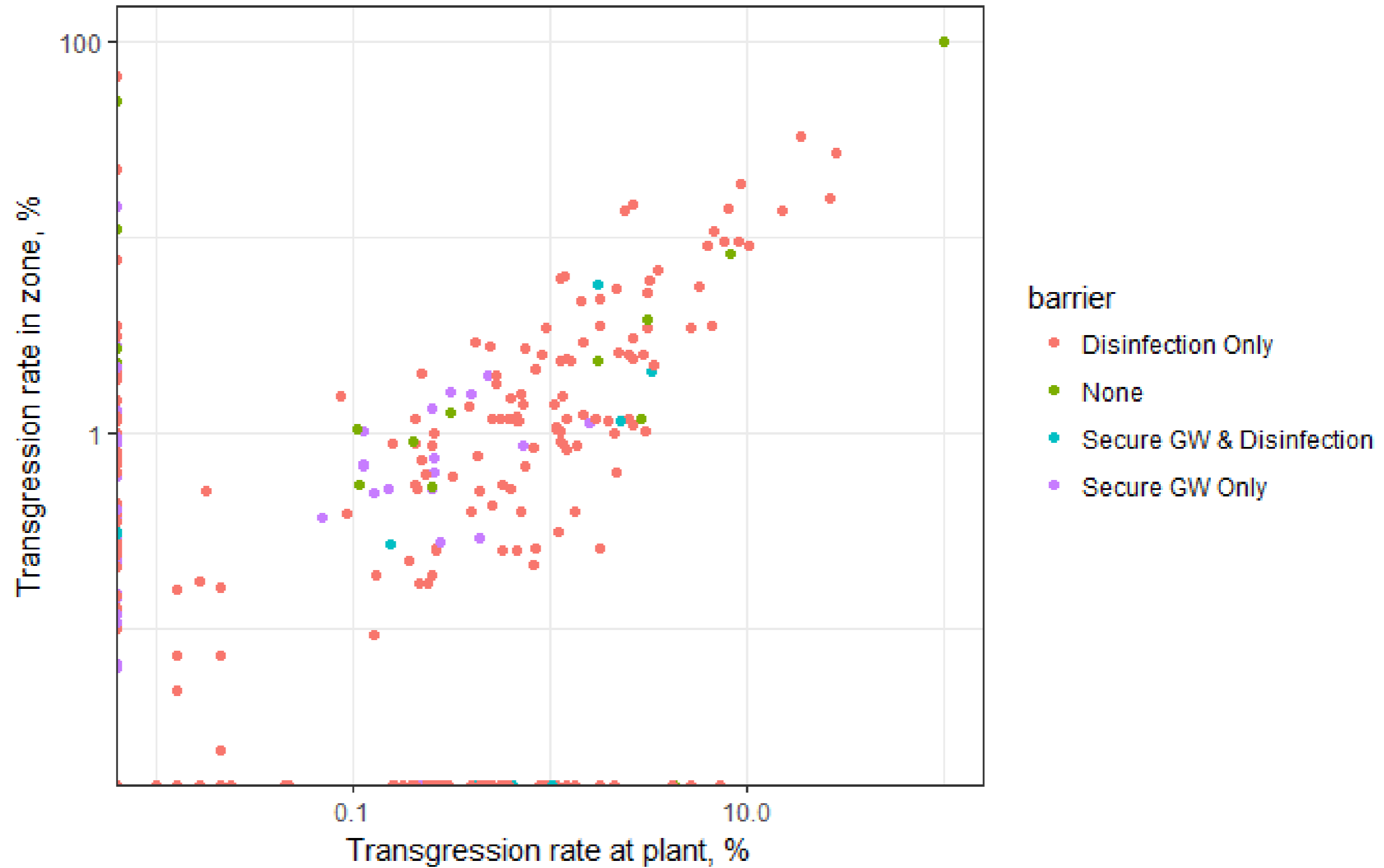
Relative Risk



Transgression rates and Barriers



Transgression zone and Plant



Secure bores

- Is it a bigger risk than other source?
- If we control for disinfection status:
 - Appears that suppliers who use secure bore water are less likely to use a deflection barrier. *(Note the sample size is very small so the results must be treated with caution)*
- For some small supplies secure bore water may be more effective than disinfection alone.

DWA Interviews



Semi structured interview- focusing on supplies with a history of intermittent transgressions.

- Monitoring
- Notification of Transgression
- Investigations (including identification of likely cause)
- Remedial Actions

Only covered transgression that occurred 2015/16.

Total of 27 transgressions in 13 zones.

Monitoring

Notification of Transgression

Investigations (including identification of likely cause)

Remedial Actions

Limitations

- Observational study (not experimental study).
- Quantitative study included all the compliance monitoring results from all supplies/zones serving more than 100.
- Qualitative study, subset of supplies and only DWA (other stakeholders views were not included).
- Findings are informative – can be treated as a working hypothesis. Multiple methods adds robustness

Findings 1

- *E. coli* Transgressions are rare.
- Higher transgression rates in small supplies than larger supplies
- Risk factors include:
 - Transgressions in previous year
 - Transgressions in plant
 - Secure bore water
- Protective factors include:
 - Disinfection (but it is not a panacea)

Findings 2

- Failure of treatment
- Post-treatments failures
- Implicit assumption that the cause of the current transgression is the same as previous transgressions
- Not always easy to identify cause (probably easier to identify treatment failures than other failures).
- Some types of remedial action can make it harder to identify cause.
- Supplier may not be able to mitigate risk

The six principles

	Evidence this study
1) A high standard of care must be embraced	One interview suggested drinking-water was a lower priority than other task of the supplier
2) Protection of source water is of paramount importance	Particular important for small supplies
3) Maintain multiple barriers against contamination	Reduces transgression rates
4) Change precedes contamination	A number of examples where change in source water quality overwhelms treatment system
5) Suppliers must own the safety of drinking water	No direct evidence from this work
6) Apply a preventive risk management approach	No direct evidence from this work

Points to consider

- DWAs and water supplier need advice determining whether remedial actions have been successful.
- Small supplier can have difficulties in responding to transgressions in accordance with the DWSNZ. Consideration should be given to practicable solutions which meet the DWSNZ.
- Disinfection is protective, but its not a panacea. In some circumstances secure groundwater may be a better risk management option than surface water with disinfection.
- Current standard mean that small supplies sometimes have to have better quality water than larger supplies to comply, some consideration needs to be given to whether this makes public health sense.
- Further work should be carrier out to look at the role of treatment other than disinfection in preventing transgressions.

Acknowledgment



The team would like to thank the DWA for their assistance in this work, We would also like to thank Sophie Hide for her help and assistance with the social science aspects of this work.

David Wood

T: 03 351 0130 E: David.Wood@esr.cri.nz