



Perceptions of water quality among rural Albertans and association with livestock.

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A transdisciplinary team

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Water policy

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Rural households, Livestock producers, Water interest groups

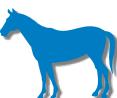


The global health problem to address

Agriculture, water, and emerging infectious diseases (EIDs)

- c.70-80% of diseases infectious to humans are of animal origin
- Basic changes in farm management reduce risk of infection > 50%
(UNDP, Hanoi, 2008; Hall & Le, 2015)
- Improved water health or hand washing reduce morbidity > 25%

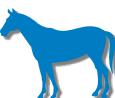
(Shuster-Wallace *et al.*, UNU-INWEH, 2008)



The problem to address

Agriculture, water, and emerging infectious diseases (EIDs)

- No requirement for rural residents to test water quality
- c. 450,000 Albertans consume water of unknown quality from 215,000 wells
 - 89.3% rarely or never test their water (Summers, 2010)
- For rural Albertans, what is:
 - knowledge of water quality
 - perceptions of water quality on homestead
 - association with presence/ management of livestock
- Limited health knowledge leads to increased risk of EIDs



The problem to address

Agriculture, water, and emerging infectious diseases (EIDs)

- *Livestock management*
 - Manure management, other animal waste
 - Pathogens including *E. coli* → human illness
 - concern if entering surface or ground water
- *Understanding perceptions/ management of those risks*
 - Influence behaviour change of rural home owners wrt water testing
 - Improve livestock waste management
 - Reduce contamination of water from livestock waste
- Policy change? Standard Operating Procedures?



One Health

The interaction of animals, humans, and their environment



Cross-disciplinary health problems
require
cross-disciplinary health solutions



Study design

- Cross sectional study of 1000 rural households
- ***Perceptions***
 - water health attributes, livestock waste management, and mitigation strategies relative to water including water testing
 - via questionnaire (demographics, agricultural & economic factors, attitudes and beliefs)
- Livestock raised on or very close to half these locations
- Requested participants submit a well ***water sample*** to AHS
 - Testing for total coliforms and *E. coli*
- Qualitative
 - based on ***interviews*** with selected participants



Study design

Analysis

- **Limited dependent (choice) regression techniques**
 - examine relations between perceptions and mitigation strategies
 - predictors of willingness to test & treat well
- **General hypothesis**
 - *residents' perceptions of livestock as a risk factor has some association with well water mitigation strategies*
 - mitigation includes testing of well water

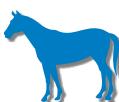
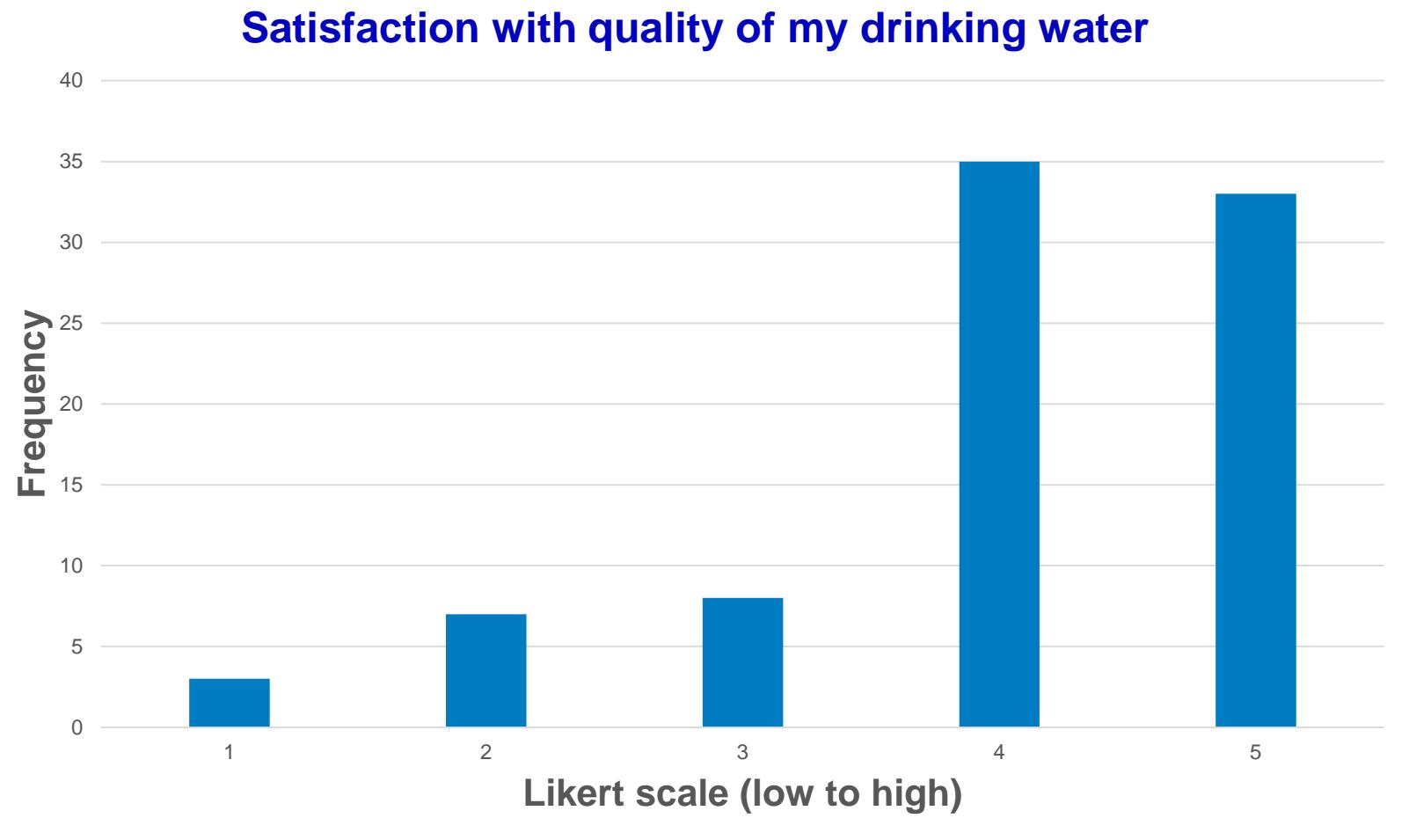


Questionnaires and samples

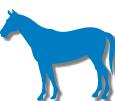
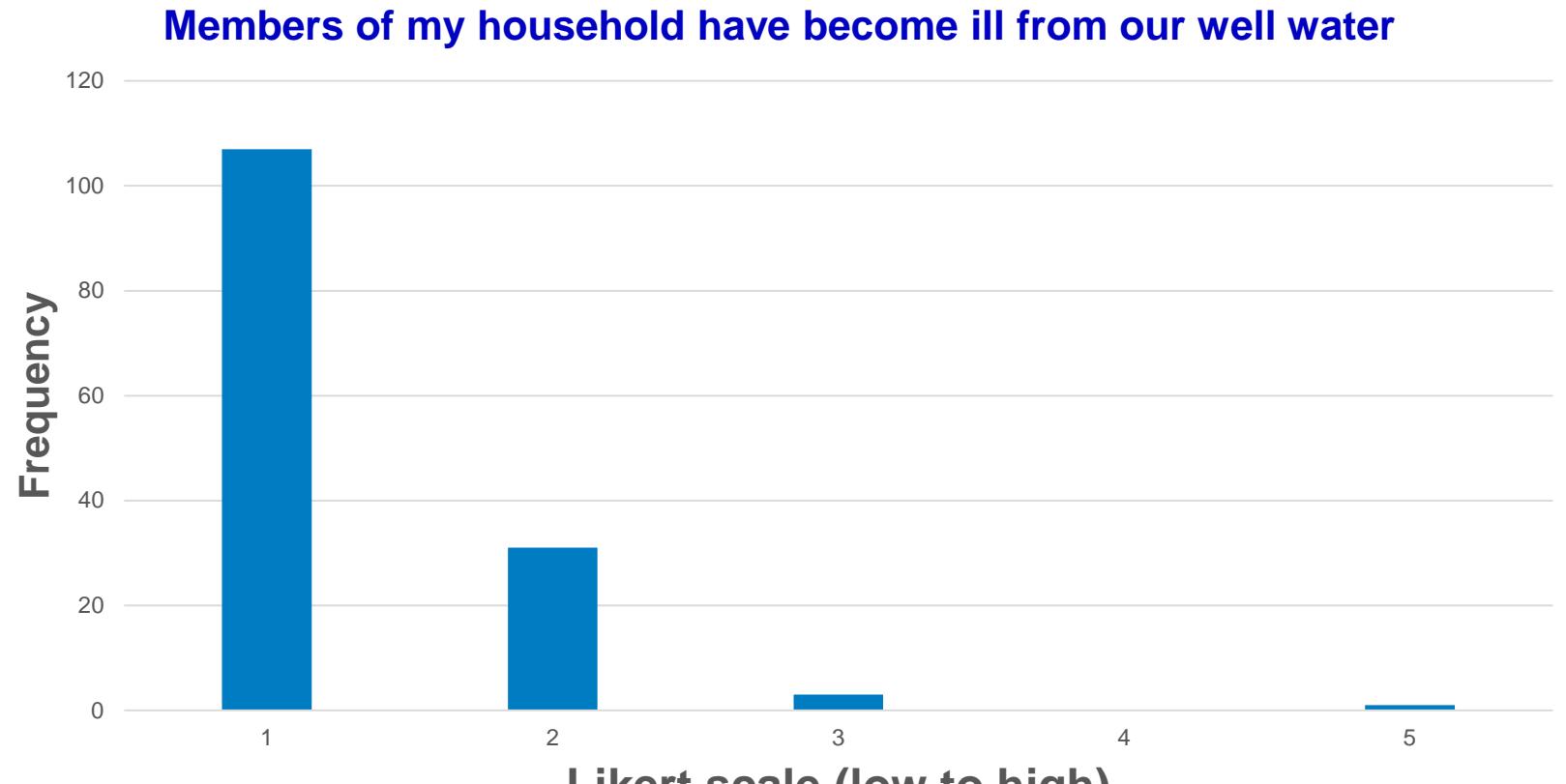
- Mail out: c. 2200+ questionnaires mailed/mailed
 - AWWID database
 - Contacts via Working Well/ watershed management group(s)
 - Professional market research firms (limited success)
 - c.20% contacted by email
- Returns:
 - 369 useable returns: 125+ paper returns, 244+ electronic returns
 - 68 livestock owners
- Water test samples
 - 82 submissions (c.22% response based on questionnaires returned)
 - Barriers cited: time of day to submit, perception of “clean” water
 - Only 1 positive for *E. coli*



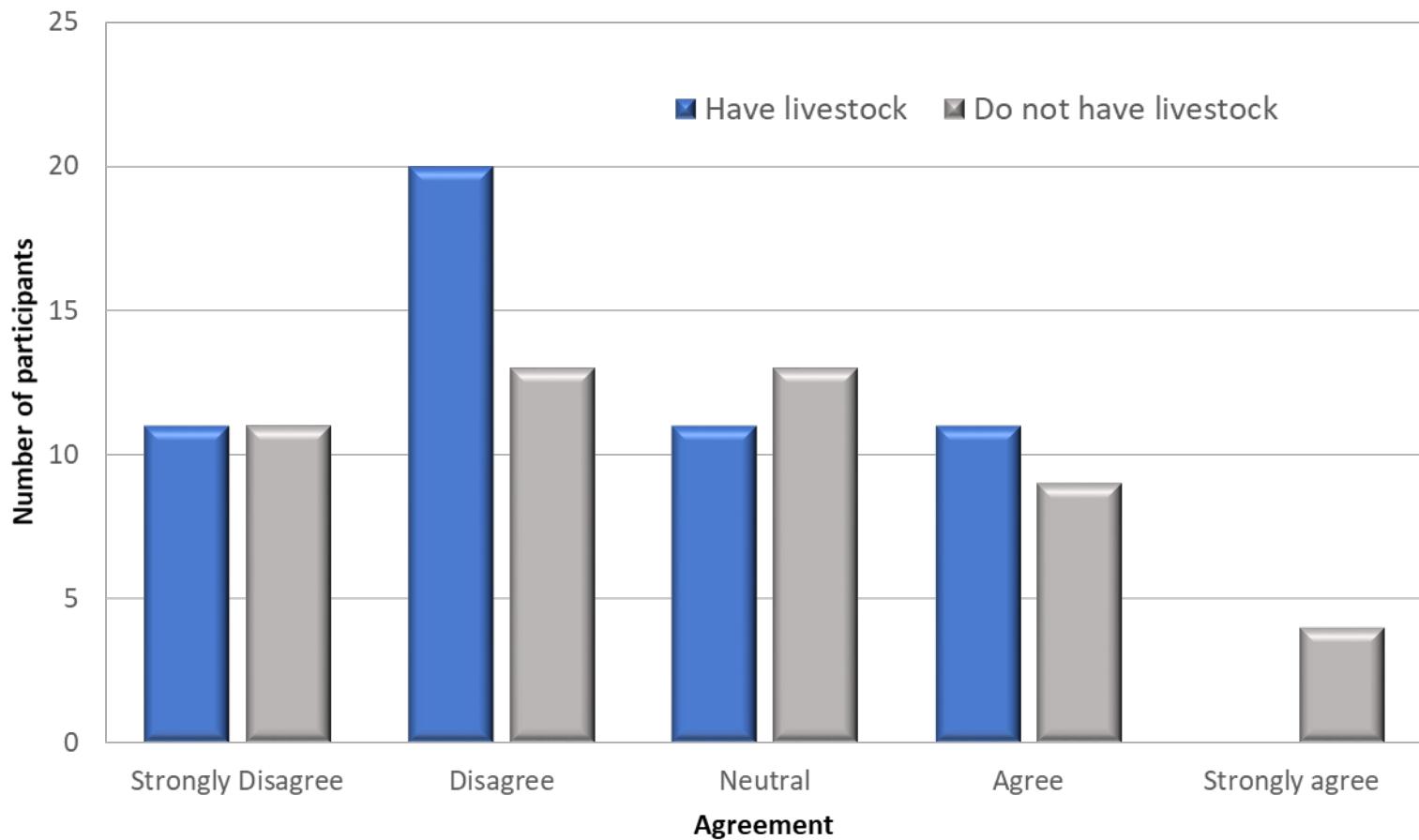
Stated satisfied with well water quality (n=86)



Perception: Sick from well water (n=142)



I worry about well water contamination (n=103)

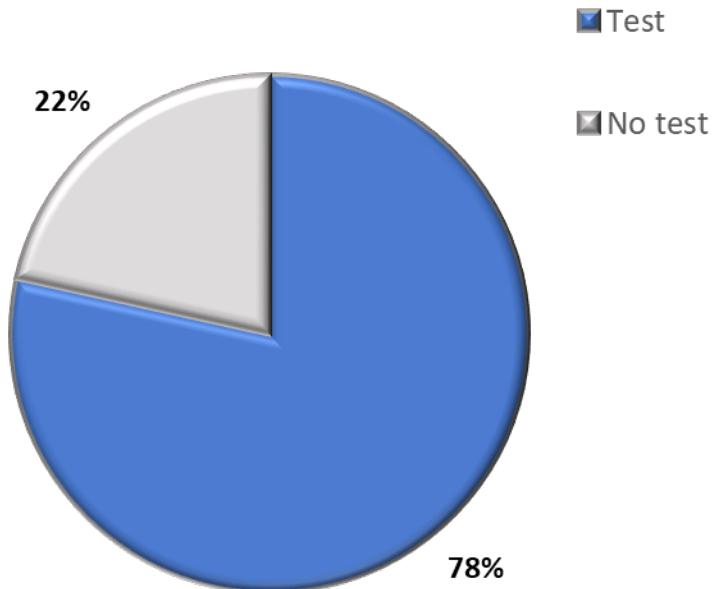


*Stated attitude that participants worry about well water contamination.
(results are significantly different by livestock ownership grouping, $p<0.01$)*



Farm ownership and water testing (n=103)

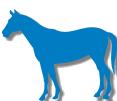
Farm owner



Acreage owner

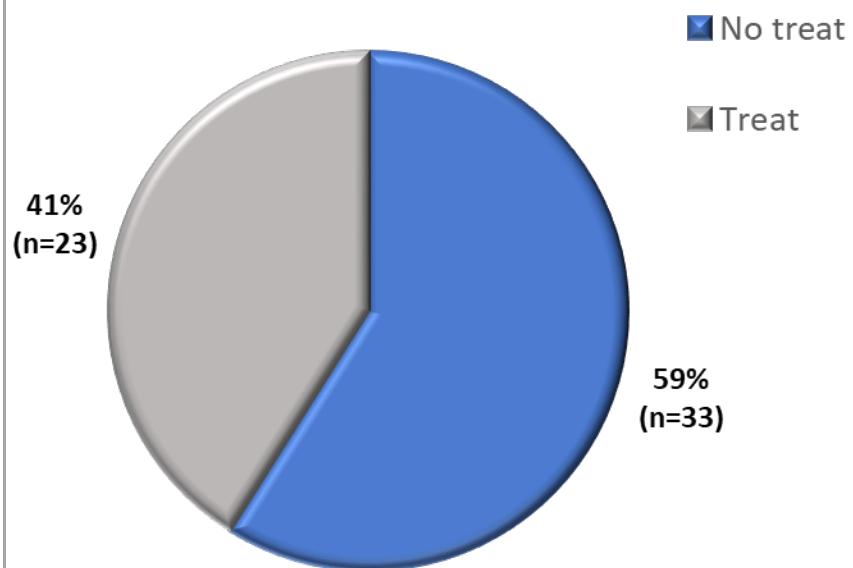


*Farm ownership and reported testing of wells for bacteria
(results are significantly different by livestock ownership grouping, $p<0.10$).*

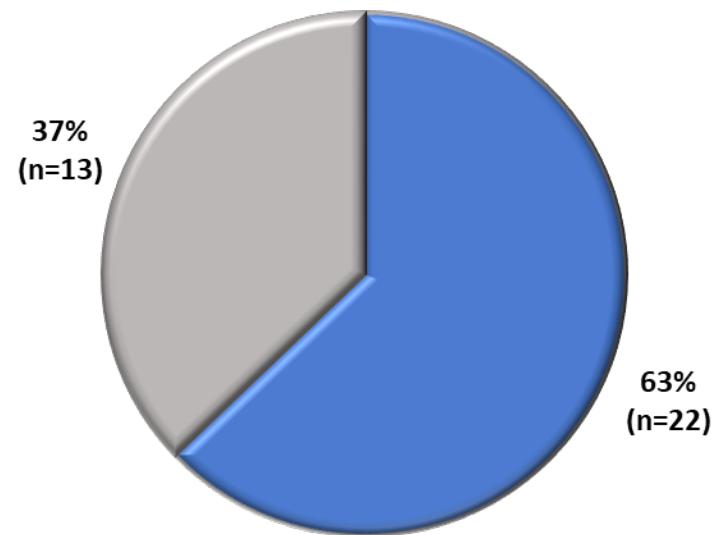


Farm ownership and water treatment (n=91)

Farm owner



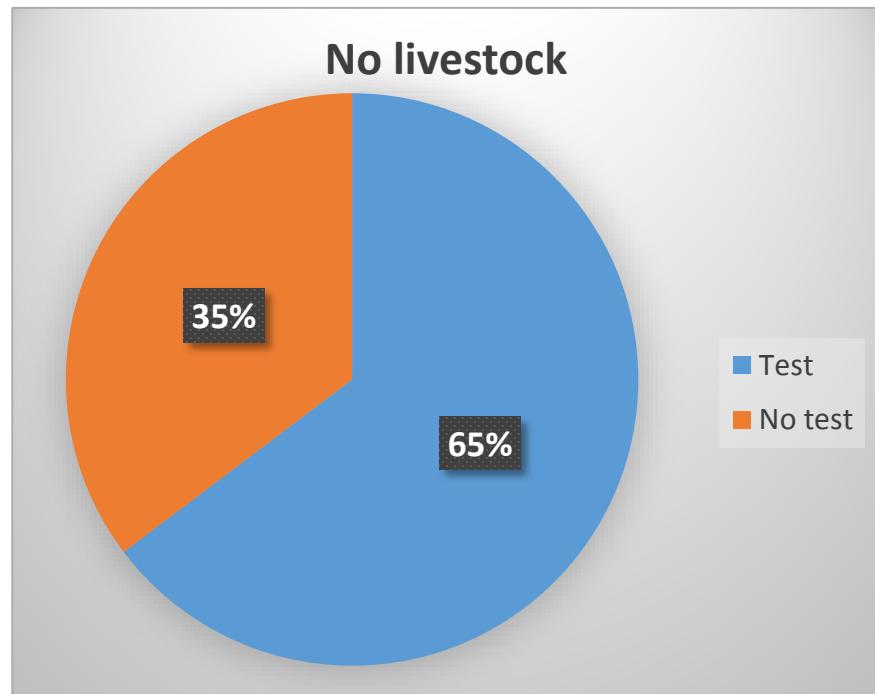
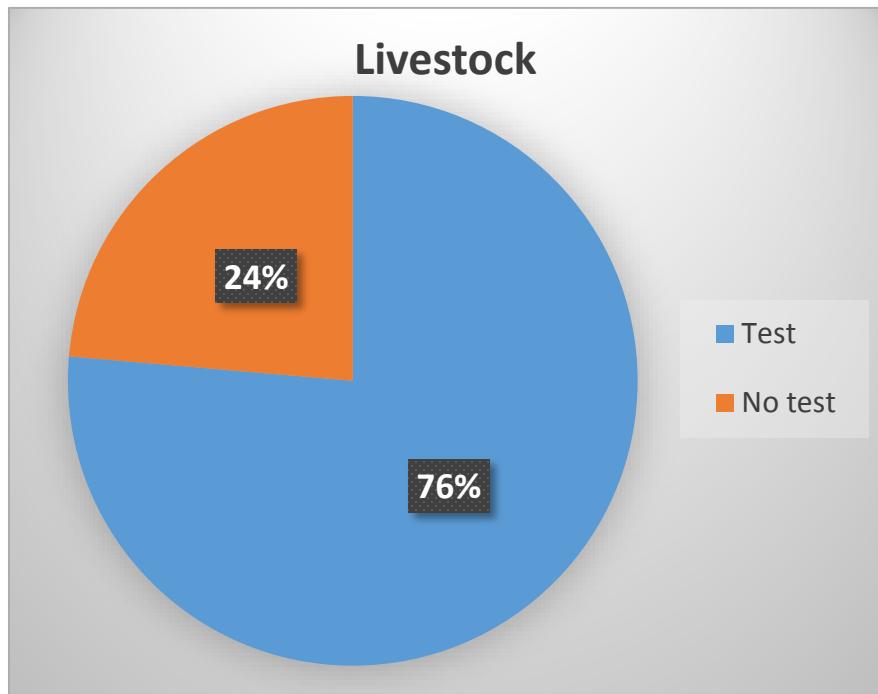
Acreage owner



*Reported treatment of wells by farm ownership
(results are significantly different by livestock ownership grouping, p<0.05)*



Livestock owners more likely to test for bacteria

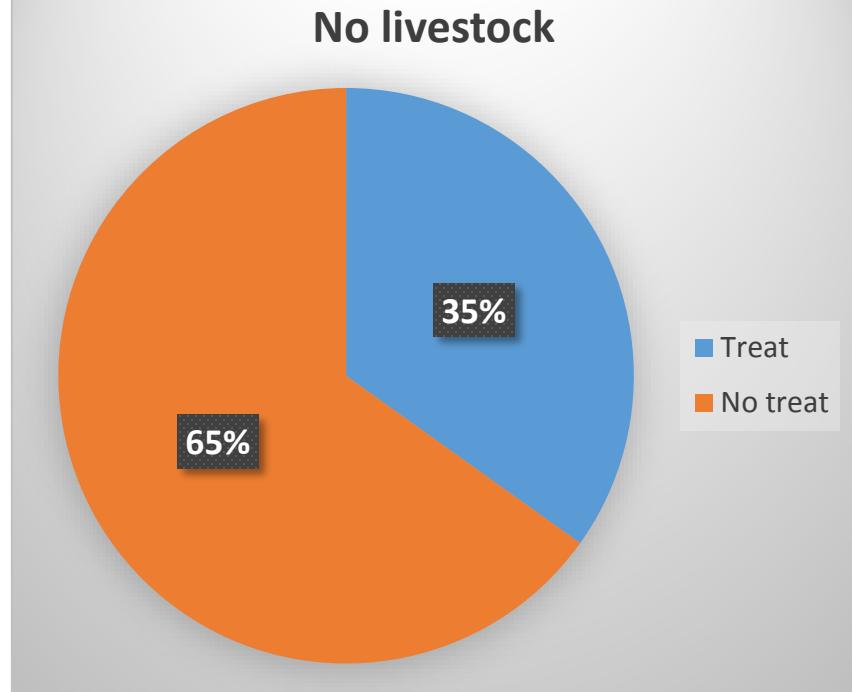
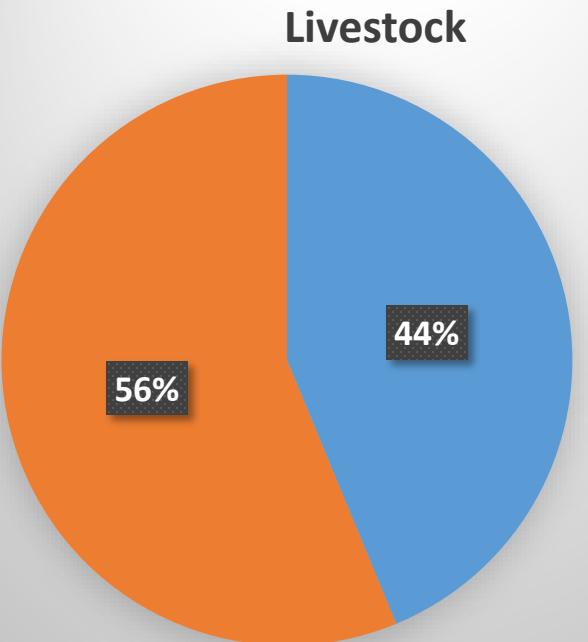


Livestock owners = 48

Non-livestock owners = 43 ($p < 0.05$)



Livestock owners more likely to treat well water

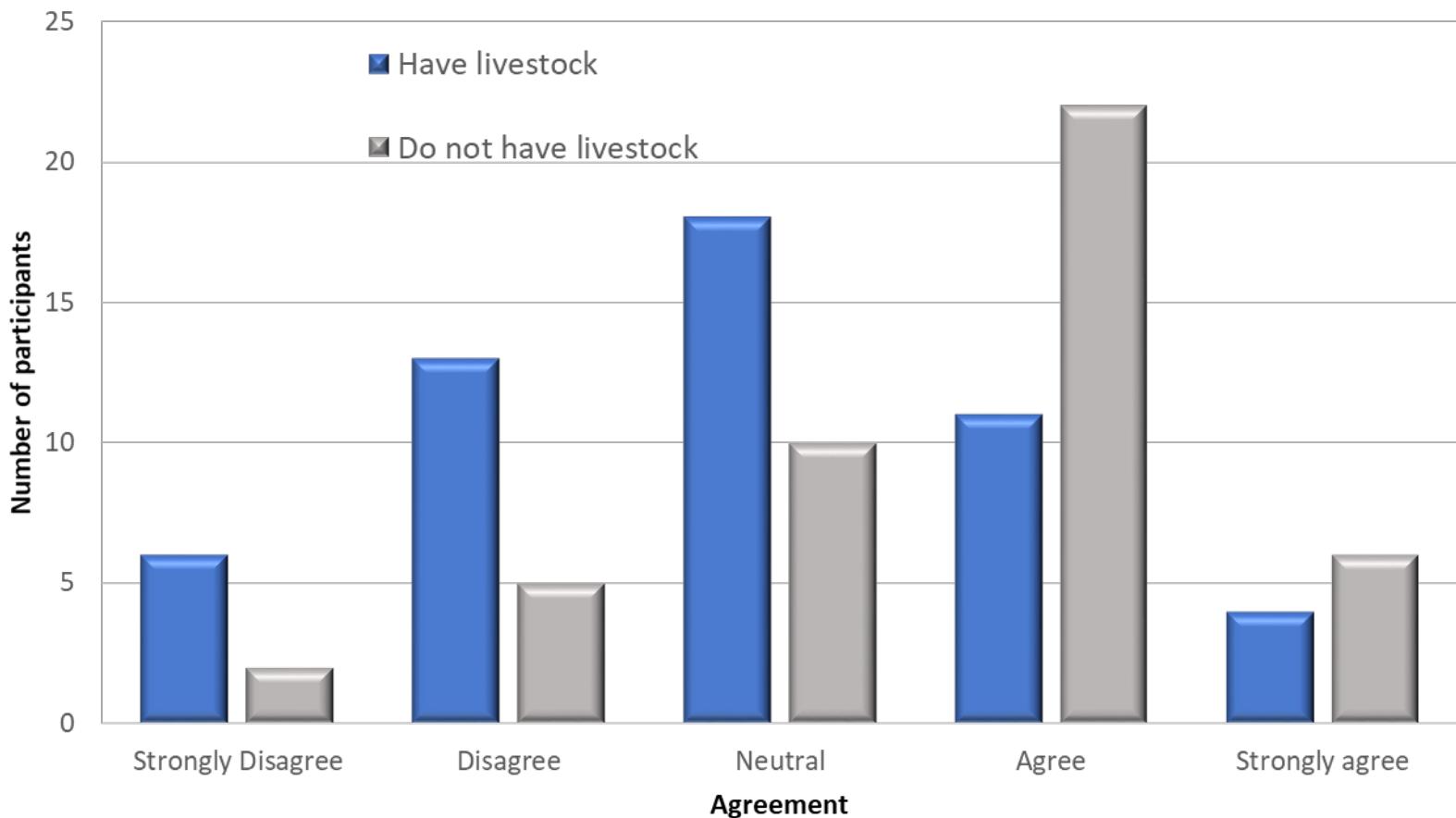


Livestock owners = 57

Non-livestock owners = 52 ($p < 0.05$)



Are livestock a source of contamination?



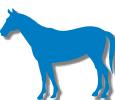
*Stated belief that livestock are a source of contamination, sorted by livestock ownership.
(results are significantly different by livestock ownership grouping, $p<0.01$)*



Summary statistics: Manure as a risk factor (n=75)

Rank source of risk wrt manure

- Feedlot ← most likely
- Swine farm
- Dairy cattle ranch
- Cow-Calf ranch
- Broiler farm
- Egg layer farm
- Steers on pasture
- Horse ranch
- Wildlife ← least likely



Summary statistics: Predictors of mitigation

Choice variable analysis (e.g., logistic regression)

Logistic regression

Number of obs	=	86
LR chi2(9)	=	38.45
Prob > chi2	=	0.0000
Pseudo R2	=	0.3776

Log likelihood = -31.692173

Bacttest	Odds Ratio	Std. Err.	z	P> z	[95% Conf. Interval]
Welldrk	6.324774	5.702466	2.05	0.041	1.080426 37.025
Awaregrp	7.455302	6.195449	2.42	0.016	1.462535 38.00357
Chlorwtr	3.923368	2.698102	1.99	0.047	1.019266 15.10187
Lvstbacgrp	.1752184	.1613481	-1.89	0.059	.0288243 1.065124
Wellfregrp	5.664574	4.493185	2.19	0.029	1.196706 26.8131
Ownfarm	.844169	.7051384	-0.20	0.839	.1642165 4.339524
Worrygrp	.373737	.2779752	-1.32	0.186	.0869893 1.605707
Genderpart	.4690418	.394311	-0.90	0.368	.0902878 2.436655
Prevmnrgroup	8.427093	8.015468	2.24	0.025	1.306332 54.36283
_cons	.0420969	.0625814	-2.13	0.033	.0022848 .7756194

Dependent variable = stated do test their water



Summary statistics: Predictors of mitigation

Best predictors of likelihood to mitigate well contamination (incl. water testing)

- Owning a farm
- Awareness of hazards
- Believe livestock pose a risk
- Stated contentment with drinking water quality
- History of testing

Weak or non-predictors:

- Children in household (weak)
- Income, education, age
- Method of manure management



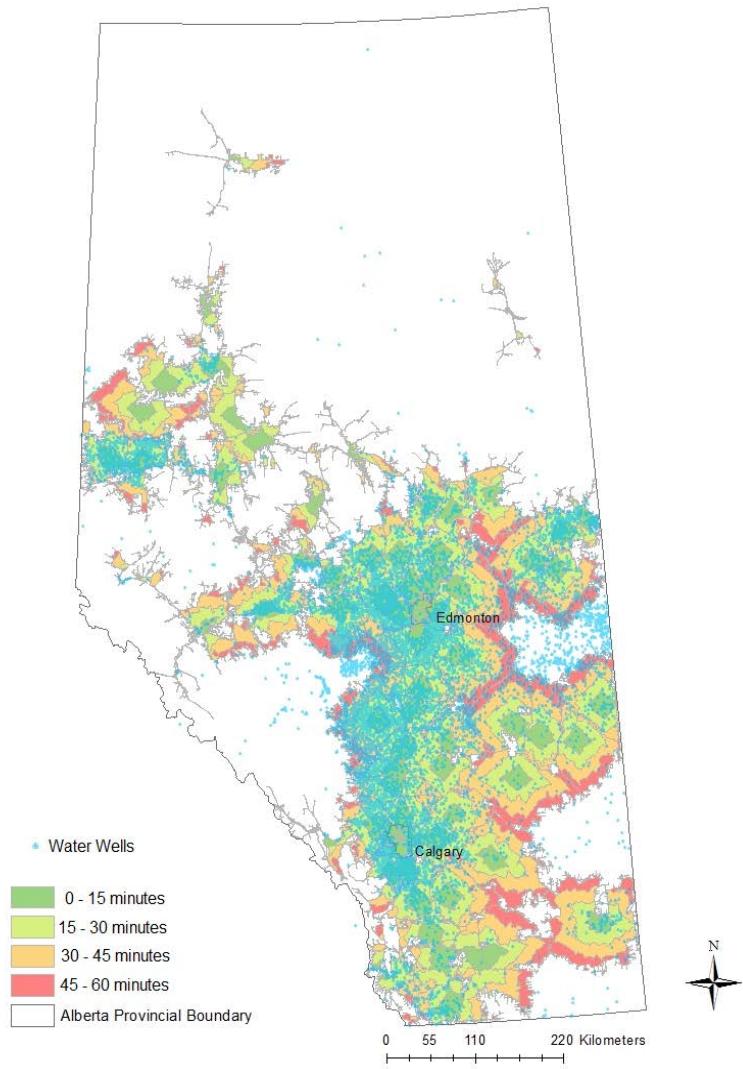
Semi-structured interviews

Phone calls

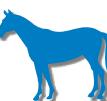
- **Qualitative semi-structured interviews**
 - Selected from water management group participants expressing interest in participating
 - Attitudes/ perceptions of water quality, presence & impact of livestock
 - c. 15-20 minute conversation; will have completed up to 20
- **Concerns so far:**
 - “Yes, I’m concerned with my water quality”
 - “I’m not a livestock keeper. I’m kinda concerned that livestock might be a risk factor wrt water contamination.” (and v.v.)
 - “Would be nice if I could go online and track my water test results over time.”
 - “Not enough people know water testing is free (but I do).”



Munene and Hall – Distance from water wells to AHS test centres



- 34% of wells w/i 15 mins drive
- 68% of wells w/i 30 mins drive
- Distance is a barrier to compliance
- Other factors:
 - Convenience
 - Ability to leave farm work
 - Time sensitive
- A GIS technique



Conclusions

Less than half of rural residents test drinking well water

Most rural residents:

- are ***content with the quality*** of their drinking well water
- feel there is ***low risk*** of microbial contamination
- ***risk increases with livestock***, but can be mitigated

Livestock owners:

- are ***more likely to test*** and treat their drinking water



Conclusions

Other:

- ***participation in water mgmt. groups*** likely increases willingness to test
- ***maintaining awareness*** of well water testing and maintenance (messaging/ community activities/ prov govt) is important to sustaining preventive measures
- Incorporating testing in ***structured livestock manure management programs*** may increase participation rates
- affirmation to non-livestock owners of the important role agriculturalists play in mitigating risk of contamination from livestock



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