

**USE OF THE BEHAVIORAL RISK FACTOR SURVEILLANCE SURVEY
TO ASSESS THE SAFETY OF PRIVATE DRINKING WATER SUPPLIES**

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**Use of the Behavioral Risk Factor Surveillance Survey to
Assess the Safety of Private Drinking Water Supplies**

**FINAL REPORT
WR08R001**

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PROJECT SUMMARY

Title: Use of the 2008-2009 Behavioral Risk Factor Surveillance Survey to Assess the Safety of Private Drinking Water Supplies

Project ID: WR08R001

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Period of Contract: July 2008 through June 2009

Background and Need

Over 850,000 households in Wisconsin use a privately-owned well as a drinking water source. Unlike households supplied by municipal water, private wells are not regulated and therefore do not require regular testing. Testing of private water supplies may be limited by several factors such as household income and knowledge of testing procedures and water quality parameters. Despite the private well tracking efforts by the DNR's Groundwater Retrieval Network (GRN), the Center for Watershed Science and Education, and DATCPs' groundwater database, there are many data gaps. We know little about the households that are testing their well water and even less about those that are not. We are particularly interested in learning more about wells used by infants, children, pregnant women and the elderly and hope to learn more about how they use their water and test it for safety, as well as about their perceptions of the quality of their well water.

Objectives

The intent of this research is to improve our understanding of the number and location of families that need assistance or information regarding drinking water safety and make it easier for public health care providers and water supply consultants to provide targeted outreach to this population. We hope findings will be useful to state and local agencies for the purpose of addressing data gaps and assessing the need for educational, professional and financial resources to increase testing of private wells and minimize ongoing exposure to common groundwater contaminants.

Methods

A module of questions about well-water testing was added to the 2008 and 2009 Behavioral Risk Factor and Surveillance System (BRFSS) surveys and administered to households that obtained their water from a privately-owned well. These questions were designed to provide us with a better understanding of water quality testing done on private well water supplies which are used by approximately one-third of Wisconsin families. Our analysis included demographic information collected as part of the BRFSS survey.

Results and Discussion

Findings from this survey indicate that about one Wisconsin family in nine (11%) obtain their drinking water from a well they have never tested for bacteriological or nitrate contamination. This population includes an estimated 140,600 children. We can also estimate that one family in six, including approximately 213,000 children, obtains their drinking water from a well they have never tested for contamination with solvents, gasoline, fuel oil, toxic metals, or pesticides.

The principle reason well owners provided when asked why they didn't test their water was that the water seemed to be safe based on its taste, odor and appearance. Nearly half of the homeowners who had never tested their water stated that they didn't know what to test for or weren't sure where to send their water for testing. In addition, some of the responses to our survey suggest that well owners may be confused about the parameters included in their well test. For example, more than a quarter of the well owners in our survey reported testing for volatile organic chemicals and nearly a third of the families reported tests for pesticides. While these rates may be accurate, they are higher than anticipated based on existing databases maintained by the State Laboratory of Hygiene and Department of Natural Resources. Further evidence of confusion is provided in responses concerning the safety of test results. Of 4% of those who reported testing their water said the test result was unsafe. About half of the unsafe results were due to bacteria and half were due to a high nitrate level. Thus, while a 2007 random survey of private wells conducted by the Wisconsin Department of Agriculture, Trade and Consumer Protection estimated that 9% of wells statewide exceeded the nitrate enforcement standards, only 2% of the nitrate test results reported by BRFSS participants were recalled by well owners in our survey as unsafe. Similarly, while a statewide study conducted in 1995 found that more than 20% of private wells contained coliform bacteria, less than 2% of the participants in our survey who tested for bacteria reported the result as "unsafe." Reasons for these apparent discrepancies are unclear but suggest that some well owners may not understand their laboratory report.

Conclusions and Recommendations

Several actions are suggested which would help well owners ensure the safety of their water supply:

1. State agencies, the State Laboratory of Hygiene, and the University of Wisconsin-Extension should work together to develop a uniform, web-based outreach program aimed at educating well owners about water quality testing and water treatment. Ideally this website could include active links to licensed laboratories. Since many Wisconsin families depend on in-home water filtration devices, it may also be helpful to include a listing of water treatment devices that have been approved by the Department of Commerce.
2. Public and private water testing laboratories should consider the use of advertising campaigns, promotional sales, discounted test packages that include testing for a broad range of chemicals that have been detected in regional groundwater, coupons, and seasonal campaigns to encourage and facilitate water quality testing in the counties they serve.
3. Existing wells should be inspected and the water should be tested for a panel of priority contaminants prior to property sales.
4. Newly constructed wells should be tested for priority contaminants before they are put into service.
5. All local health departments that serve rural populations should be encouraged to take advantage of fee-exempt testing offered by the Wisconsin Dept of Health Services.

Related Publications

None to date

Key Words: Private well, Testing, Nitrate, Bacteria, Arsenic, Drinking water, Safety

Funding: Water Resources Institute, University of Wisconsin-Madison

Use of the 2008-2009 Behavioral Risk Factor Surveillance Survey to Assess the Safety of Private Drinking Water Supplies

Introduction

Over 850,000 households in Wisconsin use a privately-owned well as a drinking water source. Unlike households supplied by municipal water, private wells are not regulated and therefore do not require regular testing. Testing of private water supplies may be limited by several factors such as household income and knowledge of testing procedures and water quality parameters. Despite the private well tracking efforts by the DNR's Groundwater Retrieval Network (GRN), the Center for Watershed Science and Education, and DATCPs' groundwater database, there are many data gaps. We know little about the households that are testing their well water and even less about those that are not. We are particularly interested in learning more about wells used by infants, children, pregnant women and the elderly and hope to learn more about how they use their water and test it for safety, as well as about their perceptions of the quality of their well water.

This research is intended to improve our understanding of the number and location of families that need assistance or information regarding drinking water safety and make it easier for public health care providers and water supply consultants to provide targeted outreach to this population. We hope findings will be useful to state and local agencies for the purpose of addressing data gaps and assessing the need for educational, professional and financial resources to increase testing of private wells and minimize ongoing exposure to common groundwater contaminants.

Methods

The Behavioral Risk Factor Surveillance System (BRFSS) is a collaborative project of the Centers for Disease Control and Prevention (CDC) and U.S. states and territories. The BRFSS, administered and supported by CDC's Behavioral Surveillance Branch, is an ongoing data collection program designed to measure behavioral risk factors for the adult population (18 years of age or older) living in households. The BRFSS objective is to collect uniform, state-specific data on preventive health practices and risk behaviors that are linked to chronic diseases, injuries, and preventable infectious diseases that affect the adult population. Factors assessed by the BRFSS include tobacco use, health care coverage, HIV/AIDS knowledge and prevention, physical activity, and fruit and vegetable consumption. Data are collected from a random sample of adults (one per household) through a telephone survey.

The Wisconsin BRFSS is managed by the Wisconsin Department of Health Services (DHS) following guidelines provided by the CDC. DHS participates in developing the survey instrument. The survey is then administered by the University of Wisconsin Survey Center under a contract with DHS. The data are transmitted to the CDC's National Center for Chronic Disease Prevention and Health Promotion's Behavioral Surveillance Branch for editing, processing, weighting, and analysis. An edited and weighted data file is provided to DHS for analysis in March or April of the following year. DHS and other agencies use BRFSS data for a variety of purposes, including identifying demographic variations in health-related behaviors, targeting services, addressing emergent and critical health issues, proposing legislation for health initiatives, and measuring progress toward state and national health objectives. Weighted data from this survey are expected to be representative of the state's population.

The questionnaire has three parts: 1) the core component; 2) optional modules; and 3) state-added questions. The *core* is a standard set of questions asked by all states. Optional CDC modules are sets of questions on specific topics (e.g., cardiovascular disease, arthritis, women's health) that states elect to use on their questionnaires. In 2009, 29 optional modules were supported by CDC. Each year, the states and

CDC agree on the content of the core component and optional modules. In addition, states are allowed to add questions which are not edited or evaluated by CDC.

In 2008 and 2009, Wisconsin used computer-assisted telephone interviewing (CATI). Following guidelines provided by CDC, the University of Wisconsin Survey Center conducts interviews. The core portion of the questionnaire lasts an average of 15 minutes. Interview time for modules and state-added questions is dependent upon the number of questions used, but generally extend the interview period by an additional 5 to 10 minutes.

All data in the BRFSS are weighted to correct for selection biases caused by regional and demographic variations in survey coverage and participation. An additional reason for weighting is to make the total number of cases equal to Wisconsin's adult population. All analyses shown in this report are based on weighted survey data unless otherwise specified.

A module of questions about well-water testing was added to the 2008 and 2009 Behavioral Risk Factor and Surveillance System (BRFSS) surveys and administered to households that obtained their water from a privately-owned well. These questions were designed to provide us with a better understanding of water quality testing done on private well water supplies which are used by approximately one-third of Wisconsin families. Our analysis included demographic information collected as part of the BRFSS survey.

Results and Discussion

Of 11,628 participants in the 2008 and 2009 Behavioral Risk Factor Surveillance Survey, 7,329 people who participated between July 1, 2008 and December 31, 2009 were asked whether their household water was supplied by a privately-owned well. Based on weighted analysis of their responses, 36% of Wisconsin households use a private well as their primary drinking water source. Households with private wells were significantly less likely to have an annual income below \$20,000 than households served by public water supplies (6% vs 10%). According to weighted responses from members of these households, 41% drink unfiltered tap water, 44% drink tap water that is filtered either at the point of entry or point of use, 7% drink bottled water and 5% drink water from another source.

Of families that use a private well, two-thirds had submitted a well water sample to a laboratory for analysis since moving into their homes. Among people who had never tested their water supplies, 82% indicated that they hadn't done so, at least in part, because their water tasted and looked fine; 48% didn't test because they had a filtration system; 45% were not sure which tests to order and 42% didn't know where to send their water to be tested. While only 13% listed cost as a factor, testing rates were strongly associated with household income with only 33% of very low income (<\$20,000/year) households reporting a previous test compared to a 71% test rate among households with annual incomes of \$75,000 or more. Education was a less important predictor with well tests reported by 58% of participants with less than a high school education versus 67% of others. The prevalence of well testing also varied by county and region of residence (see Table 1) suggesting an effect of outreach programs and well testing offered by many local health departments. The presence of children in the home had no effect on test rates and the number of pregnancies was too small to assess an effect on water testing.

Of those who tested their water, 63% had done so within the last 5 years. The primary reason for testing is unclear since most BRFSS participants listed the reason as 'other.' While our survey didn't ask about real estate transactions, many of the well tests may be been done at the point of sale since banks, realtors and buyers often require assurance that the well serving the home is safe. Thirty percent of those who tested their wells said they wanted to know more about the quality of their water, 11% tested their water

after hearing a news story or were advised to test, and 8% tested their water because of a pregnancy or newborn in the home.

Bacteria and nitrate tests were reported by 52% and 46%, respectively, of respondents who used water from a privately owned well. Tests for pesticides, volatile organic compounds, arsenic and fluoride were less common, being reported by 31%, 26%, 27% and 23% of well owners, respectively. Nearly all (96%) of the well owners who had tested their water thought their test results were within safe limits and 81% of those who obtained their drinking water from a privately-owned well reported the quality of their water as 'excellent' or 'good.'

Approximately one-third of Wisconsin's families depend on a privately-owned well as the sole source of the water they drink and use to prepare foods, bathe, do laundry and conduct household chores. While each of these families is responsible for ensuring the safety of their drinking water, very few of them are likely to be aware of the wide range of contaminants that have been detected in Wisconsin's groundwater. While most well owners understand the importance of testing their water for coliform bacteria and nitrate contamination, awareness of the need to test drinking water for naturally-occurring minerals like manganese, arsenic and radium; industrial solvents; petroleum compounds and agricultural pesticides is not as prevalent. While public water supplies are routinely monitored for many of these parameters, the 2008-9 BRFSS survey confirms that most private well owners in Wisconsin have never tested their water for these substances.

Findings from this survey indicate that about one Wisconsin family in nine (11%) obtain their drinking water from a well they have never tested for bacteriological or nitrate contamination. This population includes an estimated 140,600 children. We can also estimate that one family in six, including approximately 213,000 children, obtains their drinking water from a well they have never tested for contamination with solvents, gasoline, fuel oil, toxic metals, or pesticides.

The principle reason well owners provided when asked why they didn't test their water was that the water seemed to be safe based on its taste, odor and appearance. Nearly half of the homeowners who had never tested their water stated that they didn't know what to test for or weren't sure where to send their water for testing. In addition, some of the responses to our survey suggest that well owners may be confused about the parameters included in their well test. For example, more than a quarter of the well owners in our survey reported testing for volatile organic chemicals and nearly a third of the families reported tests for pesticides. While these rates may be accurate, they are higher than anticipated based on existing databases maintained by the State Laboratory of Hygiene and Department of Natural Resources. Further evidence of confusion is provided in responses concerning the safety of test results. Of 4% of those who reported testing their water said the test result was unsafe. About half of the unsafe results were due to bacteria and half were due to a high nitrate level. Thus, while a 2007 random survey of private wells conducted by the Wisconsin Department of Agriculture, Trade and Consumer Protection estimated that 9% of wells statewide exceeded the nitrate enforcement standards, only 2% of the nitrate test results reported by BRFSS participants were recalled by well owners in our survey as unsafe. Similarly, while a statewide study conducted in 1995 found that more than 20% of private wells contained coliform bacteria, less than 2% of the participants in our survey who tested for bacteria reported the result as "unsafe." Reasons for these apparent discrepancies are unclear but suggest that some well owners may not understand their laboratory report.

Recommendations and Conclusions

Based on findings from this survey, several actions are suggested which would help well owners ensure the safety of their water supply:

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3. Existing wells should be inspected and the water should be tested for a panel of priority contaminants prior to property sales.
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5. All local health departments that serve rural populations should be encouraged to take advantage of fee-exempt testing offered by the Wisconsin Dept of Health Services.

**2008-9 Behavioral Risk Factor Surveillance System
Well Water Questionnaire with Weighted Response Frequencies**

The questions included in the BRFSS module and the weighted frequency of responses are shown below:

1. What is the source of the water that comes into your home?
 - a. A private well serving just your household 36%
 - b. A community well or shared well <1%
 - c. A municipal water supply 64%
 - d. Don't know <1%
 - e. Refused <1%

If A, go to question 2. If B, C, D or E, STOP HERE.

The remaining questions were only asked if the household was served by a privately owned well.

2. Which of the following best describes your primary household drinking water?
 - a. Unfiltered tap water 40%
 - b. Filtered tap water 31%
 - c. Bottled water 7%
 - d. Filtered water from the refrigerator 13%
 - e. Unfiltered water from the refrigerator 1%
 - f. Water from another source 5%
 - g. Don't know <1%
 - h. Refused <1%

3. Have you ever sent a sample of your water to a laboratory for analysis?
 - a. YES 66%
 - b. NO 32%
 - c. Not sure 2%

If NO, go to question 4. If YES, go to question 5.

4. If no, why have you NOT tested your water? (list ALL that apply)
 - a. Too expensive 13%
 - b. Not sure what to test for 45%
 - c. Not sure where to send samples 42%
 - d. Tastes and looks fine 82%
 - e. Have a water filter 48%
 - f. Other 27%

5. If yes, how long ago was it tested?
 - a. Within the last year 24%
 - b. One to 5 years 39%
 - c. Over 5 years ago 35%
 - d. Don't know 1%

6. What was the primary reason you tested your water?
 - a. Tasted or smelled bad 3%

- b. Discolored or cloudy 1%
- c. Someone recommended testing or heard a news story 11%
- d. Small child in the house or pregnancy 8%
- e. Illness in family <1%
- f. Wanted to know more about the quality of the water 30%
- g. Other reason 44%
- h. Don't know <1%

7. What was your water tested for?
- a. Bacteria 77%
 - b. Nitrate 69%
 - c. Fluoride 34%
 - d. Volatile chemicals like gasoline and solvents 39%
 - e. Pesticides 46%
 - f. Arsenic 40%

8. Did the test results indicate your water was safe to drink?
- a. YES 96%
 - b. NO 4%
 - c. Not sure <1%

If answered NO, proceed to question 9. If answered yes, skip to question 11.

9. Which parameters were unsafe?
- a. Bacteria 42%
 - b. Nitrate 53%
 - c. Fluoride 0%
 - d. Volatile chemicals like gasoline and solvents 3%
 - e. Pesticides 15%
 - f. Arsenic 7%
 - g. Other 10%

10. If any of the testing results indicated your water was unsafe to drink, did you...(check all that apply)
- a. Stop drinking your well water 55%
 - b. Buy a water filter 47%
 - c. Drink water from another source 66%
 - d. Install a new well 15%
 - e. Boil the water 10%
 - f. Contact your health department or DNR office 31%
 - g. Look for more information on the web 15%
 - h. Did something else 38%
 - i. Did nothing 3%

11. How would you describe the quality of your water?
- a. Excellent 41%
 - b. Very Good 40%
 - c. Acceptable 16%
 - d. Poor 3%
 - e. Not sure <1%
 - f. Refused <1%

12. Do you think you would be more likely to test your water if you had additional assistance or information about water quality?

- | | |
|-------------|-----|
| a. YES | 42% |
| b. NO | 56% |
| c. Not Sure | 2% |

13. Are any residents in your household currently pregnant?

- | | |
|--------|-----|
| a. YES | 1% |
| b. NO | 99% |

14. Do any children under the age of 2 years live in your home?

- | | |
|--------|-----|
| a. YES | 2% |
| b. NO | 98% |

Table 1. Well Testing Rates by County and DHS Region

County	N	Weighted Testing rate %	Unweighted Testing rate %	County	N	Weighted Testing rate %	Unweighted Testing rate %
Adams	60	70	72	Menominee	75	73	73
Ashland	27	66	67	Milwaukee	35	51	37
Barron	42	86	83	Monroe	34	69	76
Bayfield	78	60	63	Oconto	41	81	76
Brown	28	79	75	Oneida	70	65	69
Buffalo	53	58	72	Outagamie	27	84	74
Burnette	84	70	68	Ozaukee	31	69	68
Calumet	21	71	81	Pepin	68	60	85
Chippewa	20	89	80	Pierce	47	78	81
Clark	46	71	76	Polk	64	54	66
Columbia	39	59	74	Portage	30	73	80
Crawford	54	72	72	Price	66	73	74
Dane	32	90	88	Racine	47	63	64
Dodge	22	53	55	Richland	50	85	84
Door	57	86	84	Rock	27	71	74
Douglas	42	65	67	Rusk	35	81	83
Dunn	48	75	79	Saint Croix	32	32	66
Eau Claire	20	83	75	Sauk	19	26	58
Florence	68	83	81	Sawyer	83	51	61
Fond du Lac	27	77	78	Shawano	38	66	71
Forest	69	71	72	Sheboygan	41	64	76
Grant	38	81	87	Taylor	70	66	67
Green	38	66	71	Trempealeau	17	47	59
Green Lake	42	58	71	Vernon	37	75	70
Iowa	37	54	73	Vilas	77	61	66
Iron	57	49	67	Walworth	42	55	67
Jackson	41	76	76	Washburn	55	48	56
Jefferson	22	56	68	Washington	56	59	57
Juneau	53	76	74	Waukesha	47	65	66
Kenosha	33	47	55	Waupaca	26	89	85
Kewaunee	31	76	81	Waushara	41	69	71
LaCrosse	27	79	81	Winnebago	32	87	84
Lafayette	33	71	79	Wood	39	53	64
Langlade	61	80	79	Region			
Lincoln	49	88	88	Southern	509	67	74
Manitowoc	21	82	81	Southeast	320	57	59
Marathon	52	84	81	Northeast	686	75	75
Marinette	44	63	64	Western	844	67	73
Marquette	81	71	74	Northern	907	68	71

*County not available for 26 responses

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