



Community Resilience: Understanding the Economic Impacts of Disruptions in Water Service¹

Colleen M. Heflin, Jennifer Keller Jensen, and Kathleen K. Miller



Colleen Heflin is Associate Professor in the Harry S Truman School of Public Affairs at the University of Missouri

Talking Points

- Routine water disruptions affect both residential and business users but neither is well prepared for these disruptions.
- About one-third of businesses in the three cities examined here lost revenue as a result of water disruptions; their losses ranged from as low as \$100 to as high as \$400,000.
- These findings suggest that local governments and commercial users adopt strategies to minimize the economic impact of disruption.



Jennifer Keller Jensen was a research analyst for the Rural Policy Research Institute in the Harry S Truman School of Public Affairs at the University of Missouri

Introduction

Communities face a myriad of potential threats to their infrastructure, ranging from natural disasters to terrorist activities. Some threats can be thought of as a high probability, such as hurricanes along coastal regions, while others may be much less likely, such as acts of terrorism. In addition, the impacts of threats range from short-lived with minor economic consequences to quite severe in terms of their destruction and economic costs. However, there are also threats to communities' infrastructure that are far more common, and the impacts are much less known. This brief considers the economic impacts on both households and businesses resulting from a disruption in the water system. These events occur with regularity across the U.S., with causes ranging from water main breaks from old pipes to construction interference or bacterial contaminations. While the preparation for "large impact, low probability" events often takes center stage in community planning, preparations and



Kathleen K. Miller is Program Director for the Rural Policy Research Institute in the Harry S Truman School of Public Affairs at the University of Missouri

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adaptations to such “low impact, high probability” events such as water outages are no less important to community resilience.

The purpose of this brief is to describe three case studies documenting how residents and businesses respond to these unexpected water disruptions, and assess the economic costs to households and businesses. In most cases, when a water system experiences a disruption, such as a water main break, a “boil water advisory” is in place for approximately 48 hours, while the water system is tested and tests are returned clear of bacterial contaminants. Therefore, most water disruptions events include some period where boiling water is advised.

Case Study Areas

Three areas were selected for case studies, where water disruption events impacted a significant portion of residential and business populations.

- In April, 2011, Harrisburg, Pennsylvania experienced a period of low water pressure following a major water main break. Following the break, a boil water advisory was in place.
- In May, 2010, a major water main break affected the city of Boston, Massachusetts, and 30 surrounding communities.
- In June, 2011, a water main break resulted in a seven-day boil water advisory for Talladega, Alabama.

Table 1: Water Disruption Case Study Events at a Glance

| | Harrisburg, PA | Boston Area, MA | Talladega, AL |
|--|--------------------------------------|--|----------------------|
| Water Source | Harrisburg Municipal Water Authority | Massachusetts Water Resource Authority | City of Talladega |
| Number of hookups served by source | 20,778 | 895,500 | 5,900 |
| Number of water users served | 66,540 | 2,550,000 | 17,000 |
| Percent of users affected by disruption | 100 | 78.4 | 100 |
| Length of “boil water advisory” in place | 5 days | 2.5 days | 7 days |

As part of these case studies, residents and businesses were interviewed to explore the prevalence, variety, and costs associated with various adaptations during these water disruption events. In Boston and Harrisburg, residential interviews were conducted in person in addition to

telephone interviews with businesses. In Talladega, only business interviews were conducted by telephone, and no residents were interviewed. In all three communities, local media coverage, telephone interviews with local leaders, and official documents prepared by the community served as background information for the case studies.

Residential Response to Water Disruptions: Observations in Boston and Harrisburg

A crucial component to a community's ability to respond to large or small scale disasters is the ability to get vital information out to residents that are potentially affected. Questions in the residential surveys were designed to ascertain the method by which residents learned of the water disruption and of the proper precautions to take regarding the boil advisory. In both Boston and Harrisburg, of those who were aware of the advisory, the majority learned of the water disruption through media coverage, or by word of mouth.

Table 2: Knowledge of Water Disruption Event

| | |
|--|------|
| Total survey respondents | 111 |
| Percent aware of event | 92.8 |
| Of those aware of event: | |
| Percent learning through media coverage (radio, TV) | 78.6 |
| Percent learning through word of mouth | 49.5 |
| Percent learning through emails, text messages, internet | 17.5 |
| Percent learning through door hangings and notifications | 13.6 |

Individuals were asked about their level of preparedness for a water disruption before the local event. Nearly 75 percent of residents interviewed reported that they had not made any preparations for this type of event. Respondents were asked if they now do anything different at home after experiencing this event, only one-third indicated taking preparedness steps, such as keeping more bottled water on hand.

Households managed the water disruption and boil advisory in consistent ways. In total, the majority of households (62.2%) bought more bottled water and/or sanitized tap water through bleaching or boiling methods. A majority of respondents (51.4%) reported no costs associated with boiling or bleaching water, while the cost of buying more bottled water averaged \$15.50 per household. Many households (36.9%) also flushed their home water systems after the boil alert was lifted, with an average cost of \$13.41.

Work life adaptations were less commonly reported. Some individuals reported a change in their work schedule, due to being sent home early from work, while others reported working longer hours. Work life was also impacted by a lack of personal services available at their worksite. When water coolers were not in place, individuals reported bringing bottles of water to work.

Additionally, some respondents reported late arrival to work due to home life and hygiene disruptions.

Table 3: Summary of Residential Response to Water Disruption

| | |
|---|---|
| Common home-life adaptations % | Boil/bleach water (64) Purchase bottled water (62.2) |
| Common work-life adaptations % | Bring water to work (4.5) Change work hours (3.6) |
| Percent of respondents with preparedness steps prior to water event | 25.2 |
| Percent of respondents making preparedness steps post disruption | 29.7 |

Business Response to Water Disruptions: Observations in Boston, Harrisburg and Talladega

A range of businesses were selected for telephone interviews. The North-American Industry Classification System (NAICS) codes were applied to ensure an adequate representation of business sectors across the case studies. The level of preparedness for a water disruption varied by industry. Government offices and hospitals had specific boil advisory action plans in place, while many private businesses did not. Several businesses reported that the water event increased their need for preparedness and acknowledged the event brought more awareness to the businesses' vulnerability and reliance upon water.

Again, the notification process for these events is an important component to community resilience, and the majority of businesses reported learning about the water disruption through media and web outlets, followed by automated calls from city government offices and word of mouth.

Table 4: Knowledge of Water Disruption Event

| | |
|---|------|
| Total survey respondents | 93 |
| Percent aware of event | 96.8 |
| Of those aware of event: | |
| Percent learning through media coverage (radio, TV, web) | 74.4 |
| Percent learning through telephone calls from authorities | 34.4 |
| Percent learning through word of mouth | 27.8 |

Differences in business adaptations to the water disruptions were related to the reliance on water by the different businesses. Food and beverage industries relied heavily on water as an input, while administrative and financial businesses rates their water reliance very low. Some food and beverage establishments required significant steps to ensure food safety, while others opted to

close for the duration or for a portion of the disruption. Financial and administrative industries had relatively no impact on their functioning during the event, while hotels and residential facilities needed to alert tenants and staff members of the boil water advisory.

Table 5: Summary of Business Response to Water Disruption

| | |
|--|---|
| Common adaptations % | Provided bottled water/ice for employees or clients (45.7) Adapted products or services normally offered (18.1) Temporarily closed business (8.5) |
| Reported lost revenue % | 31.9 |
| Steps taken after boil advisory was lifted % | Flush water system (37.2) Clean equipment; replace filters (12.8) |

The costs associated with the various adaptations, and the revenue impacts, varied by the type of business. In general, businesses engaged in the manufacture or serving of food reported higher costs associated with adaptations, and particularly in lost revenue. While just over a third of all businesses reported lost revenue as a result of the water disruption, 100 percent of the food and beverage businesses reported lost revenue, ranging from less than \$100 to over \$400,000.

Conclusion

While the household level economic costs associated the water disruptions were relatively small, the process of notification and adapting to such an event plays an important role in a community's overall strategy for disruptions of any sort. Lessons learned from the experiences in these water disruption events can provide important input into planning processes for more traumatic events, such as major weather storms or terrorist attacks.

The business costs, on the other hand, did vary across business types, and in some cases were quite significant. Generally, businesses serving or manufacturing food and beverages had the highest economic costs.

While these case studies provide important insight into the economic costs of water disruptions, more systematic efforts are needed to collect data that can be used to forecast the direct and indirect costs at a community level.