Supporting Information

1. SI Literature Review

Most studies that track bottled water consumption as an averting action are limited to cross-sectional, self-reported data from a single location or event (e.g. (*1*, *2*). For example, both Harrington et al (1991) and Laughland et al (1996) examine averting costs due to *Giardia* contamination and rely on telephone surveys of 50 and 175 respondents, respectively. In addition, Abdalla et al. (1992) examine self-reported expenditures on averting actions during a trichloroethylene violation in a Pennsylvanian town. Mailed surveys of 761 households found that only 43% were aware of the contamination that lasted over a year, and of these, nearly 44% took averting actions, which included bottled water purchase, in-home treatment, and boiling (*3*). In contrast, Harding and Anadu (2000) find that 71- 87% of respondents in Oregon communities were aware of quality issues (*E. coli* at one study site; filtration failure at another site) and took averting actions (*4*).

Only one panel study could be found in the literature on averting actions and drinking water quality violations (e.g. (*5*). A panel dataset of water systems and stores located in the respective water service areas was assembled for 2001-2005 in Northern California and Nevada. Findings indicate that sales of bottled water increase due to maximum contaminant level (MCL) violations related to microorganisms (22% increase) and other chemicals (17%), but not nitrate.

More commonly, studies address compliance with boil water notices, which tend to be issued as a precaution for possible biological contamination. In a meta-analysis of customer compliance with boil water advisories, the vast majority of customers avoided drinking water directly from tap, but compliance rates were lower for other ingestion activities, such as brushing teeth and washing produce (*6*). Among those who were aware of the notice, compliance across the 11 studies ranged from 36 – 98%, with a median of 68%. Reasons for not complying include forgetting, not believing the notification, and not avoiding all ways that tap water can be ingested.

Studies of response to boil water notices have revealed that bottled water is generally preferred to boiling (*4*, *7*, *8*). Bottled water purchase can be influenced by a variety of factors, including perceived risk from tap water, awareness of contamination, race, and age (*3*, *9*).

Besides specific water contamination events, some studies address response to ongoing concerns (e.g. (*10*, *11*). Jakus et al (2009) assess risk perception and averting actions in locations with arsenic contamination. A telephone-mail survey collected information on risk and self-reported bottled water expenditures from 201 households who were either served by public systems or private wells (*10*). In addition, Wrenn et al (2016) analyze the perceived risk of shale gas development on groundwater quality and bottled water purchases. Rather than store-level data, this study uses household-level purchases, the majority of which are repeated cross-sections (*11*). Annual averting expenditures are estimated to be $10.74, based on a triple difference model.

In addition, little is known about how individuals respond differently to short-term water quality concerns compared with recurring problems (*4*). One study from the UK documented that after boil water advisory, about 10% of respondents did not return to their usual water using habits (*12*).

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2. SI Background

This study focuses on averting actions in response to health-based violations of the SDWA. Standards for contaminants are defined by the National Primary Drinking Water Regulations and include standards regarding MCL, maximum residual disinfectant level (MRDL), and treatment technique (TT). Tier 1 violations occur when certain contaminants or contaminant indicators, primarily pathogens and nitrate, exceed a MCL standard. In contrast, Tier 2 violations involve contaminants that are unlikely to cause negative health effects after short-term exposure. Tier 2 violations occur when water systems do not comply with MCL, MRDL, or TT requirements for contaminants or indicators such as total coliform, nitrate, disinfection by-products (DBPs), arsenic, and other organic and inorganic chemicals.

Key information that notices must contain is also specified by the US Environmental Protection Agency (EPA), under the Public Notification rule. The same information elements are required for both Tier 1 and Tier 2 violations. Notices must describe the type of violation and possible health consequences, the population at risk, when the violation occurred, and when the issue is likely to be resolved. Recommended actions must also be provided, including alternate water supplies and/or seeking medical care. Information content and mode of delivery can vary across states since each state can specify slightly different protocols, as long as national standards are met. Typically, the affected water system works with the county health department and state-level agency responsible for enforcing the SDWA.

State-level differences also exist in terms of requirements to notify customers when violations are resolved. Federal regulations recommend, sending “problem corrected” notices once a water system has returned to compliance, it is the responsibility of each primacy agency to establish requirements (*13*). Several states do require “problem corrected” notices, especially for Tier 1 violations (*13*). Even within states, notification can differ substantially. For example, two studies of organic contaminants in drinking water found that 96% of households were aware at a site in central Pennsylvania (*21*), but only 43% were aware at a location in a southeastern county (*3*). For a given violation event, the timing of public notification is unknown because the EPA does not compile records on public notices; primacy agencies keep records on file for only three years. In addition, some counties and water systems will provide customers with free or discounted bottled water during violation periods. Thus, controlling for county-level effects is an important feature of our analysis.

Information content also varies by contaminant type (Table S1). Generally, Tier 1 notices emphasize recommended actions and near-term health consequences. In contrast, Tier 2 notices are intended to provide information about the water quality situation, but do not use alarming language (*13*). Furthermore, Tier 2 notices emphasize that customers do not face a near-term health risk and do not need to seek alternate sources of water. Since customers are immediately notified of Tier 1 violations, there is a strong possibility of taking averting actions, such as purchasing bottled water. In contrast, Tier 2 notifications can be provided within 30 days. Some violations might be corrected within that timeframe. Thus, some notifications of Tier 2 violations will only inform customers of past water quality, rather than provide actionable information to address current issues.

Across categories of Tier 1 violations, recommended actions and health effects mentioned in public notifications can also differ. In this study, we create categories of violations based on potential health consequences and public notification, as summarized in Table S1 and fully described in the *SI Data* section. The category 'Pathogens' includes violations of total coliform and turbidity standards. These contaminant indicators can trigger Tier 1 violations due to the presence of fecal coliform or due to elevated levels of turbidity, which can interfere with disinfection and promote growth of bacteria, viruses, and parasites (e.g. *Cryptosporidium*). The classification of 'Nitrate' includes nitrate and nitrite violations, while 'Other' includes all other contaminants that can trigger health-related violations, such as arsenic, disinfection by-products, and radionuclides. All 'Nitrate' violations are Tier 1, while all 'Other' violations are Tier 2.

Tier 1 notices for noncompliance with total coliform and turbidity state that elevated levels have been found in the water supply and recommend boiled or bottled water. In addition, public notices for a confirmed presence of *E. coli* will state that this indicates possible contamination from human or animal wastes, which can cause illness. Tier 1 notices for nitrate state that infants under six months old should not drink tap water. Meanwhile, for Tier 2 violations, possible health effects are only mentioned for some Pathogen violations. Notification for these violations state that there is an increased chance that disease-causing organisms are in the water supply and not all in-home filters can effectively remove parasites. Meanwhile, Tier 2 violations of 'Other' chemical types mention increased health risks due to drinking tap water with contaminants in excess of the MCL over many years (*14*).

Compliance with public notices will influence the extent to which customers take averting action and reduce exposure to contaminated water. Bottled water purchase is a commonly recommended action, in addition to boiling and/or in-home filtration or chlorine treatment for many pathogenic concerns. In contrast, nitrate cannot be removed by boiling and either requires purchase of alternative water source or another treatment processes, such as reverse osmosis.

Bottled water consumption has increased dramatically over the past several decades, partly due to perceived health and safety concerns (*15*). While quality standards are mostly similar for public tap water and bottled water, differences in regulation do exist. Standards for bottled water are regulated by the US Food and Drug Administration (FDA) under the Federal Food, Drug, and Cosmetic Act. While FDA regulations apply to bottled water sold in interstate commerce, such regulations are not applicable to water that is produced and sold in a single state. Yet, state public health agencies can choose to implement standards (*16*). Sampling protocols and oversight activities also differ between the FDA and EPA. The EPA requires public water testing by certified laboratories, which submit results directly to state regulators. In contrast, the FDA relies on bottlers to submit their own sampling results. Both source water and finished bottled water must be tested at least once a week for microbiological contaminants, which is less frequent than many public water systems. Public systems serving more than 4,100 people must sample more frequently than once a week for microbiological contaminants, indicated via total coliform. Meanwhile, bottlers are required to test at least once a year for other contaminants.

While bottled water standards typically match those of the Safe Drinking Water Act, at the Federal level, differences do exist when compared to state-level standards for public tap water. Primacy agencies have the authority to establish standards that are stricter than the Federal level. In these cases, bottled water tends to be subject to the less strict Federal standards. In other ways, bottled water standards can be higher than public tap water. For example, the lead action level for tap water is 15 parts per billion (ppb), while the level for bottled water is 5 ppb (*17*). This difference is due to the fact that water at bottling facilities does not flow through lead pipes.

Beyond water quality testing, bottling facilities are also subject to FDA inspection for sanitary conditions. Facilities are inspected as part of the overall food safety program. Yet, the number of inspections has declined in recent years. In 2010, the FDA conducted 371 inspections, but only 209 by 2017 (*18*). Typically, few staff oversee state bottled water programs, with only one full-time employee in California and New Jersey, for example. Beyond inspections, some states also require bottlers to be licensed each year. Therefore, the quality of bottled water likely varies across states, both by state of origin and state of sale.

A major difference between bottled water and tap water is reporting and notification. Bottlers do not need to notify the public if elevated contaminant levels are found, nor are quality data collected by the FDA in a public repository. Public records on bottled water quality can be difficult to access and some states do not collect this information or might destroy testing reports after only a few years. The FDA does issue an annual report on the quality of U.S. bottled water, yet only aggregate results are reported across all companies. In contrast, public water systems must notify their service areas of elevated contaminates, provide annual water quality summaries to customers, and data on public water quality is maintained in a publicly-accessible database, the Safe Drinking Water Information System.

Enforcement activities can be conducted by both the FDA and EPA. The FDA can issue warning letters and, as of 2011, can mandate recalls on noncompliant products. Yet, the FDA has yet to mandate a recall. In recent years, about 22 recalls have been issued by bottlers, for arsenic levels and other concerns (*18*).

Few studies exist on bottled water quality in the U.S. and associated health impacts. Several studies have been conducted on total nitrate in bottled water and have generally found low concentrations (*19–21*). Yet, one study found some bottled water contained total nitrate level above the federal MCL, with spring water having the highest levels (*22*). Average bacterial counts were found to be higher in bottled water compared to Cleveland tap water (*23*), while a study in Europe detected norovirus in a third of mineral water samples (*24*). Few studies address health impacts associated with bottled water. Disease outbreaks associated with bottled water do occur, but are often not reported (*25*). The Centers for Disease Control and Prevention (CDC) collects information on outbreaks, including those attributable to bottled water. All 14 reported outbreaks due to bottled water, from 1971-2010, have been related to acute gastrointestinal illness (AGI). Beyond outbreaks, one study found that bottled water consumption was associated with greater risk of AGI in children in Milwaukee (*26*). Yet, for nitrate, an epidemiologic study found that bottled water concentrations of nitrate tended to be lower than public tap water and resulted in lower median nitrate intake from drinking water (*21*).

3. SI Data

Bottled Water Sales

Our data on bottled water consumption uses weekly sales (Sunday to Saturday) from the Nielsen Retail Scanner dataset for weeks from January 1, 2006 to December 31, 2015. The Nielsen dataset includes grocery stores, drugstores, convenience stores, and mass merchandisers (e.g. club, Walmart, military, dollar stores). These stores are affiliated with about 90 participating retail chains and are estimated by Nielsen to represent over half of total sales volume of U.S. grocery and drug stores as well as more than 30% of mass merchandiser sales volume.

It should be noted that conclusions drawn from these data are our own and Nielsen had no role in the analysis. Our assembled dataset includes sales in dollars for over 5,000 Universal Product Codes (UPCs) of bottled water, which include flavored and unflavored water, as well as different container sizes of the same product. Since the Nielsen dataset does not consistently provide information about volume of water sold, we define our dependent variable as the log of aggregate sales in dollars (constant $2015) for all UPCs by county and week. We exclude stores that report sales during fewer than 469 weeks, which represents 90% of the weeks in our study period.

Water Quality Violations

We obtained violation data from the EPA Safe Drinking Water Information System (SDWIS) for years 2006 to 2015. These data include the contaminant that triggered the violation, start and end date of the violation, and community water system (CWS) characteristics, including the number of people and counties served. For CWS that serve multiple counties, we split the population served between counties based on the share of combined population. For example, if a CWS serves two counties, where County A has twice the population of County B, then two-thirds of the service population is designated as County A. Few water systems (n=102) serve multiple counties.

When a violation occurs at a given CWS, we designate all counties served by that CWS as having a violation. We define several violation variables. Tier 1 violations include contaminants that pose an immediate health risk, such as pathogens and nitrate. Meanwhile, Tier 2 violations occur when water systems do not comply with other requirements related to MCL, MRDL, and TT. CWS are required to notify customers within 24 hours for Tier 1 violations, and within 30 days for other health-related violations.

We create categories of violations based on potential health consequences and public notification, as summarized in Table S1. The category ‘Pathogens’ includes contaminants that can cause acute gastrointestinal illness. Tier 1 violations of this category include excessive turbidity levels or confirmed presence of fecal coliform or *E. coli*. Meanwhile, Tier 2 violations feature indications of bacterial concerns (that lack confirmed fecal contamination) and a variety of treatment techniques related to *Cryptosporidium*, *Giardia lamblia*, and viruses. Effective averting actions are boiling water and purchasing bottled water.

Our ‘Nitrate’ category includes nitrate and nitrite violations, which only present an immediate risk to infants. Nitrate cannot be removed through boiling and require other treatment processes, such as reverse osmosis. Lastly, our ‘Other’ category includes all other contaminants that can trigger health-related violations, including arsenic, lead, copper, disinfection by-products, and radionuclides. These 'Other' contaminants are not considered to pose immediate health risks. Rather, long-term exposure to these contaminants can lead to elevated risk of a variety of conditions, including cancer and nervous system problems.

We calculate the duration of each violation category based on start and end dates of the compliance period. A small number of violations in the SDWIS dataset (n=249, or 0.002% of all violations in the raw dataset) are excluded because an end date is not reported and the compliance status is unknown. For violations with known violation status and have returned to compliance, if the end date is not reported, the return to compliance date is assumed (n=2,114, or 0.02% of all violations in the raw dataset).

Weather Data

Temperature and precipitation data were obtained from the NOAA National Centers for Environmental Prediction (NCEP). Daily average air temperature is from the NCEP North American Regional Reanalysis (NARR) dataset, which has a 32km resolution (*27*). Daily average precipitation was from the U.S. Climate Prediction Center (CPC) Gauge-Based Analysis of Global Daily Precipitation (*28*). This is a global dataset available at 0.5-degree resolution. Gridded climate data was converted to county-level information by calculating average values of cells within county boundaries. Number of rainy days in a given week and county was calculated based on the number of days that average precipitation was 1mm or greater.

Demographic Data

Annual, county-level Census characteristics include median household income, housing density, percent nonwhite population, and median year housing stock built. These demographic data were obtained from the decennial census in 2010 and the American Community Survey data in years of 2006, 2008, and 2012. Values in inter-census years were estimated using monotone piecewise cubic interpolation.

4. SI Materials and Methods

Regression Models of Quality Violations on Bottled Water Sales, by violation category

Demand for bottled water is influenced by attributes of substitutes and customer characteristics, such as income and preferences. Preferences can be shaped by both time-invariant and time-varying factors. Substitutes, including tap and bottled water, can differ across attributes such as taste, aesthetics, convenience, and perceived quality. If a violation occurs, demand for bottled water would be expected to increase as consumers substitute away from tap water. Yet, bottled water could be purchased for a variety of reasons other than reducing exposure to contaminated water supply, such as taste and convenience.

This jointness in production can complicate efforts to understand health-related reasons for bottled water purchase. Our study addresses this issue of joint production in three ways, as described in the Main Text. First, the analysis focuses on changes in purchases during quality violation events. Changes in bottled water expenditures during these defined events are likely to be due to health concerns rather than changes in other preferences. Second, the regression models control for year and week fixed effects as well as weather variables that capture seasonal preferences. Third, we develop a a modified specification to test if repeated violations (violations other than first-time violations) are associated with a lower response of increased bottled water sales, perhaps due to habitual drinking of bottled water.

In the regression models, the violation indicator is calculated by taking the portion of the county population that was served by a given water system and multiplying this by the portion of days in the week that the violation was in effect. This measures possible exposure of the county population to violations and coefficient β_1 is interpreted as the percent change in sales in a given county from a violation that affects the entire county population.

In addition, weather variables control for time-varying preferences for bottled water. Weather variables include weekly mean temperature and number of rainy days each week. Census variables (Z_{cy}) are included for each county *c* and year *y*. Census characteristics include logged median household income, logged housing density, percent nonwhite population, and logged median year housing stock built.

Lastly, ε_{ct} is an error term that includes a county-specific component, which allows for correlation in sales over time within a given county. By clustering errors, our models relax the assumption that errors be independent and identically distributed from one observation to the next. Model errors might be correlated for water systems within the same county, but model errors across counties are assumed to be uncorrelated. Failing to control for within-cluster error correlation can produce misleadingly small standard errors. By estimating cluster-robust standard errors, we can relax the assumption of normally distributed errors and homoscedasticity. Models are specified for several types of Tier 1 and Tier 2 violations, based on categories defined in the *SI Data* section.

Regression Models of Quality Violations on Bottled Water Sales, by demographic group

The analysis also addresses how averting actions vary based on community demographics, such as below median income and rural areas. To estimate the average response of rural counties with household income below and above the median, we specify an interaction term of the Tier 1 violation indicator and a dummy variable for counties with below median income, while restricting the sample to rural counties. Counties are designated as above or below median income based on the average income across all years for each county. To classify communities as above or below median income, we calculate the national median household income across all counties over the full study period, 2006-2015. A given county is then classified as being below median income if that county has an average income level, 2006-2015, that is below our calculated national median value.

Counties are classified as rural if average housing density across all years is less than 16 units per square mile, based on rural categories defined in (*29*). Therefore, we calculate the mean value of housing density for a given county across all years, 2005-2016, and observe whether this average value is less than 16 units per square mile. To estimate change in sales for non-rural counties with below median household income, we specify an interaction term of the Tier 1 violation indicator and a dummy variable for rural counties, while restricting the sample to counties with below median income. The average change in sales is calculated using a similar approach for non-rural counties with above median household income. This provides insight into which types of communities take averting actions due to impaired drinking water and which do not avert exposure through bottled water purchase. Lower increases in bottled water sales could be attributable to (i) individuals not averting exposure through bottled water purchase, or (ii) relatively high baseline sales of bottled water, which leads to smaller increases during violation periods.

Regression Models of Repeat Violations and Post-Violation Sales

We also assess whether responses of sales differ for repeat violations as well as periods after a violation ends. For repeat violations, we compare the change in sales due to first-time violations (i.e. the first observed violation at a given CWS in our study period) and repeat violations (i.e. subsequent violations that occur at a given CWS). In this way, we seek to determine if the response of bottled water sales increases over time, perhaps due to learning (i.e. the public learns how to react to public notices), or dampens over time, perhaps due to habitual drinking of bottled water or the public becoming indifferent to violation notices. To test, we modify the violation indicator in the base model (Eqn 1) and restrict the sample to counties that have at least one CWS with a more than one violation (i.e. CWS with at least one repeat violation). In the base model, there is one indicator that is calculated by taking the portion of the county population that was served by a given water system (p_{ic}/p_c) and multiplying this by the portion of days in the week that the violation was in effect ($k_{ict}/7$). The modified specification considers three types of violation periods: (i) No violation, (ii) First-time violation, and (iii) Repeat violation. The modified regression model omits the first-time violation period; this then serves as the comparison category. The model does include indicators for 'No violation' and 'Repeat violation'. This allows the estimated coefficient value for 'Repeat violation' to indicate the change in sales due to repeat violations, relative to first-time violations.

We also examine if bottled water sales remain elevated after a violation period has ended. To do so, we modify the violation indicator in the base model and restrict the sample to counties that have at least one Tier 1 violation. The modified specification considers three types of violation periods: (i) Before the first-time violation, (ii) After any Tier 1 violation period (*Post-violation*), and (iii) during a Tier 1 violation (*Any Tier 1*). During the post-violation period, no CWS in a given county has a violation. These models were not run for Tier 2 violations because the greater prevalence of Tier 2 violations means there are fewer periods, post-violation, during which no CWS in a given county had Tier 2 violations. The modified regression model omits the before first-time violation period; this serves as the comparison category. This allows the estimated coefficient value for 'Post-violation' to indicate the change in sales after violations, relative to sales before a violation occurs for the first time during our study period.

The post-violation regression models also include a specification with an interaction term. This term is an interaction of the post-violation period and the number of weeks since the violation ended. The estimated coefficient value for this interaction term will indicate whether purchasing behavior changes, relative to sales before a violation occurs for the first time during our study period. Therefore, this analysis indicates whether any altered behavior declines or increases based on the amount of time after a violation.

5. SI Results

Summary Statistics

Bottled water sales vary seasonally, as discussed in the Main Text. Sales are particularly high during the North American heat wave in summer 2011. This illustrates the importance of controlling for seasonal and temporal variations in bottled water sales. Total sales per capita across all years in the study period range from $0.35 to $53.03.

In our regression sample, about 31% of counties in the continental U.S. are excluded either due to (i) lacking CWS that meet our study inclusion criteria (2% of counties), or (ii) lacking stores with suitable sales data (28% of counties). Insufficient sales data can be due to a county either (i) lacking any stores that report to the Nielsen database, or (ii) lacking at least one store that reports for 469 weeks or more during 2006-2015. Considerable areas in the Central Plains and Midwest are not included in the final regression samples. Compared to included counties, excluded counties tend to be more rural and have lower median household income, less nonwhite population, and older building structures. When comparing the study sample to all counties in the U.S., our sample has slightly higher household income ($1,136 per year), greater percent nonwhite population (1.2 percentage points), and newer building structures (2.2 years newer). Yet, the study sample is not significantly more urban (i.e. housing density does not differ) than counties in the continental U.S. overall. Based on these comparisons, it appears that study results cannot be generalized to counties excluded from the regression sample. These counties represent 31% of counties and 4.6% of population in the continental U.S.

Duration of violations can be measured either at the individual water system or county-level. At the county-level, violation duration is longer since violation periods at individual water systems can overlap. For example, Tier 1 violations at the county-level last over 50% longer than at individual systems (Table S3). Meanwhile, Tier 2 violations have more than double the duration at the county-level, compared to the CWS-level (Table S3).

Seasonality is present for the occurrence of Pathogen violations. Tier 1 violations of this contaminant category have slight seasonal peaks during summer months of June to September, particularly in July and August (Figure 2). Tier 2 Pathogen violations also have clear summertime peaks (Figure S2). These violations are particularly frequent in September and October, while occurrence is relatively infrequent in March and April. Inter-annual variation also exists, most notably for Tier 2 Other contaminants.

Geographically, violation occurrence is concentrated in some locations of the country. Tier 1 violations are especially prevalent in parts of the Central Plains (southern Oklahoma and central Texas), Southwest, and Appalachia (Figure 2). Tier 2 violations are also prevalent in these areas in addition to the Carolinas and New England (Figure S3).

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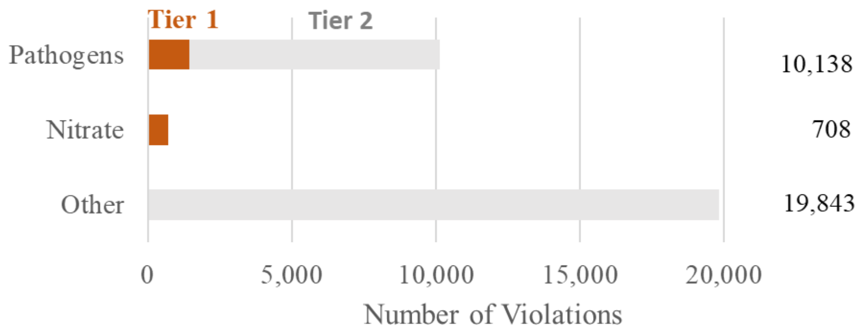

Fig. S1. Number of violations 2006-2015, by contaminant category.

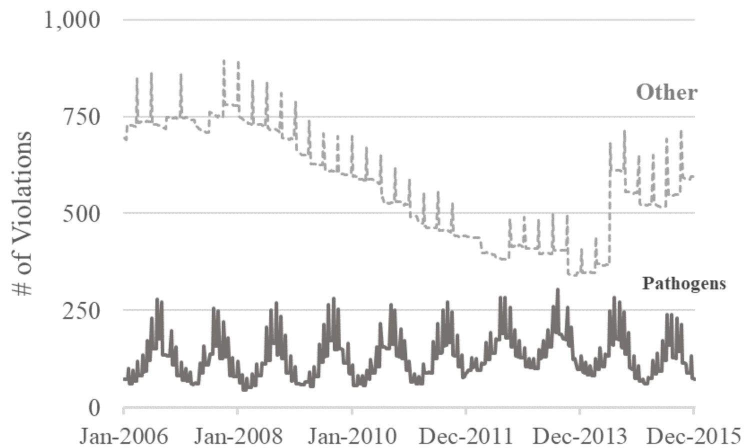

Fig. S2. Number of weekly Tier 2 violations, 2006-2015. Violation counts are presented separately for those attributable to two categorizations –Pathogens (solid gray line) and Other (dashed gray line).

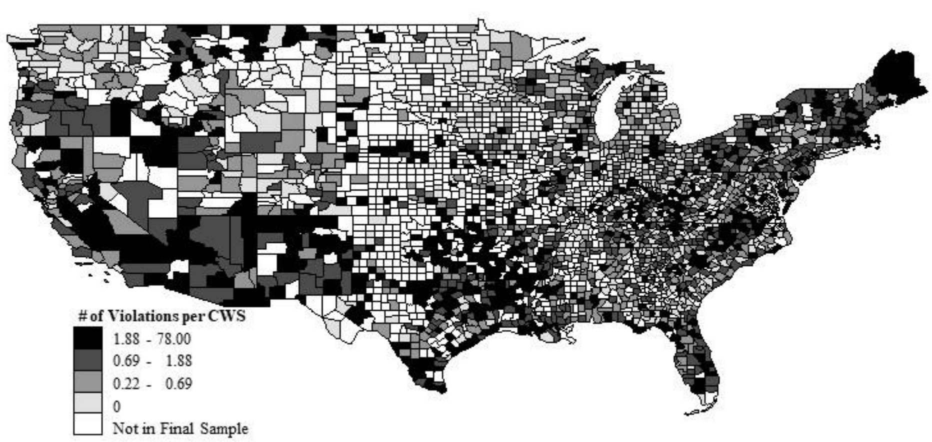

Fig. S3. County-level Map of Tier 2 Violations per Community Water System, 2006-2015. Counties not included in the final sample are mostly attributable to insufficient sales data (*SI Results*).

Table S1. Information Content for Tier 1 and Tier 2 Public Notices

Study Category	Contaminants	SDWA Rules	Public Notification	
			Recommended actions	*Mention of health effects*
Tier 1				
Pathogens	Fecal coliform, *E. coli* [1] Turbidity [2]	•Total Coliform Rule •Revised Total Coliform Rule •Surface Water Treatment Rules [3] •Ground Water Rule	Boiled or bottled water	Yes - nausea, cramps, diarrhea, and headaches
Nitrate	Nitrate, Nitrite [4]	•Phase II	Infants <6 months should not drink tap water; do not boil tap water	Yes – "blue baby" syndrome [5]
Tier 2				
Pathogens	Total coliform [6], Turbidity, *Cryptosporidium*, *Giardia lamblia*, other Treatment Techniques [7]	•Total Coliform Rule •Revised Total Coliform Rule •Surface Water Treatment Rules •Ground Water Rule	N/A	Yes - nausea, cramps, diarrhea, and headaches[8]
Other	Arsenic, lead, copper, DBPs, radionuclides, other chemicals	•Arsenic rule •Lead and Copper Rule •DBPs rules [9] •Radionuclides •Phase I, Phase II, Phase V	N/A	Yes – Increased risk due to exposure in excess of MCL over many years

Notes:
[1] MCL violation or failure to test for fecal coliform or *E. coli* after a repeat sample tests positive for total coliform.
[2] MCL violation or failure to consult with primacy agency within 24 hours of exceedance. The MCL for monthly average turbidity is 1 Nephelometric turbidity unit (NTU). For systems that are required to filter but have not yet installed systems, the two-day average MCL is 5 NTU.
[3] Includes the Surface Water Treatment Rule, Interim Enhanced Surface Water Treatment Rule, Long Term 1 Enhanced Surface Water Treatment Rule, and Long Term 2 Enhanced Surface Water Treatment Rule.
[4] MCL violation or failure to take confirmation sample within 24 hours of MCL exceedance. It should be noted that all nitrate and nitrite violations are Tier 1.
[5] Elevated levels of nitrate pose a particular risk to infants less than six months old and can cause methemoglobinemia, or "blue baby" syndrome.
[6] MCL violation is triggered when greater than 5% of monthly samples for total coliform-positive. For CWS collecting fewer than 40 monthly samples, more than one sample is total coliform-positive.
[7] Treatment technique violations of the Surface Water Treatment rules include failure to filter, inadequate disinfection, failure to cover finished water in a reservoir, and failure to conduct required Cryptosporidium monitoring. Treatment technique violations of the Ground Water Rule include failure to maintain 4-log treatment of viruses and failure to take corrective action within required time frame.
[8] Health effects are not mentioned for Tier 2 violations of the Total Coliform Rule.
[9] Includes Trihalomethanes rule, Stage 1 Disinfectants and Disinfection By-products Rule, and Stage 2 Disinfectants and Disinfection By-products Rule.

Table S2. Summary statistics for regression sample. Descriptive statistics for the sample of county-week observations included in the six main regression models presented in Table 2.

Variable	Description	Mean	SD	Min	Max
Dependent Variable					
Bottled Water Sales	Weekly sales of bottled water, in $2015	22,996	89,260	0.816	4,231,504
Violation Variables[1]					
Any Tier 1	Indicator of Tier 1 violation	0.002	0.03	0	1
Tier 1: Pathogens	Indicator of a Pathogens, Tier 1 violation	0.001	0.02	0	1
Tier 1: Nitrate	Indicator of a Nitrate, Tier 1 violation	0.001	0.03	0	1
Any Tier 2	Indicator of Tier 2 violation	0.038	0.13	0	1
Tier 2: Pathogens	Indicator of a Pathogen, Tier 2 violation	0.006	0.05	0	1
Tier 2: Other	Indicator of an Other, Tier 2 violation	0.032	0.13	0	1
Independent Variables					
Mean Temperature	Average weekly temperature, in degrees Celsius	13.5	10.3	-24.8	38.6
# Rainy Days	Number of rainy days in the week	2.05	1.59	0	7
Median Household Income	Median household income, in $2015	51,308	14,439	16,583	145,501
% Nonwhite	Percent nonwhite population	0.170	0.157	0	0.881
Housing density	Housing units per square mile	143	983	0.358	38,312
Median year structure built	Median year housing units were built	1975	10.31	1939	2007
Obs	1,120,666				
# Counties	2,151				
# Community Water Systems	18,814				

Notes:
[1] Violation indicator variables are calculated by multiplying (i) the portion of county population served by a system in violation, and (ii) the portion of days in week that violation was in effect

Table S3. Summary of violation durations. Duration of violation by violation type, presented for the study sample of community water systems and the sample of counties.

	CWS Level					**County Level**			
	Number of Violations	***Duration (Days)***				***Duration (Weeks)***			
	Count	*Mean*	*SD*	*Min*	*Max*	*Mean*	*SD*	*Min*	*Max*
Tier 1 Violations									
All Tier 1 Violations	2,147 [1]	53.2	61.4	27	1,551	11.1	32.9	3.71	495.4
Pathogens	1,438	29.6	2.83	27	90	5.48	3.69	3.71	48.1
Nitrate	708	101	89.4	27	1,551	37.7	72.7	4.00	495
Tier 2 Violations									
All Tier 2 Violations	28,543	113	339	1	7,631	32.7	69.1	0.140	521
Pathogens	8,700	53.8	233	1	7,631	7.99	22.3	0.710	492
Other	19,843	139	374	1	6,346	69.7	92.7	0.140	521

Notes:
[1] Tier 1 violations include the following categories: Pathogens, Nitrate, and Chlorine dioxide. Only one Tier 1 chlorine dioxide violation occurs in the study sample. For this reason, the sum of Any Tier 1 violation count is one violation greater than the sum of the two presented categories.

Table S4. Summary Statistics for Regression Sample of Demographic Groups in Table 3.
S4.A. Rural County samples

		Rural, Low Income				Rural, High Income			
Variable	**Description**	**Mean**	**SD**	**Min**	**Max**	**Mean**	**SD**	**Min**	**Max**
Dependent Variable									
Bottled Water Sales	Weekly sales of bottled water, in $2015	2,310	6,828	1.132	134,524	3,845	6,678	0.8160	99,348
Per Capita Bottled Water Sales	Per capita, weekly sales of bottled water, in $2015	0.085	0.12	0	3.2	0.13	0.17	0	2.3
Violation Variables[1]									
Any Tier 1	Indicator of Tier 1 violation	0.0049	0.053	0	1	0.0042	0.051	0	1
Tier 1: Pathogens	Indicator of a Pathogen, Tier 1 violation	0.0013	0.023	0	1	0.0006	0.019	0	1
Tier 1: Nitrate	Indicator of a Nitrate, Tier 1 violation	0.0036	0.048	0	1	0.0036	0.047	0	1
Any Tier 2	Indicator of Tier 2 violation	0.061	0.17	0	1	0.042	0.16	0	1
Tier 2: Pathogens	Indicator of a Pathogen, Tier 2 violation	0.0080	0.061	0	1	0.0077	0.057	0	1
Tier 2: Other	Indicator of Other, Tier 2 violation	0.053	0.17	0	1	0.035	0.15	0	1
Independent Variables									
Mean Temperature	Average weekly temperature, in degrees Celsius	14.5	10.5	-24.4	38.6	10.2	11.6	-24.8	37.0
# Rainy Days	Number of rainy days in the week	1.86	1.63	0	7	1.66	1.60	0	7
Median Household Income	Median household income, in $2015	40,339	6,980	20,067	60,464	56,363	9,085	38,336	108,300
% Nonwhite	Percent nonwhite population	0.22	0.20	0	0.87	0.10	0.091	0	0.57
Housing density	Housing units per square mile	9.24	4.52	0.358	17.0	7.98	4.48	0.394	16.2
Median year structure built	Median year housing units were built	1973	8.961	1939	1999	1972	11.04	1944	1998
CWS-Level Variables									
# Total Violations per CWS	Number of total violations per CWS	3.16	5.10	0	40.5	2.59	8.72	0	78.0
# Tier 1 Violations per CWS	Number of Any Tier 1 violations per CWS	0.325	1.67	0	24.0	0.227	0.812	0	5.67
# Tier 1: Pathogens per CWS	Number of Tier 1 Pathogen violations per CWS	0.138	0.424	0	4.667	0.0790	0.281	0	2.500
# Tier 1: Nitrate per CWS	Number of Tier 1 Nitrate violations per CWS	0.19	1.61	0	24.0	0.15	0.76	0	5.67
# Tier 2 Violations per CWS	Number of Any Tier 2 violations per CWS	2.84	4.65	0	36.0	2.36	8.53	0	78.0
# Tier 2: Pathogens per CWS	Number of Tier 2 Pathogen violations per CWS	0.71	1.11	0	15.0	0.45	0.72	0	4.00
# Tier 2: Other per CWS	Number of Tier 2 Other violations per CWS	2.13	4.47	0	34.0	1.91	8.55	0	78.0
Observations			182,871				93,776		
# Counties			351				180		
# Community Water Systems[2]			1,810				966		

S4.B. Non-Rural County samples

Variable	Description	Non-Rural, Low Income				Non-Rural, High Income			
		Mean	SD	Min	Max	Mean	SD	Min	Max
Dependent Variable									
Bottled Water Sales	Weekly sales of bottled water, in $2015	7,364	17,521	1.246	381,996	47,622	133,516	1.246	4,231,504
Per Capita Bottled Water Sales	Per capita, weekly sales of bottled water, in $2015	0.083	0.079	0	1.38	0.15	0.13	0	2.89
Violation Variables[1]									
Any Tier 1	Indicator of Tier 1 violation	0.0011	0.022	0	1	0.0013	0.023	0	1
Tier 1: Pathogens	Indicator of a Pathogen, Tier 1 violation	0.0011	0.022	0	1	0.0008	0.020	0	1
Tier 1: Nitrate	Indicator of a Nitrate, Tier 1 violation	0.0000	0.0010	0	0.076	0.0005	0.012	0	0.94
Any Tier 2	Indicator of Tier 2 violation	0.039	0.14	0	1	0.027	0.10	0	1
Tier 2: Pathogens	Indicator of a Pathogen, Tier 2 violation	0.0048	0.044	0	1	0.0050	0.042	0	1
Tier 2: Other	Indicator of Other, Tier 2 violation	0.035	0.13	0	1	0.022	0.093	0	1
Independent Variables									
Mean Temperature	Average weekly temperature, in degrees Celsius	14.8	9.53	-20.0	37.2	12.9	10.3	-23.6	37.7
# Rainy Days	Number of rainy days in the week	2.20	1.56	0	7	2.08	1.58	0	7
Median Household Income	Median household income, in $2015	42,098	6,308	16,583	60,918	62,055	14,020	38,838	145,501
% Nonwhite	Percent nonwhite population	0.18	0.17	0	0.88	0.15	0.12	0	0.81
Housing density	Housing units per square mile	92.8	530	15.2	12,531	262.2	1,439	14.2	38,312
Median year structure built	Median year housing units were built	1976	9.255	1939	1997	1977	11.16	1939	2007
CWS-Level Variables									
# Total Violations per CWS	Number of total violations per CWS	1.78	2.83	0	21.4	1.41	2.24	0	28.0
# Tier 1 Violations per CWS	Number of Any Tier 1 violations per CWS	0.119	0.427	0	6.50	0.096	0.322	0	4.83
# Tier 1: Pathogens per CWS	Number of Tier 1 Pathogen violations per CWS	0.107	0.353	0	4.50	0.0650	0.203	0	4.00
# Tier 1: Nitrate per CWS	Number of Tier 1 Nitrate violations per CWS	0.0120	0.238	0	6.33	0.0300	0.222	0	3.55
# Tier 2 Violations per CWS	Number of Any Tier 2 violations per CWS	1.66	2.66	0	19.6	1.31	2.15	0	28.0
# Tier 2: Pathogens per CWS	Number of Tier 2 Pathogen violations per CWS	0.390	0.560	0	5.00	0.455	0.724	0	10.0
# Tier 2: Other per CWS	Number of Tier 2 Other violations per CWS	1.27	2.51	0	19.0	0.858	1.95	0	27.7
Observations			377,724				466,295		
# Counties			725				895		
# Community Water Systems[2]			5,146				10,923		

Notes:
[1] Violation indicator variables are calculated by multiplying (i) the portion of county population served by a system in violation, and (ii) the portion of days in week that violation was in effect.
[2] The total number of CWS in the regression sample is 18,814. This is not equal to the sum of CWS across the four demographic groups due to CWS that serve multiple counties. Within a given demographic group, the total number of CWS is reported. Some CWS serve multiple counties that are categorized into different demographic groups.

Table S5. Summary of violation prevalence, by demographic group. Number of violations per county and per CWS, 2006-2015. Reported values are the quotient calculated by dividing the total number of violations by the number of counties or CWS in each demographic group, respectively.

	Rural, Low Income		**Rural, High Income**		**Non-Rural, Low Income**		**Non-Rural, High Income**		**Total**	
	violations per county	**violations per CWS**	**per county**	**per CWS**	**per county**	**per CWS**	**per county**	**per CWS**	**per county**	**per CWS**
All violations	15.9	3.08	8.98	1.67	13.1	1.85	15.6	1.28	14.3	1.63
Tier 1[1]	1.30	0.252	0.872	0.163	0.852	0.120	1.02	0.0839	1.00	0.114
Tier 2	14.6	2.83	8.11	1.51	12.3	1.73	14.6	1.20	13.3	1.52
Tier 1 - Pathogens	0.732	0.142	0.317	0.0590	0.746	0.105	0.651	0.0534	0.669	0.0764
Tier 1 - Nitrate	0.567	0.110	0.556	0.104	0.106	0.0150	0.371	0.0304	0.329	0.0376
Tier 2 - Pathogens	3.59	0.696	2.60	0.484	3.02	0.426	5.34	0.438	4.04	0.462
Tier 2 - Other	11.0	2.13	5.51	1.03	9.23	1.30	9.28	0.760	9.23	1.05
# counties and # CWS[2]	351	1,810	180	966	725	5,146	895	10,923	2,151	18,814

Notes:

[1] Tier 1 violations include the following categories: Pathogens, Nitrate, and Chlorine dioxide. Only one Tier 1 chlorine dioxide violation occurs in the study sample. For this reason, the sum of Any Tier 1 violation count is one violation greater than the sum of the two presented categories.

[2] The total number of CWS in the regression sample is 18,814. This is not equal to the sum of CWS across the four demographic groups due to CWS that serve multiple counties. Within a given demographic group, the total number of CWS is reported. Some CWS serve multiple counties that are categorized into different demographic groups.

Table S6. Comparison of summary statistics: Regression sample vs. excluded counties

	Regression Sample				Excluded counties			
Variable	**Mean**	**SD**	**Min**	**Max**	**Mean**	**SD**	**Min**	**Max**
Independent Variables								
Mean Temperature	13.6	4.57	-0.610	25.2	12.6	4.55	-2.51	23.7
# Rainy Days	2.05	0.460	0.250	3.59	1.79	0.450	0.500	3.44
Median Household Income	51,308	13,677	23,243	133,323	47,589	10,162	21,031	129,943
% Nonwhite	0.170	0.160	0.0100	0.860	0.130	0.170	0.0100	0.890
Housing density	143	983	0.370	37,349	46.0	248	0.190	4,843
Median year structure built	1975	10.20	1939	2000	1968	11.50	1939	1999
# Counties	2151				946			

Note:
These summary statistics represent the county-level. For each county, mean values for each independent variable were calculated. Then, the average across these means was calculated for the regression sample and excluded counties.

Table S7. Regression Results: Repeat violations. In these regressions, samples are restricted to counties with at least one CWS with a repeat violation, as described in *SI Materials and Methods*.

	Tier 1	**Tier 2**
No violation	0.0027	-0.041***
	(0.025)	(0.013)
Repeat violation	0.168**	0.058**
	(0.083)	(0.022)
Observations	117,224	708,034
R^2	0.988	0.986

Notes:
*** Significant at the 1 percent level, ** Significant at the 5 percent level, * Significant at the 10 percent level.
Standard errors (in parentheses), clustered at county level. The regression includes year, week, and county fixed effects. In addition, the regression controls for all variables presented in Eqn. 1.
Repeat violation model is restricted to counties with at least one CWS with a repeat violation. These models omit the first-time violation period, which serves as the comparison category.

Table S8. Regression Results: Post-Violation Sales. These models consider changes in bottled water sales after Tier 1 violations, compared to sales during a Tier 1 violation period.

	(1) No Interaction	(2) Interaction	(3) No Interaction	(4) Interaction
Post-violation	0.023**	0.026**	0.0015	0.0069
	(0.011)	(0.011)	(0.020)	(0.020)
Post-violation X # weeks after		-0.0001*		0.00
		(0.0001)		(0.0001)
Any Tier 1	0.171***	0.156***	0.137*	0.124
	(0.055)	(0.054)	(0.076)	(0.075)
Observations	321,456	321,456	117,224	117,224
R^2	0.988	0.988	0.988	0.988

Notes:
*** Significant at the 1 percent level, ** Significant at the 5 percent level, * Significant at the 10 percent level.
Standard errors (in parentheses) clustered at county level. All regressions include year, week, and county fixed effects. In addition, regressions control for all variables presented in Eqn. 1.
In models (1) and (2), sample is restricted to counties with at least one violation. In models (3) and (4), sample is restricted to counties with at least one CWS with a repeat violation; this is the same sample as Table S7. These models omit the before first-time violation period, which serves as the comparison category.