

“The Impact of Geographical Water Shutoffs on the Diagnosis of Potentially Water-associated Illness, with the Role of Social Vulnerability Examined”

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Executive Summary

The Henry Ford Global Health Initiative undertook research with community partners to understand the relationship between city-imposed water shutoffs and health outcomes among patients at its hospital in Detroit. Block-level addresses in the city where water shutoffs occurred between January 2015 and February 2016 were compared with Henry Ford Hospital patient admissions and diagnoses of certain gastrointestinal [GI] and skin and soft tissue infections [SSTI]). Both sets of data were then controlled for potential socioeconomic status confounding using metrics from the CDC. Those who were diagnosed with a water-associated illness were 1.42 times more likely to have lived on a block that had experienced a water shutoff. Those patients who came from blocks that experienced a shut off were 1.55 times more likely to have been diagnosed with a water-associated illness. It should be noted that the data was analyzed at the block level, that patients were not contacted about experiencing shutoffs, and that confirmatory lab testing of infections or point-source contaminants was not conducted. This study demonstrates an association, not a causal link.

Objective

The aim of this study was to measure whether City of Detroit-ordered water shutoffs had an effect on the illnesses experienced by a sample of Henry Ford Hospital patients. Researchers from Henry Ford Health System’s Global Health Initiative hypothesized a statistically significant direct association between water shutoffs and water shutoff-associated illness.

Methods

An anonymized data set of hospital admissions was obtained containing addresses and diagnoses (coded to the ICD-9) of 37,441 patients diagnosed with a skin or soft-tissue infection or gastrointestinal infection (herein water-associated illness) between January 1, 2015 and February 12, 2016 at Henry Ford Hospital. These data were compared against a data set of partially-masked, block-level Detroit addresses¹ that had been shut off from City of Detroit water supply for past-due water utility bills. Patient admissions were coded as to whether or not the patient lived on a block that had experienced a water shutoff. Researchers grouped shutoff and non-shutoff blocks by socioeconomic status in order control for confounding on the basis of poverty. They used the CDC-created Social Vulnerability Index as their measure for socioeconomic status; SVI is a census tract ranking that includes poverty; access to housing, healthcare, and transportation; language; household composition; and disability. The Henry Ford Health System Institutional Review Board approved this research study.

Results

A significant difference in diagnoses related to water-associated illness was found between those who live on blocks that have experienced shutoffs (4.9%, n=905) and those who did not (3.5%,

¹ The data set included Detroit Water and Sewerage Department-provided addresses that had been partially masked to reveal only the first two digits of the household address. Thus, the data set of water shutoffs could only be interpreted at the block-level.

n=663), [Exact p=.00, $X^2(1)=49.91$, $P<.001$]. A propensity score adjusted logistic regression was run to determine the relationship between a diagnosis of a potentially water-associated illness for a person living on a block that has experienced water shutoffs, after being adjusted to control for poverty percentile. The logistic regression model was statistically significant, [$\chi^2(2)=80.495$, $P<.001$] and correctly classified over 50% of cases. Those who were diagnosed with a water-associated illness were 1.42 times more likely to have lived on a block that had experienced a water shutoff.

An experimental hierarchical logistic regression model tested the ordered structure of living on a shut off block as a predictor of water-associated illness, beyond the influence of social vulnerability. Both models were statistically significant predictors, [$\chi^2(2)=66.013$, $P<.001$] and correctly classified over 95.8% of cases. Those patients who came from blocks that were shut off were 1.55 times more likely to have been diagnosed with a water-associated illness.

There are limitations to this study. First, we did not evaluate individual cases for route of acquisition of infection. For example, our finding could be the result of organisms in water sources or an inability to bathe or use the toilet. Second, this is a retrospective population study examining an association between block-level residence, block-level incidence of water shutoffs, and census-tract population statistics of illness and social vulnerability. Our study is not designed to make a causal link between water shutoffs and illness.

Discussion

Overall, the models showed that patients who are the most likely to be impacted by water-associated illness resulting from the shutoffs are also the most socially vulnerable. After accounting for vulnerability, the effect of living on a block that has been affected by shutoffs results in increased likelihood that patients will be diagnosed with water-associated illness. Moreover, the data shows that patients diagnosed with water-associated illnesses are more likely to come from blocks affected by shutoffs than from blocks not affected by shutoffs, even when controlling for socioeconomic status.