

**Does Public Information Disclosure Reduce Drinking Water Violations?
Evidence from Massachusetts
Katrina Jessoe, Hixon Fellow of Urban Ecology 2006-2007
Sheila Olmstead, Faculty Advisor
Yale School of Forestry and Environmental Studies**

Project Overview: The 1996 amendments to the Safe Drinking Water Act required that community drinking water services provide Consumer Confidence Reports to their consumers. The CCRs disclose information on the source of drinking water, any detected contaminants and violations of health-based drinking water violations and procedural protocol. This “right to know” legislation informs households about drinking water contaminants and the deleterious health effects associated with exposure to these contaminants. Information disclosure may alter the behavior of both water suppliers and consumers.

Panel data on drinking water violations by 517 community systems from 1990 to 2003 were collected by the State of Massachusetts. This study employed three different estimation strategies – panel data models, a quantile regression and a regression discontinuity design – to explore the impact of information disclosure on drinking water violations.

Prior to the “right to know” legislation, water utilities submitted water violation information to the State; thus water utilities gained no new information from the “right to know” legislation. The results suggest that utilities altered behavior following the CCR legislation. This finding is more pronounced for utilities that were required to mail CCRs directly to consumers. Consumer awareness of drinking water violations will likely generate political responses and risk averting behavior. Public awareness of drinking water quality will most likely increase if consumers are directly informed about water quality via the in-home delivery of CCRs.

Contributions of Fellow: My research contribution included data collection of CCR mailings, a feasibility study of national data, a literature review on CCR legislation and an examination of Poisson models.

Count Data Models and Exposure: In the econometric strategy, violations of maximum contaminant loads (MCLs) depend on multiple covariates, including exposure. Exposure describes the number of contaminants with which a water service provider must comply; exposure varies over time and system size. Given that exposure impacts violations, how should one incorporate exposure into a count data model? Below I describe the two most popular methods for dealing with exposure. It appears that most statistical packages interpret measures of exposure as reliable and accurate, and thus recommend explicitly modeling MCLs as exposure. However to confidently include exposure in a model, one should estimate two models; the first includes MCLs as exposure and the second models MCL as a covariate. The second model serves as a robustness check to determine if MCLs represents an accurate exposure coefficient.

In specifying exposure, one assumes that exposure is proportional to the policy variable number of MCLs. The exposure coefficient controls for the fact the number of MCLs can vary over time and by supplier. In STATA, the incidence rate measures the rate at which the event occurs; in our case this is the rate of violations. To estimate the expected number of violations, one multiplies the incidence rate by exposure. For example, if an incidence rate of .1 is observed and there are 10 MCLs for a given supplier, then the expected number of violations is 1.¹

STATA always assumes a level of exposure. When no level of exposure is specified, STATA assumes exposure is unknown and sets $E_j = 1$ or $\ln(E_j) = 0$, where E denotes exposure. Under the assumption of no exposure, the model is restrictive in that either (i) the expected

¹ For our purposes, we assume non-overlapping exposures are mutually independent. Thus, the number of MCL variables in district A and district B are independent

number of events happens irrespective of exposure or (ii) MCL regulations are uniform across space and time.

One problem of explicitly measuring exposure is that one can wrongly specify exposure. For example if small water suppliers, compared to large water providers, are characterized by less administration and smaller administrative budgets, then these small providers face a higher probability of failing to submit or publish disclosure reports. As a result, if we model exposure as the number of MCLs, then we may wrongly characterize the relationship between administrative violations and system size. A more appropriate measure of exposure will include a combination of administrative capacity (hence lower violations from not reporting) and MCL policy variables. If we are uncertain about our measure of exposure, we can explicitly include $\ln(\text{MCL})$ as an independent variable. In this treatment of MCL policy variables, we do not constrain $\ln(\text{MCL})$ to be 1. Thus, if the coefficient on MCLs is equal to one, we know the MCL policy variable is an accurate measure of exposure.

CCR Legislation: To determine the motivation behind the CCR legislation in the 1996 Safe Drinking Water Act Amendments, I scanned the legislative history of the SDWA amendments including the actual public law, the congressional reports, the congressional hearings, and the congressional debates leading up to the passage of the law. With the exceptions of the "Right to Know" provisions in the public law and Waxman's congressional comment, there was no documentation on public notification of the CCR legislation. In 1996 (104th session) Henry Waxman introduced HR 3280, the "Water Quality Public Right-to-Know Act of 1996". In his testimony, Waxman emphasizes that the CCR legislation was intended to inform consumers,

“Under current law the public has no information about the presence of serious contaminants in their drinking water. Every year millions of Americans unknowingly drink tap water contaminated with cryptosporidium, carcinogens, and arsenic. If we can’t

prevent this contamination, we should at least give our constituents the ability to protect against themselves.”

Based upon the legislative history, it appears that the CCR legislation intended to inform customers about water quality. This study investigates whether information disclosure in the form of CCRs altered water suppliers’ behavior.

Industry anticipation of CCR legislation may have induced suppliers to invest in contaminant reductions or other mitigation behavior prior to the release of the CCRs. If industry action reduced MCL violations prior to the implementation of CCRs, then the effect of information on contaminant violations will be dampened. Based upon industry reports from the American Waterworks Association, Water Today, and periodicals, it does not appear that water suppliers prematurely responded to the CCR legislation.

Consumer Confidence Certification Reports: The regression discontinuity model exploits the CCR mailing threshold to identify the effect of CCRs on contaminant violations. Water suppliers that serve a population of 10,000 or greater are required to mail CCRs to every customer. By contrast, smaller suppliers can publish CCRs in the newspaper or publicly advertise where customers can obtain a CCR report. Regression discontinuity models compare violations in water suppliers that just exceed the mandatory mailing threshold with those that fall just below the threshold. The model assumes that all water systems serving roughly 10,000 customers are identical except for the CCR mailing requirement. The model estimates the effect of CCR mailings on violations at this size threshold.

While the sharp regression discontinuity model assumes that all suppliers below 10,000 choose not to mail CCR, some small providers choose to mail CCR reports to their customers. A size threshold does not accurately identify CCR mailings. A “fuzzy” regression discontinuity

model allows for an imperfect size threshold. In the "fuzzy" regression discontinuity approach, the 10,000 person threshold is used as instrument for actual CCR mailing.

During July of 2006, I visited the Department of Environmental Protection in Boston, MA to collect microfiche and paper data on the actual mailing of CCRs. Between 1998 and 2003 every water supplier submitted a CCR certification form to the Department of Environmental Protection. In the certification report, suppliers document if they mailed CCRs to consumers. In the case that suppliers did not mail CCR reports, they described the methods taken to advertise the availability of CCR reports. For example, some suppliers published CCR reports or information on where to obtain CCR reports in local newspapers. The data on CCR certification are partially incomplete; some suppliers did not provide CCR certification reports. The data reveal that approximately 18 percent of small suppliers choose to mail CCRs to customers. Additionally, suppliers vary in mailing behavior over time.

Future Collaborative Research: Within the field of economics, PhD students generally work as research assistants to learn the application of econometrics and microeconomic theory. Support from the Hixon Center for Urban Ecology enabled research collaboration between the research fellow, Professor Olmstead and Professor Benneer (Duke University). During the summer of 2006, I was introduced to the existing research project, data collection, econometric methods and the future objectives of the research project. This apprenticeship allowed me to work closely with faculty and develop the skill set to apply economic methodologies to environmental problem solving.

Recently, Professor Olmstead and Professor Benneer were awarded a National Science Foundation grant on "Collaborative Research: The Impact of the 'Right to Know': Information Disclosure and Drinking Water Quality". This grant includes support for doctoral research, both

in the form of a research assistant and a collaborator. In the short-term I plan to continue working as a research assistant on this project. During my time at Yale, I will also collaborate with Professor Olmstead and Professor Bennear to produce a co-authored paper on information disclosure and drinking water violations. The Hixon Fellowship allowed me to (i) interact closely with faculty members on economic research, and (ii) gain the statistical and economic experience to transition from a research assistant to a coauthor.

Works Cited:

Bennear, Lori S. and Olmstead, Sheila M., (2007), “The Impacts of the “Right to Know”:
Information Disclosure and the Violation of Drinking Water Standards”, *Working Paper*.