Determining the Impact of Well Maintenance, Condition, Type, and Location Factors on E. coli and Total Coliforms in Maryland Farm Private Drinking Water Wells

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Background

- The EPA does not regulate or monitor the drinking water quality of private wells therefor there are no limitations for acceptable microbial contaminant levels based on the Safe Drinking Water Act of 1974 [1, 2] .
- There are currently limited published studies focusing on well water quality and the impact of well conditions, type and location in Maryland.

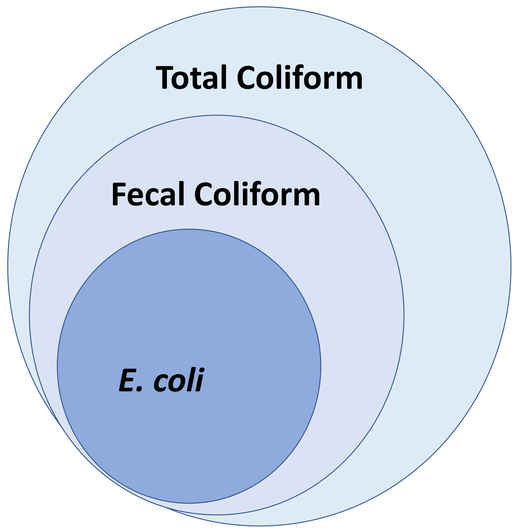

Figure 1. Diagram representing the relationship of total coliforms, fecal coliform, and *E. coli*

Objectives

1. Evaluate well water quality for the presence of *E. coli* and total coliforms from private drinking water wells on farms located throughout Maryland.
2. Evaluate survey data from water testing participants to understand current well practices and conditions.
3. Determine the correlation between the well water quality data and participant survey data for the participating Maryland farms.

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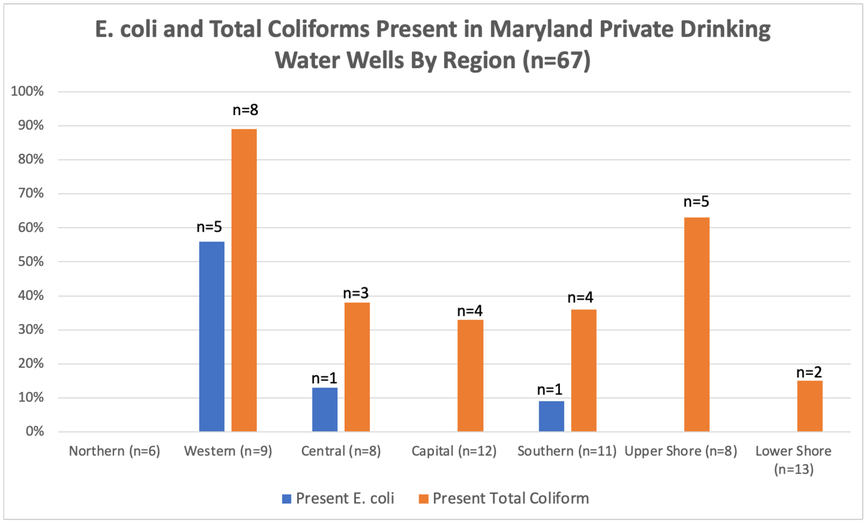

Figure 2. The percentage and number of samples positive for *E. coli* and total coliforms from the 67 water samples by region. Western region had a higher number of *E. coli* (n=5) and total coliforms (n=8) compared to the other regions.

Survey Factor & Category (n)	Positive *E. coli* (%)	*p*-value (*E. coli*)	Positive Total Coliform (%)	*p*-value (Total Coliform)
Region		*0.001		*0.004
Capital (n=12)	0 (0)		4 (15)	
Central (n=8)	1 (14)		3 (12)	
Lower Shore (n=13)	0 (0)		2 (8)	
Northern (n=6)	0 (0)		0 (0)	
Southern (n=11)	1 (14)		4 (15)	
Upper Shore (n=8)	0 (0)		5 (19)	
Western (n=9)	5 (71)		8 (31)	
TOTAL (n= 67)	7 (100)		26 (100)	
Previously tested pH		0.11		*0.002
Yes (n=20)	4 (100)		12 (86)	
No (n=19)	0 (0)		2 (14)	
TOTAL (n= 39)	4 (100)		14 (100)	
Tested water quality		0.70		0.80
Yes (n=42)	5 (71)		17 (65)	
No (n=25)	2 (29)		9 (35)	
TOTAL (n= 67)	7 (100)		26 (100)	
Well Age		1.00		0.31
<25 years (n=26)	2 (33)		12 (48)	
>26 years (n=39)	4 (67)		13 (52)	
TOTAL (n= 65)	6 (100)		25 (100)	
Observed water quality issues		0.41		1.00
Yes (n=42)	6 (86)		17 (65)	
No (n=24)	1 (14)		9 (35)	
TOTAL (n= 66)	7 (100)		26 (100)	

Table 1. The frequency of total responses for a selection of survey questions and *p*-values for the survey factors and the presence of *E. coli* and total coliforms.
p-value with (*) signifies a statistically significant result from the Fishers Exact Test.

Approach

- Received 67 water samples from private drinking water wells from 7 regions of Maryland (Regions listed in Table 1).
- Processed and analyzed water samples with the U.S. EPA Standard Method 1604[4].
- Participants filled out a 32 question online survey.
- Analyzed participant survey results and water quality results with Fishers Exact Test.

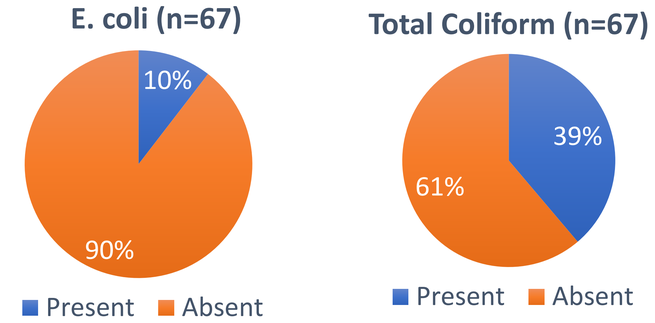

Figure 3. The percentage of *E. coli* and total coliforms present and absent. (n= 67)

Results/Conclusion

- 10% (7/67) of the wells were positive for *E. coli* (Fig. 3).
- 39% (26/67) of the wells were positive for total coliforms (Fig. 3).
- Western Region had the highest percentage of positive *E. coli* and total coliforms (Fig. 2).
- Region was the most significant factor impacting *E. coli* presence (Table 1).
- Region, County, and prior pH testing were significant factors for total coliform presence (Table 1).

Importance To Public Health

- Emphasizes the importance of well water testing and maintenance for private well owners.
- Could impact the approximately 350,000 Maryland homes that have private wells [3] and the 23 million homes that have private drinking water wells in the United States. [2]
- Residents that live in regions with higher risk of microbial contamination could use this data to make informed decisions.

References

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