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Experiences of the Flint Water Crisis among Reproductive-Age Michigan Women in Communities Outside of Flint:
Differences by Race and Ethnicity

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ABSTRACT

We sought to understand how women in Michigan communities outside of Flint experienced the Flint Water Crisis, an avoidable public health disaster widely attributed to structural racism. Using survey data from 950 Michigan women aged 18-45 from communities outside of Flint, we examined racial and ethnic differences in personal

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4 connections to Flint, perceived knowledge about the water crisis, and beliefs about the role of anti-Black racism in
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6 the water crisis—factors that could contribute to poor health via increased psychological stress. We found that White
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8 (OR=0.32; 95% CI: 0.22, 0.46) and Hispanic (OR=0.21; 95% CI; 0.09, 0.49) women had lower odds than Black
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10 women of having family or friends who lived in Flint during the water crisis. Compared to Black women, White
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12 women were less likely to be moderately or very knowledgeable about the water crisis (OR=0.58; 95% CI: 0.41,
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14 0.80). White women (OR=0.26; CI: 0.18, 0.37), Hispanic women (OR=0.38; 95% CI: 0.21, 0.68), and women of
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16 other races (OR=0.28; 95% CI: 0.15, 0.54) were less likely than Black women to agree that the water crisis
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18 happened because government officials wanted to hurt Flint residents. Among those who agreed, White women
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20 (OR=0.47; 95% CI: 0.30, 0.74) and women of other races (OR=0.33; 95% CI: 0.12, 0.90) were less likely than
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22 Black women to agree that government officials wanted to hurt people in Flint because most residents are Black.
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24 We conclude that the Flint Water Crisis was a racialized stressor, with potential implications for the health of
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26 reproductive-age Black women.
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29 Keywords: Flint Water Crisis; structural racism; vicarious racism; racialized stressor
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31 AUTHOR CONTRIBUTIONS

32
33 Conceptualization: Katherine W. Bauer, Cleopatra M. Abdou, and Belinda L. Needham; Formal (Quantitative)
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38 Allgood, Dasha (Darya) Dokshina, and Belinda L. Needham; Project Administration: Michelle Clayson; Funding
39 Acquisition: Katherine W. Bauer, Cleopatra M. Abdou, and Belinda L. Needham.
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4 Experiences of the Flint Water Crisis among Reproductive-Age Michigan Women in Communities Outside of Flint:
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6 Differences by Race and Ethnicity
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11 The Flint Water Crisis is an ongoing human-made disaster that has profoundly impacted the city's nearly
12 100,000 residents, a majority of whom are Black [1]. While research has begun to document the direct effects of
13 the water crisis on the physical and mental health of Flint residents [2–10], the public health consequences of the
14 water crisis may extend well beyond the city limits of Flint. Building on previous quasi-experimental studies
15 documenting the effects of indirect exposure to macro-level racialized stressors on the health of racial and ethnic
16 minorities [11–14], the objective of the current study was to determine whether experiences of the Flint Water Crisis
17 among Michigan women who live in communities outside of Flint differ by race and ethnicity. We hypothesized
18 that Black women would be more likely than women in other racial and ethnic groups to have personal connections
19 to Flint, to report greater knowledge of the water crisis, and to attribute the water crisis to anti-Black racism on the
20 part of government officials – factors that may contribute to the burden of poor health and health disparities among
21 Black women via increased psychological stress.
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34 *The Flint Water Crisis*
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36 The Flint Water Crisis began in April 2014 when the state-appointed emergency manager switched the
37 city's source of drinking water from the Detroit water system to the Flint River. The change was projected to save
38 the economically distressed city \$5 million over a two-year period [15]. Within one month of the switch, residents
39 began to complain about the smell, taste, and appearance of the water, as well as health-related problems like rashes
40 and hair loss [16]. The first of several boil water advisories was issued in August 2014 due to detection of fecal
41 coliform bacteria [17], and just six months after the switch, General Motors stopped using water from the Flint River
42 in its factories, noting that the water was causing engine parts to rust [18]. The failure to properly treat water from
43 the Flint River also resulted in corrosion of pipes and solder in the city's water distribution system, causing lead and
44 other metals to leach into the water supply [17,19]. High lead levels were found in the tap water of Flint residents as
45 early as February 2015, but authorities continued to insist that the water was safe to drink and only agreed to
46 reconnect to the Detroit water system after the September 2015 release of a report documenting high blood lead
47 levels in Flint children [2]. On January 5, 2016, nearly two years after the water crisis began, Michigan governor
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4 Rick Snyder issued a state of emergency in Flint. Less than two weeks later, President Barack Obama declared a
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6 federal state of emergency [16].
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9 After the governor’s emergency declaration, coverage of the Flint Water Crisis became prominent in
10 regional and national media outlets [17]. Many of these reports suggested that racism played a role in the series of
11 events that led to the crisis, as well as in the responses of the state and federal government to the crisis [20,21]. A
12 report issued in February 2017 by the Michigan Civil Rights Commission substantiated this claim, concluding that
13 racist policies and practices in the areas of employment, housing, and education, as well as racially disparate effects
14 of the state’s emergency manager law, contributed to the water crisis [22]. Furthermore, a growing body of
15 academic research has characterized the Flint Water Crisis as an example of structural racism [23–27], and Flint
16 residents themselves have described the water crisis as an act of genocide targeting Black people [28], who
17 accounted for 57% of the city’s population when the water crisis began [29].
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27 *Health Impacts of the Flint Water Crisis*

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30 In addition to elevated blood lead levels in children [2,3], which are expected to cost the city of Flint \$400
31 million in long-term social and educational costs [4], Flint residents have experienced a number of other health-
32 related problems as a result of the water crisis. Low chlorine levels in the municipal water system resulted in an
33 outbreak of Legionnaires’ disease that killed 12 people and sickened dozens of others [5]. Residents reported
34 rashes, hair loss, and nausea [6], as well as increased mental health symptoms, such as stress and anxiety, problems
35 sleeping, depressed mood, and trouble concentrating [7–9]. Pregnant women were more likely to smoke after the
36 water switch, and mothers of infants were less likely to breastfeed [30]. Studies examining changes in fertility rates
37 produced mixed results [10,31,32], but a number of studies found evidence of an increase in adverse birth outcomes,
38 including lower birthweight and increased incidence of low birthweight [10,32,33]. In contrast to the growing body
39 of evidence documenting effects of *direct* exposure to the water crisis on the mental and physical health of Flint
40 residents, little is known about the potential health impacts of *indirect* exposure for people who live outside of Flint.
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42 Several recent quasi-experimental studies have shown that exposure to vicarious structural racism, defined as
43 witnessing the effects of racist structural conditions or practices on members of one’s own racial or ethnic group
44 [34,35], is a risk factor for adverse health-related outcomes. For example, Alsan and Wanamaker [13] found that
45 disclosure of the Tuskegee Study in 1972 was associated with increased medical mistrust and mortality and decreased
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4 health care utilization among Black men but not among other groups, while Bor et al. [12] found that exposure to one
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6 or more police killings of unarmed Black people in a respondent's state of residence during the three months prior to
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8 completing the Behavioral Risk Factor Surveillance System (BRFSS) interview was associated with an increase in
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10 the number of poor mental health days reported by Black respondents only. Similarly, Novak et al. [11] found that
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12 babies born to Hispanic mothers in the state of Iowa in the 37 weeks following a major immigration raid in a rural
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14 Iowa town had increased risk of low birth weight compared to the same 37-week period in the prior year, while no
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16 such changes were observed among babies born to non-Hispanic mothers. Finally, Vu [14] found that the
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18 likelihood of very low birth weight increased by 23% for infants of foreign-born Hispanic mothers only, following
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20 implementation of a strict immigration enforcement program. These prior studies suggest that vicarious exposure to
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22 the Flint Water Crisis had the potential to negatively impact the mental and physical health of Black people who live
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24 outside of Flint.

25 26 27 *Vicarious Structural Racism and Health: Mechanisms*

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Though not directly examined in previous research, there are a number of plausible mechanisms underlying observed associations between exposure to vicarious structural racism and health-related outcomes. First, people of the same race or ethnicity may be more likely to have personal connections to those who were directly affected by the event. Research using functional magnetic resonance imaging (fMRI) has shown that the emotional brain circuits that are activated when an individual experiences a painful stimulus firsthand are the same as those that are activated when witnessing a loved one being subjected to a painful stimulus [36]. Similarly, witnessing the painful direct effects of structural racism on close friends or family members likely has negative psychological consequences for those who are aware of their loved ones' exposure, even in the absence of being directly exposed themselves. Second, news of the event may be more salient to people of the same race or ethnicity as those directly affected, leading to higher levels of information-seeking behavior [37], either from personal connections or from the media. Given evidence that exposure to disaster media coverage is associated with negative psychological outcomes [38], having greater knowledge of an event may contribute to observed associations between exposure to vicarious structural racism and adverse health outcomes. Finally, people of the same race or ethnicity as those directly affected by an event may be more likely to consciously perceive that racism contributed to the event, resulting in greater distress due to a sense of personal vulnerability [39] and inability to trust in government or other important institutions [40].

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4 Michigan between March 1, 2019 and March 1, 2020. Patients from the Ypsilanti Health Center were recruited
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6 because the health center provides preventative healthcare to a racially, ethnically, and socioeconomically diverse
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8 patient population. Individuals who enrolled in the study via this effort were also invited to share the study website
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10 with female friends and family.

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12 In the first week of data collection, 593 individuals provided valid and complete data on the eligibility
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14 screener. Of these, 447 were eligible and completed the study. Enrollment was paused during the second week of
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16 data collection due to concerns about potentially fraudulent survey responses. All survey responses submitted after
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18 the suspected fraudulent activity began were discarded to be conservative regarding the inclusion of valid data.
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20 After implementing a number of additional data security systems and examining the demographic composition of
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22 the existing participants, a second recruitment wave was initiated to increase representation of low-income women
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24 in the study sample. Study invitations containing a personal, one-time-use link to the eligibility screener were
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26 emailed to 3,881 women who were publicly-insured (Medicaid) and had given birth at the University of Michigan
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28 Hospital between September 1, 2016 and November 18, 2020. From this recruitment effort, 606 individuals
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30 completed the eligibility screener. Of these, 503 were eligible and completed the study. The final, combined
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32 sample includes 950 respondents.

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35 Eligibility screening and data collection were conducted using surveys developed in Qualtrics (Provo, UT).
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37 Self-identified females between the ages of 18 and 45 who were able to complete the survey in English and who
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39 lived in any Michigan county except Genesee County (i.e., the county where Flint is located) were eligible to
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41 participate in the study. Individuals who did not meet these eligibility criteria or who had missing data for any of
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43 the screening questions were ineligible and were not invited to complete the survey. Eligible individuals were
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45 immediately redirected to the survey after completing the eligibility screener. Individuals who completed at least
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47 78% of survey questions were sent a \$20 gift card. The study was determined to be exempt from oversight by the
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49 University of Michigan's Institutional Review Board.

50 51 52 *Measures*

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55 Race and ethnicity. Respondents were asked to report which of the following racial or ethnic group(s) they
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57 most identify with: Black or African American, Hispanic or Latina, American Indian or Alaska Native, Asian or
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59 Pacific Islander, White, and Other. For respondents who selected more than one race/ethnicity, we used the
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4 procedure developed by the National Longitudinal Study of Adolescent to Adult Health to assign them to a single
5 category [41]. Those who selected Hispanic or Latina were coded as Hispanic. For respondents who did not select
6 Hispanic or Latina, race/ethnicity was coded in the following order: Black or African American, Asian or Pacific
7 Islander, American Indian or Alaska Native, Other, and White. Due to small sample sizes, women who identified as
8 American Indian or Alaska Native, Asian or Pacific Islander, or Other were combined into a single other race
9 category [41]. The reference racial/ethnic group is Black or African American.

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17 Personal connections to Flint. To assess personal connections to Flint, respondents were asked whether
18 they ever lived in Flint, Michigan (1=yes; 0=no or don't know/not sure)¹ and whether they had any family or friends
19 who lived in Flint when the water crisis happened (1=yes; 0=no or don't know/not sure).
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24 Knowledge and sources of information about the water crisis. Respondents were asked to report their level
25 of knowledge about the Flint Water Crisis. Response options included not knowledgeable at all, slightly
26 knowledgeable, moderately knowledgeable, very knowledgeable, and don't know/not sure. Responses were
27 combined to create a dichotomous variable (1=moderately or very knowledgeable; 0=slightly or not at all
28 knowledgeable or don't know/not sure). Next, respondents were asked to report how they heard about the water
29 crisis. Response options included friend or family member, television, newspaper, radio, social media, and "other,"
30 which included the option to write in a response (1=yes; 0=no). Respondents could select all responses that applied.
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39 Opinions and beliefs about the water crisis. Respondents were asked to report who, in their opinion, was
40 responsible for the Flint Water Crisis. Response options included no one/it was an accident, the Michigan
41 government, the Flint government, the United States government, people who live in Flint, business owners in Flint,
42 and "other," which included the option to write in a response (1=yes; 0=no). Respondents could select all responses
43 that applied. Next, respondents were asked to report their opinion regarding the following statements about factors
44 that may have contributed to the water crisis: (1) government officials didn't care about what happened to people in
45 Flint, (2) government officials wanted to hurt people in Flint, (3) people in Flint didn't fight hard enough to make
46 their voices heard, (4) government officials didn't know how to make water from the Flint River safe to drink, (5)
47 government officials were greedy, and (6) Flint's emergency manager didn't listen to the people because he wasn't
48 elected by them. Response options for each of the above possible contributing factors included a great deal,
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60 ¹ Two respondents replied "don't know/not sure" when asked whether they ever lived in Flint, Michigan.
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4 somewhat, and not at all, and were combined to create a dichotomous variable for each statement (1=somewhat or a
5 great deal; 0=not at all). Respondents who answered somewhat or a great deal to the first statement about
6 contributing factors (n=839) were asked a follow-up question to assess why they agreed that government officials
7 didn't care about what happened to people in Flint. Response options included the following: (1) because most
8 people in Flint are poor, (2) because government officials don't care about the people they serve, (3) because most
9 people in Flint don't vote, (4) because most people in Flint are Black, (5) because the people in charge weren't from
10 Flint, and (6) "other," which included the option to write in a response (1=yes; 0=no). Respondents could select all
11 responses that applied. Respondents who answered somewhat or a great deal to the second statement about
12 contributing factors (n=457) were asked a follow-up question to assess why they agreed that government officials
13 wanted to hurt people in Flint. Response options included the following: (1) because they wanted to make people
14 spend more money on health care, (2) because most people in Flint are poor, (3) because they wanted to get more
15 money from the federal government, (4) because most people in Flint are Black, (5) because they wanted to take
16 power away from the people in Flint, and (6) "other," with the option to write in a response (1=yes; 0=no).
17 Respondents could select all responses that applied.

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33 Covariates. Covariates include age (in years), educational attainment (high school or less, some
34 college/associate's degree, bachelor's degree or more [reference category]), and recruitment wave (1=wave 2;
35 0=wave 1).
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39 *Statistical Analysis*

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42 First, we calculated descriptive statistics for each study variable by race/ethnicity. "Other" responses for
43 questions about sources of information about the water crisis and opinions and beliefs about the water crisis were
44 excluded from the current analysis but are briefly summarized in the supplemental materials (Supplementary Tables
45 S1-S4). P-values for racial/ethnic differences were calculated by chi-square tests for categorical variables and by
46 one-way ANOVA for continuous variables. Next, to determine whether there were differences by race/ethnicity in
47 personal connections to Flint, knowledge of the water crisis, and opinions and beliefs about the water crisis, we ran a
48 series of logistic regression models in which we regressed each outcome on race, controlling for age, educational
49 attainment, and recruitment wave. We excluded one participant who reported that they had not heard of the Flint
50 Water Crisis, 17 participants who reported that they lived in Flint in 2014 or later, and one participant who did not
51 report their race/ethnicity. The analytic sample ranged from 457 to 932 participants, depending on the outcome. In
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4 sensitivity analyses, we stratified the logistic regression models by recruitment wave to determine whether
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6 differences in recruitment procedures affected study results.
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8 9 RESULTS

10 11 *Descriptive Statistics*

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13 The study sample included 244 Black women (26.2%), 564 White women (60.5%), 71 Hispanic women
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15 (7.6%), and 53 women of other races (5.7%). As shown in Table 1, there were no significant differences in age by
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17 race/ethnicity ($p=0.09$). Mean age was 31-32 years in all racial/ethnic groups. Women of other races (64.2%) were
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19 most likely to report having a bachelor's degree or more, followed by White women (45.6%), Hispanic women
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21 (31.0%), and Black women (17.6%) ($p<0.0001$). Finally, there were significant differences in recruitment wave by
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23 race/ethnicity ($p<0.0001$). A majority of Black (60.7%) and Hispanic (70.4%) participants were recruited in the
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25 second wave, while a majority of women of other races (73.6%) were recruited in the first wave. White women
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27 were evenly split between the first and second recruitment waves (50.9% in wave 1 and 49.1% in wave 2).
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29 Descriptive statistics for race/ethnicity, age, and educational attainment by recruitment wave are shown in
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31 Supplementary Table S5. Descriptive statistics for the outcome variables by race/ethnicity are available in
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33 Supplementary Tables S6-S11.
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35 36 37 *Personal Connections to Flint*

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39 In the first set of logistic regression models, we examined race/ethnicity as a predictor of personal
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41 connections to Flint. As shown in Figure 1 and Supplementary Table S12, the odds of having previously lived in
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43 Flint were not significantly different for White women compared to Black women.² However, White (OR=0.32;
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45 95% CI: 0.22, 0.46; $p<0.0001$) and Hispanic (OR=0.21; 95% CI: 0.09, 0.49; $p=0.0003$) women had significantly
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47 lower odds than Black women of having family or friends who lived in Flint during the water crisis.
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49 50 51 *Knowledge and Sources of Information about the Flint Water Crisis*

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53 In the next set of logistic regression models, we examined race/ethnicity as a predictor of knowledge and
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55 sources of information about the Flint Water Crisis. As shown in Figure 2 and Supplementary Table S13, compared
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57 to Black women, White women had 42% lower odds (OR=0.58; 95% CI: 0.41, 0.80; $p=0.0009$) of reporting that

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59 ² Odds ratios for Hispanic women and women of other races could not be calculated because none of the study
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61 participants from these groups previously lived in Flint.
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4 they were moderately or very knowledgeable about the water crisis versus slightly or not at all knowledgeable.
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6 There were no significant differences in self-reported knowledge for Hispanic women or women of other races
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8 compared to Black women. Furthermore, race/ethnicity was not significantly associated with the odds of having
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10 heard about the water crisis from friends or family, television, newspapers, radio, or social media.
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12 *Opinions and Beliefs about the Flint Water Crisis*

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15 Next, we examined race/ethnicity as a predictor of opinions and beliefs about the Flint Water Crisis. As
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17 shown in Figure 3 and Supplementary Table S14, White respondents were nearly 3 times more likely than Black
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19 respondents (OR=2.99; 95% CI: 1.19, 7.52; p=0.02) to report that no one was responsible for the water crisis
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21 because it was an accident. Compared to Black respondents, White respondents (OR=0.53; 95% CI: 0.37, 0.74;
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23 p=0.0002) and respondents of other races (OR=0.41; 95% CI: 0.21, 0.82; p=0.01) had significantly lower odds of
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25 reporting that the United States government was responsible for the water crisis. Race/ethnicity was not
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27 significantly associated with reporting that the Michigan government, the Flint government, people who live in
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29 Flint, or business owners in Flint were responsible for the water crisis.
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32 As shown in Figure 4 and Supplementary Table S15, race/ethnicity was not significantly associated with
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34 the odds of agreement that the Flint Water Crisis happened because government officials didn't care what happened
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36 to people in Flint. However, White respondents (OR=0.26; CI: 0.18, 0.37; p<0.0001), Hispanic respondents
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38 (OR=0.38; 95% CI: 0.21, 0.68; p=0.0012), and respondents of other races (OR=0.28; 95% CI: 0.15, 0.54; p=0.0001)
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40 were significantly less likely than Black respondents to agree that the water crisis happened because government
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42 officials wanted to hurt people in Flint. Compared to Black respondents, White respondents had 54% lower odds
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44 (OR=0.46; 95% CI: 0.33,0.65; p<0.0001) of agreement that people in Flint didn't fight enough to make their voices
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46 heard. Race/ethnicity was not significantly associated with agreement that the water crisis happened because
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48 government officials didn't know how to make the water from the Flint River safe to drink. Compared to Black
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50 respondents, White respondents had 60% lower odds (OR=0.40; 95% CI: 0.18, 0.89; p=0.02) of agreement that the
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52 water crisis happened because government officials were greedy. Finally, White (OR=0.42; 95% CI: 0.25; 0.70;
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54 p=0.001) respondents were significantly less likely than Black respondents to agree that the water crisis happened
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56 because Flint's emergency manager didn't listen to the people because he wasn't elected by them.
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4 Among the 839 respondents who agreed somewhat or a great deal with the statement that the Flint Water
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6 Crisis happened because government officials didn't care about what happened to people in Flint, there were a
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8 number of significant differences by race/ethnicity in opinions about reasons for government officials' indifference.
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10 As shown in Figure 5 and Supplementary Table S16, White respondents were significantly less likely than Black
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12 respondents to agree that government officials didn't care what happened to people in Flint because most people in
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14 Flint are poor (OR=0.61; 95% CI: 0.42, 0.88; p=0.008) and because most people in Flint don't vote (OR=0.47; 95%
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16 CI: 0.28, 0.79; p=0.005). Compared to Black respondents, White respondents (OR=0.31; 95% CI: 0.21, 0.45;
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18 p<0.0001), Hispanic respondents (OR=0.52; 95% CI: 0.28, 0.95; p=0.03), and respondents of other races (OR=0.26;
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20 95% CI: 0.13, 0.51; p<0.0001) had significantly lower odds of agreement that government officials didn't care what
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22 happened to people in Flint because most people in Flint are Black. Race/ethnicity was not significantly associated
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24 with agreement that government officials didn't care about what happened to people in Flint because government
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26 officials don't care about the people they serve or because officials weren't from Flint.
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29 Finally, among the 457 respondents who agreed somewhat or a great deal with the statement that the Flint
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31 Water Crisis happened because government officials wanted to hurt people in Flint, there were some significant
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33 differences by race/ethnicity in opinions about reasons for government officials' malice. As shown in Figure 6 and
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35 Supplementary Table S17, White respondents (OR=0.47; 95% CI: 0.30, 0.74; p=0.001) and respondents of other
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37 races (OR=0.33; 95% CI: 0.12, 0.90; p=0.03) were significantly less likely than Black respondents to agree that
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39 government officials wanted to hurt people in Flint because most people in Flint are Black. Compared to Black
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41 respondents, Hispanic respondents were 2.6 times more likely (OR=2.58; 95% CI: 1.17, 5.69; p=0.02) to agree that
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43 government officials wanted to hurt people in Flint because they wanted to take away their power. Race/ethnicity
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45 was not significantly associated with agreement that government officials wanted to hurt people in Flint because
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47 they wanted to make people spend more money on health care, because most people in Flint are poor, or because
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49 they wanted to get more money from the federal government.
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51 *Sensitivity Analyses*

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54 Sensitivity analyses stratified by recruitment wave produced results that are similar to the main study
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56 findings, with a few notable exceptions (results available upon request). First, in the full sample, race/ethnicity was
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58 not significantly associated with the odds of having previously lived in Flint. In stratified models, among wave 1
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60 participants only, White respondents were significantly less likely than Black respondents to have previously lived
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4 in Flint. Next, in the full sample, White respondents were significantly less likely than Black respondents to report
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6 that they were moderately or very knowledgeable about the water crisis versus slightly or not at all knowledgeable.
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8 In stratified models, this association was only observed for wave 2 respondents. In the full sample, race/ethnicity
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10 was not significantly associated with the odds of having heard about the water crisis from friends or family,
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12 television, newspapers, radio, or social media. In stratified models, among wave 1 respondents only, White and
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14 Hispanic women were significantly less likely than Black women to have heard about the water crisis from a friend
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16 or family member. Finally, in the full sample, White respondents were significantly less likely than Black
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18 respondents to agree that government officials wanted to hurt people in Flint because most people who live there are
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20 Black. In stratified models, this association was only significant for wave 2 respondents.
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22 23 DISCUSSION 24

25 A growing body of research suggests that second-hand, or vicarious, exposure to racism is associated with
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27 adverse health outcomes [34]. While most prior research in this area has focused on interpersonal racism, recent
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29 studies have shown that exposure to macro-level racialized stressors, including the Tuskegee Study [13], police
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31 killings of unarmed Black people [12], and immigration enforcement [14,42] also negatively impact the health of
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33 racial and ethnic minorities. In this study, we sought to understand how women in Michigan communities outside of
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35 Flint experienced the Flint Water Crisis, an avoidable public health disaster that Flint residents [28], the media [17],
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37 the Michigan Civil Rights Commission [22], and scholars [23–27] alike have attributed to structural racism. We
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39 hypothesized that Black women would be more likely than women in other racial/ethnic groups to have personal
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41 connections to Flint, to report greater knowledge of the water crisis, and to attribute the water crisis to anti-Black
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43 racism on the part of government officials—factors that could contribute to poor health via increased stress. Overall,
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45 we found strong support for these hypotheses.
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48 First, we found that Black women in Michigan communities outside of Flint were more likely to have
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50 friends or family who lived in Flint during the water crisis, although they were no more likely to have previously
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52 lived in Flint themselves. Given previous research demonstrating that the emotional brain circuits that are activated
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54 when an individual experiences a painful stimulus firsthand are the same as those that are activated when they
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56 witness a painful stimulus administered to a loved one [36], women with greater personal connections to Flint may
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58 be at increased risk for negative psychological outcomes. Next, despite a lack of significant racial/ethnic differences
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60 in sources of information (e.g., friends or family, television, social media) about the crisis, we found that Black
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4 women reported greater knowledge of the water crisis. While we did not ask about the quantity of exposure to
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6 media coverage of the water crisis, it is possible that Black women perceive themselves to be more knowledgeable
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8 because they sought out more information about the crisis. Previous research has shown that exposure to disaster
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10 media coverage is associated with negative psychological outcomes [38]. Thus, it is possible that greater perceived
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12 knowledge among Black women could result in adverse health consequences.
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15 With respect to opinions and beliefs about the water crisis, we found a number of notable differences by
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17 race/ethnicity. First, White women were nearly three times more likely than Black women to report that no one was
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19 responsible for the water crisis because it was an accident (although only 5.1% of White women reported this
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21 opinion), while Black women were more likely than White women and women of other races to blame the US
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23 government. Despite widespread agreement across racial/ethnic groups that the water crisis happened because
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25 government officials didn't care about people in Flint, Black women were more likely to attribute officials'
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27 indifference to the fact that Flint is a majority Black city. Black women were more likely than all other groups to
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29 agree that the water crisis happened because government officials wanted to hurt people in Flint and to attribute
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31 officials' malice to the fact that most people who live in Flint are Black. Taken together, these results suggest that
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33 Black women are more likely to blame government officials for the water crisis and to attribute the water crisis to
34
35 anti-Black racism. Thus, along with greater personal connections to Flint and greater perceived knowledge of the
36
37 water crisis, Black women are more likely to report potentially distressing opinions and beliefs about what caused
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39 the water crisis.
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41 *Limitations, Strengths, and Directions for Future Research*

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44 An important limitation of this study is the use of non-probability sampling techniques. Respondents were
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46 not randomly selected and, therefore, may not be representative of the target population of reproductive-age women
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48 in Michigan communities outside of Flint. Given our sampling strategy, some groups of women were more likely to
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50 receive an invitation to participate, including women from Southeast Michigan, publicly insured women, and
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52 women with young children. In addition, those who agreed to participate may be different than those who declined
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54 the invitation. Future studies using probability sampling techniques are needed to confirm or refute the results
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56 presented here. Another potential limitation is the initiation of a second recruitment wave following the detection of
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58 fraudulent activity. While it is possible that data from the first recruitment wave may include some fraudulent
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60 responses, it is more likely that we excluded valid responses after applying our stringent quality control measures.
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4 A potentially more serious concern is related to differences in recruitment procedures between waves, which, by
5 design, resulted in a higher proportion of Black respondents in wave 2 versus wave 1. Sensitivity analyses stratified
6 by recruitment wave produced results similar to the main study findings, suggesting that differences in recruitment
7 procedures did not affect study conclusions.
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12 Other study limitations are related to the timing of data collection. First, the Flint Water Crisis emergency
13 declaration occurred more than five years before we began data collection. Given the potentially greater salience of
14 the water crisis to Black respondents, recall may differ by race/ethnicity. This is not necessarily problematic,
15 though, since most study questions related to the water crisis (with the exception of questions about information
16 sources) were not designed to assess objective data or past perceptions. Rather, most questions were designed to
17 elicit current perceptions, opinions, and beliefs about the water crisis. A potentially more significant limitation of
18 the timing of the study is that data collection occurred during the COVID-19 pandemic and shortly after the murder
19 of George Floyd by Minneapolis police officer Derek Chauvin. Both the pandemic and George Floyd's murder
20 drew heightened attention to structural racism and may have influenced respondents' opinions about the Flint Water
21 Crisis. This likely had a greater effect on the responses of women with less prior knowledge of structural racism,
22 potentially resulting in smaller racial/ethnic differences in opinions and beliefs about the water crisis than might
23 have been observed one year earlier.
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38 Despite these limitations, this study has several strengths. First, to our knowledge, this is the first study to
39 explore how people in communities outside of Flint experienced the Flint Water Crisis. Findings suggest that the
40 water crisis was a racialized stressor. More work is needed to understand whether indirect exposure to the Flint
41 Water Crisis increased racial/ethnic health disparities. Future analyses using the survey data will explore opinions
42 and beliefs about the water crisis as potential mechanisms underlying racial/ethnic differences in emotional reactions
43 to the water crisis, as well as trust in water and beverage consumption practices. Another strength of this study is
44 the large, sociodemographically diverse sample. The large sample size increases power to detect group differences
45 in women's experiences of the Flint Water Crisis, while the sociodemographic diversity ensures adequate
46 representation according to race/ethnicity and socioeconomic status.
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56 *Conclusions*
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This study revealed that Black women in Michigan communities outside of Flint experienced the Flint Water Crisis differently than women in other racial and ethnic groups. Five years after the emergency declaration, Black women were more likely to know someone who was directly affected by the water crisis; they perceived themselves to be more knowledgeable about the water crisis; and they were more likely to believe that the water crisis was an intentional act of harm resulting from anti-Black racism among government officials. We conclude that the Flint Water Crisis was a racialized stressor that may have negatively impacted the health and well-being of Michigan women who were not directly harmed by the lead-tainted water. More work is needed to understand the effects of vicarious exposure to the Flint Water Crisis – and vicarious exposure to structural racism, more generally – on minority health and health disparities in Michigan and throughout the US.

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COMPLIANCE WITH ETHICAL STANDARDS

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Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent: Informed consent was obtained from all individual participants included in the study.

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Table 1. Descriptive statistics for the study sample by race/ethnicity, n=932					
	Black	White	Hispanic	Other race	p-value
Age, in years (M, SD)	31.1(6.2)	32.2(6.0)	31.2(6.8)	31.4(5.7)	0.09
Educational attainment (n, %)					<0.0001
High school or less	69(28.3)	62(11.0)	17(23.9)	5(9.4)	
Some college/Associate's degree	132(54.1)	245(43.4)	32(45.1)	14(26.4)	
Bachelor's degree or more	43(17.6)	257(45.6)	22(31.0)	34(64.2)	
Recruitment wave (n, %)					<0.0001
1	96(39.3)	287(50.9)	21(29.6)	39(73.6)	
2	148(60.7)	277(49.1)	50(70.4)	14(26.4)	
Note: P-values for differences by race/ethnicity calculated by chi-square tests for categorical variables and by one-way ANOVA for continuous variables. Data were collected between August and December of 2020 via online survey from a sample of women aged 18-45 in Michigan communities outside of Flint.					

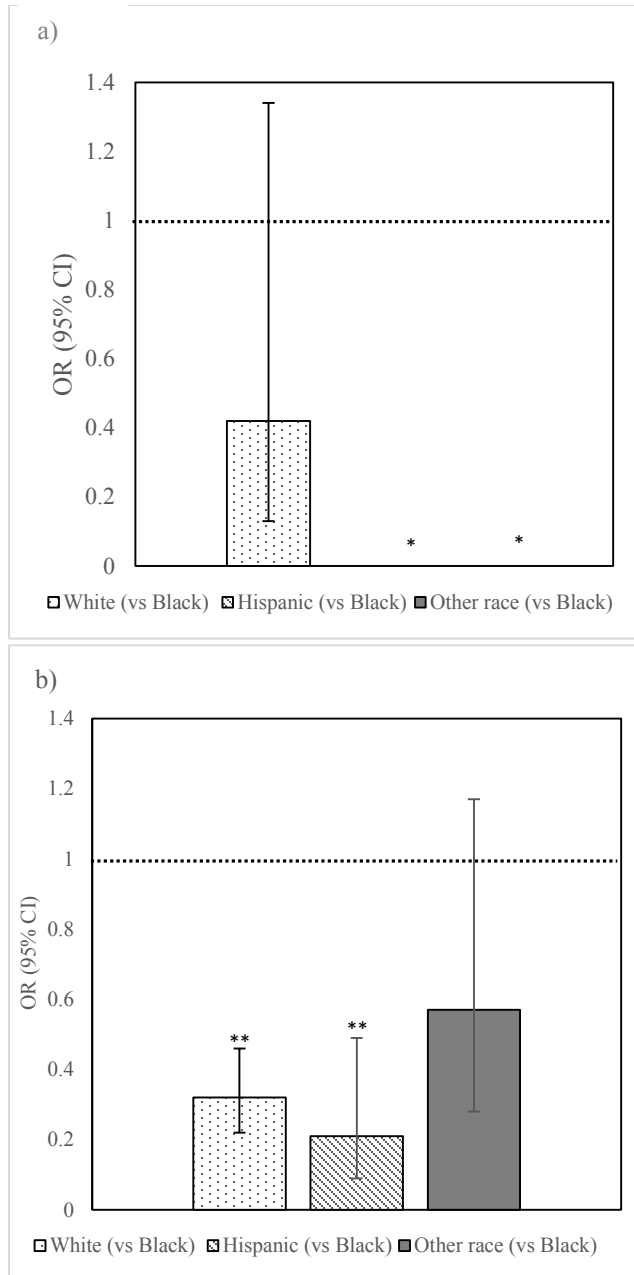


Fig. 1 Logistic regression models examining race/ethnicity as a predictor of personal connections to Flint: (a) Odds of having previously lived in Flint, MI (vs. never having lived in Flint), n=932 and (b) Odds of having family or friends who lived in Flint during the Flint Water Crisis (vs. having no loved ones directly affected), n=893. Note: All models adjusted for age, educational attainment, and recruitment wave. Error bars refer to 95% confidence intervals. OR=odds ratio. CI=confidence interval.

*No Hispanic women or women of other races previously lived in Flint, therefore there is no estimate.

** p-value < 0.05.

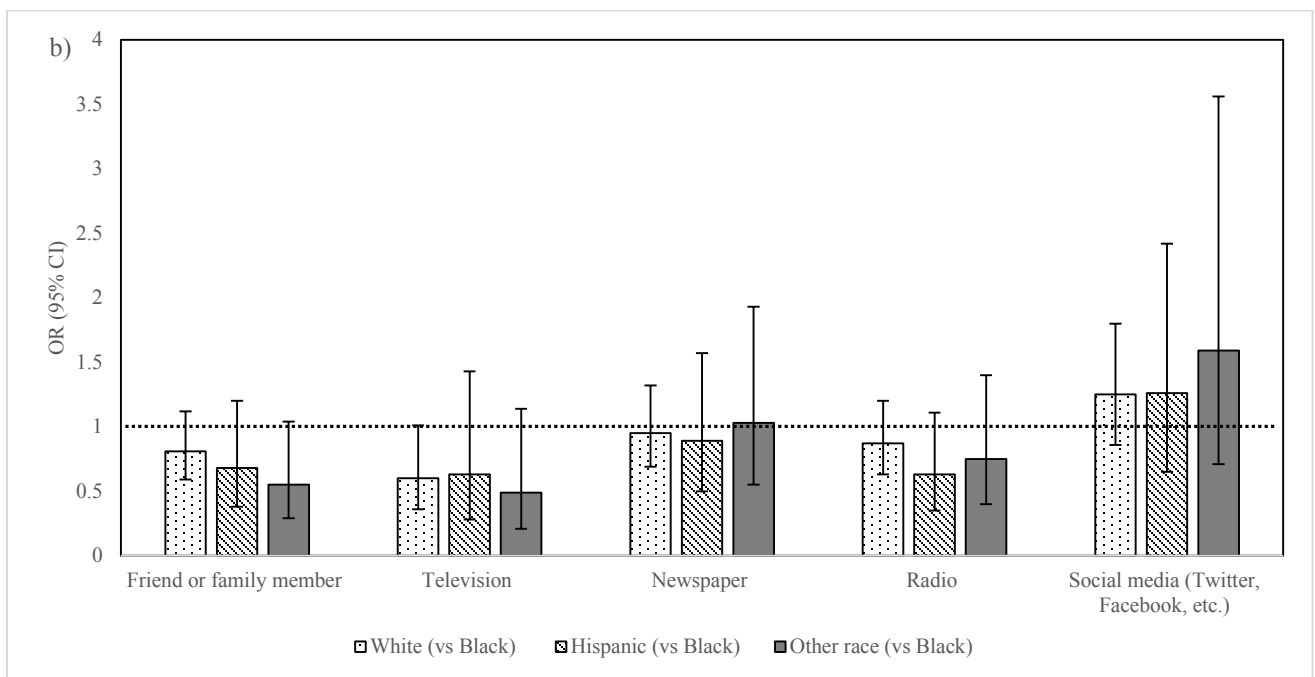
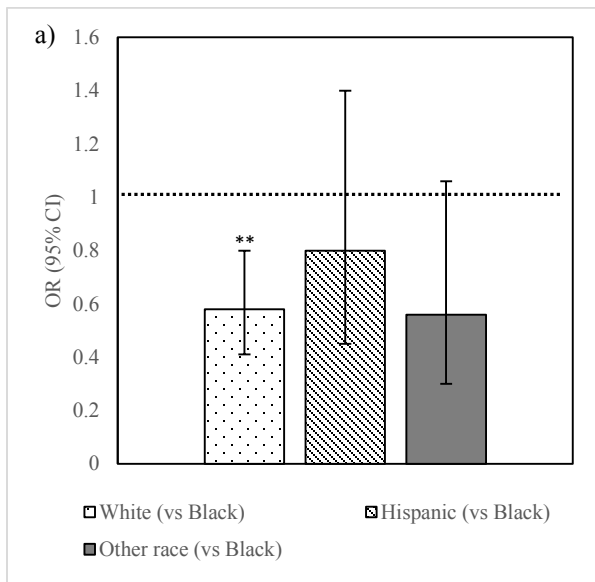


Fig. 2 Logistic regression models examining race/ethnicity as a predictor of perceived knowledge of the Flint Water Crisis and sources of information about the Flint Water Crisis: (a) Odds of being moderately or very knowledgeable about the Flint Water Crisis (vs. slightly or not at all knowledgeable), n=898 and (b) Odds of having heard about the Flint Water Crisis from [source] (vs. not having heard about the Flint Water Crisis from [source]), n=899. Note: All models adjusted for age, educational attainment, and recruitment wave. Error bars refer to 95% confidence intervals. OR=odds ratio. CI=confidence interval. ** p-value < 0.05.

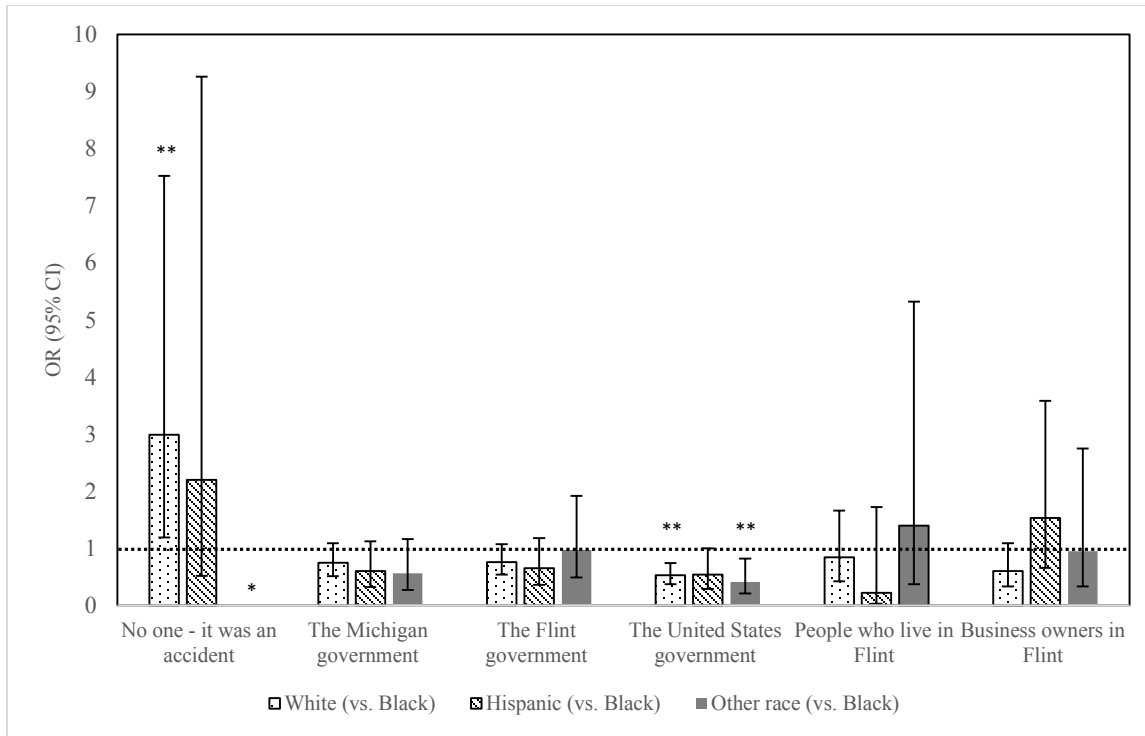


Fig. 3 Logistic regression models examining race/ethnicity as a predictor of opinions about who was responsible for the Flint Water Crisis: Odds of responding yes (vs. no) to each option, n=892. Note: All models adjusted for age, educational attainment, and recruitment wave. Error bars refer to 95% confidence intervals. OR=odds ratio. CI=confidence interval.

*No women of other races endorsed “No one - it was an accident”, therefore there is no estimate.

** p-value < 0.05.

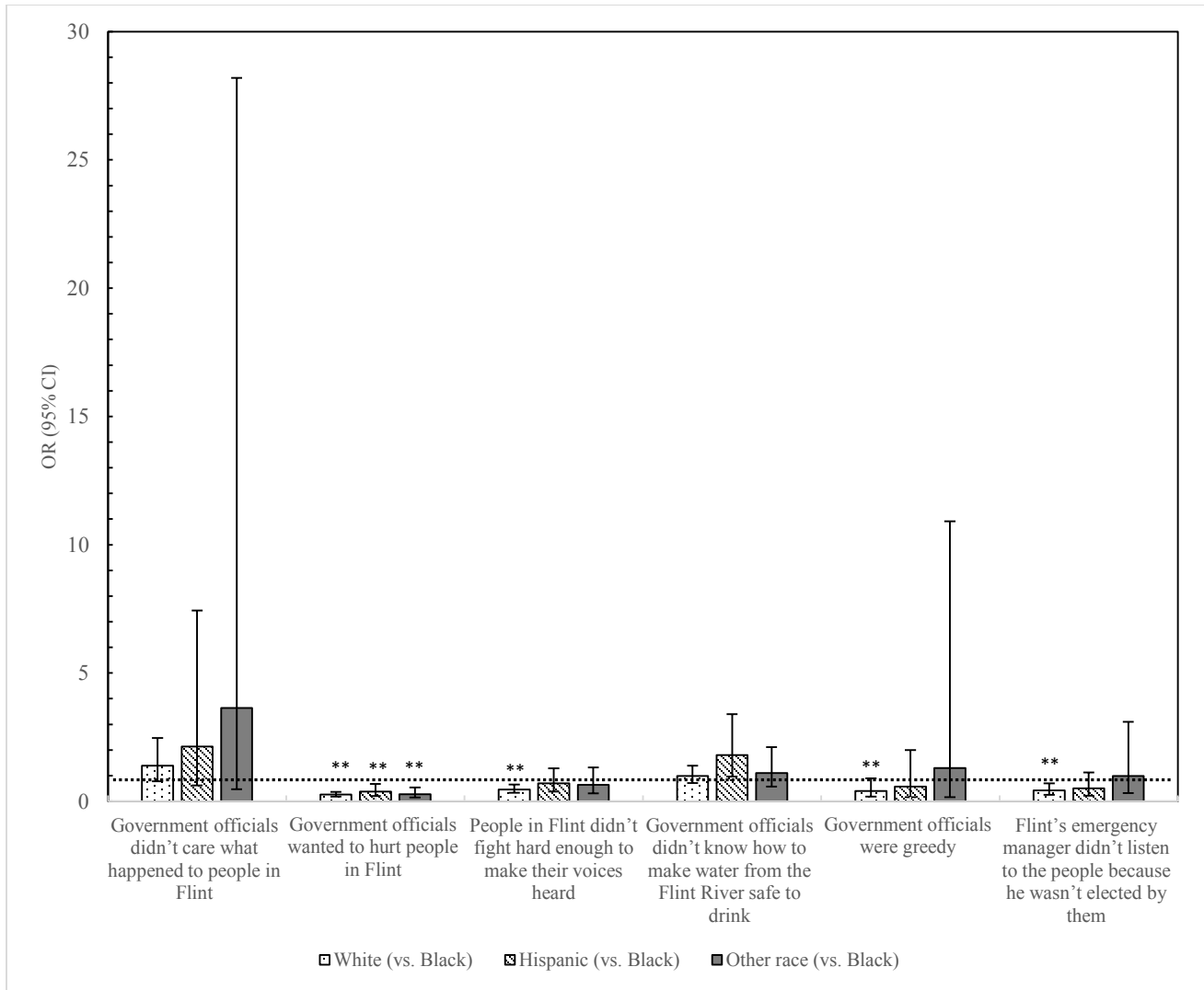


Fig. 4 Logistic regression models examining race/ethnicity as a predictor of opinions about what contributed to the Flint Water Crisis: Odds of responding somewhat or a great deal (vs. not at all) to each option, n=883-899 (see Supplementary Table S15 for sample sizes for each outcome). Note: All models adjusted for age, educational attainment, and recruitment wave. Error bars refer to 95% confidence intervals. OR=odds ratio. CI=confidence interval.

** p-value < 0.05.

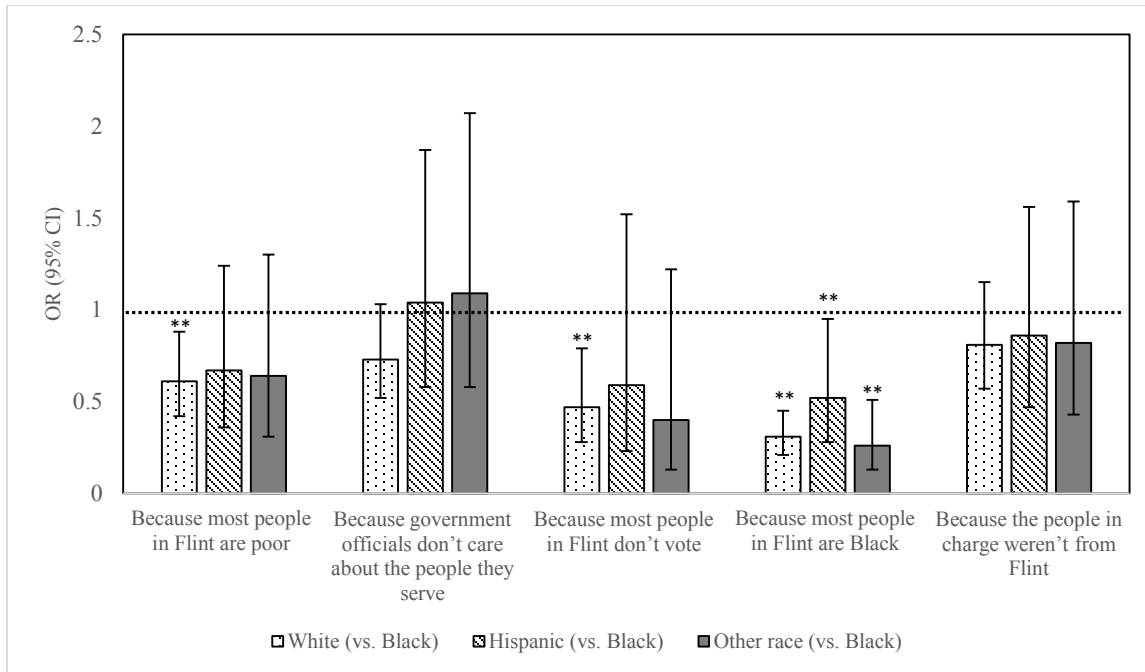


Fig. 5 Logistic regression models examining race/ethnicity as a predictor of opinions about why government officials didn't care what happened to people in Flint: Odds of responding yes (vs. no) to each option, n=839. Note: This question was only asked of respondents who agreed somewhat or a great deal with the following statement: Government officials didn't care what happened to people in Flint. All models adjusted for age, educational attainment, and recruitment wave. Error bars refer to 95% confidence intervals. OR=odds ratio. CI=confidence interval.

** p-value <0.05.

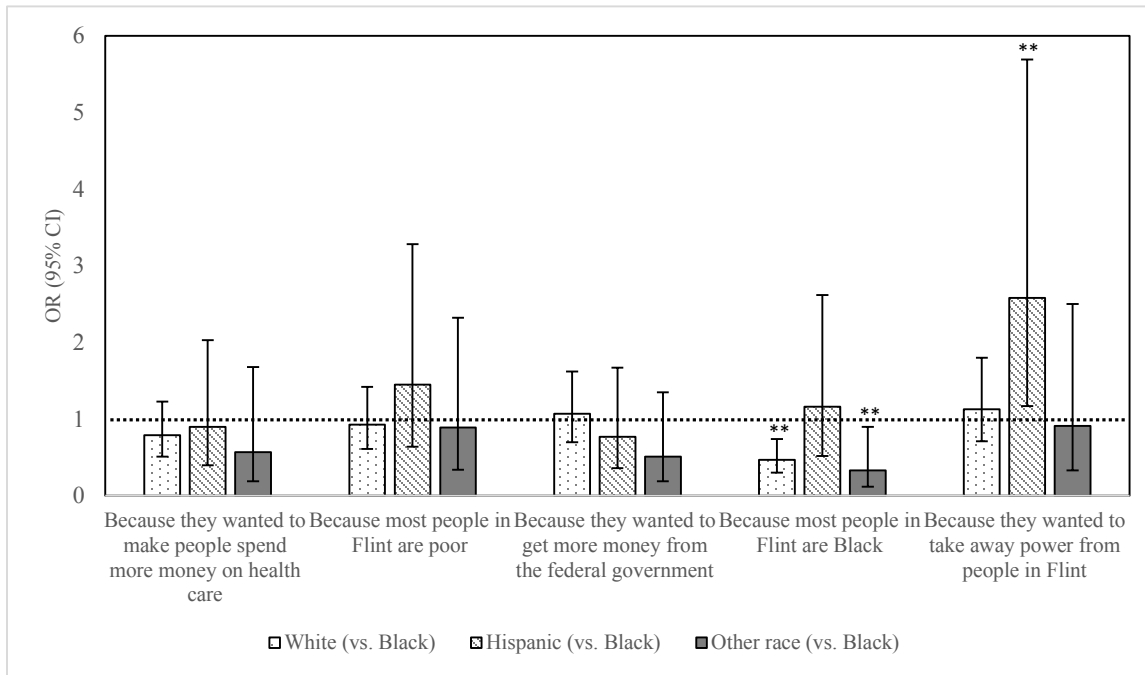


Fig. 6 Logistic regression models examining race/ethnicity as a predictor of opinions about why government officials wanted to hurt people in Flint: Odds of responding yes (vs. no) to each option, n=457. Note: This question was only asked of respondents who agreed somewhat or a great deal with the following statement: Government officials wanted to hurt people in Flint. All models adjusted for age, educational attainment, and recruitment wave. Error bars refer to 95% confidence intervals. OR=odds ratio. CI=confidence interval. ** p-value < 0.05.

Ref: REHD-D-21-00627

Manuscript Title: Experiences of the Flint Water Crisis among Reproductive-Age Michigan Women in Communities Outside of Flint: Differences by Race and Ethnicity

We thank the reviewers for their thoughtful comments, which have strengthened the manuscript. Responses to the reviewers' comments appear below each point in bold type.

Reviewer 1

This paper presents the results of a survey of nearly 1000 women who have received health care in the greater Ann Arbor area (specifically Ypsilanti Health Center and the University of Michigan Hospital). The authors find numerous interesting and statistically significant results, including that Black respondents (when compared to White respondents) were more likely to know someone who lived in Flint during the water crises, to be knowledgeable about the crisis, to think it was not an accident and was the fault of the U.S. government, to think that government officials wanted to hurt people in Flint and didn't care because the residents of Flint are poor, black, and don't vote.

Comments and suggestions:

1. The main tables would likely be easier to comprehend as bar charts, which these tables moved to the appendix.

We created bar charts for each of the main tables, except for Table 1. We replaced the tables with the bar charts in the main text and moved the tables to the supplemental materials.

2. I recommend not using the gendered term "man-made" and instead using a gender-neutral term like "human-made" or even "avoidable" or "preventable"

We removed the term "man-made" in the abstract and manuscript. We now say "human-made" or "avoidable" when referring to the water crisis.

3. I recommend citing the following two other papers on the indirect health effects of public policy on specific racial and ethnic groups:

* Marcella Alsan, Marianne Wanamaker, Tuskegee and the Health of Black Men, *The Quarterly Journal of Economics*, Volume 133, Issue 1, February 2018, Pages 407-455

* Hoa Vu, I Wish I Were Born in Another Time: Unintended Consequences of Immigration Enforcement on Birth Outcomes* <https://hoa-vu.github.io/research/HoaVu-JMP.pdf>

We thank Reviewer 1 for drawing our attention to these papers. We now cite these papers in the introduction (pp. 3, 4-5) and the discussion (p. 13).

4. Instead of "evidence of increased fetal death and miscarriage" I'd like the authors to say "evidence of reductions in fertility rates". See footnote 11 in the published version of Grossman and Slusky (2019)

After including additional citations suggested by Reviewer 1 in the comment below, we revised the text citing the Grossman and Slusky 2019 paper to say: "Studies examining changes in fertility rates produced mixed results [10,31,32], but a number of studies found evidence of an increase in adverse birth outcomes, including lower birthweight and increased incidence of low birthweight [10,32,33]."

5. There are many other studies on Flint across multiple literatures to cite:

* Abouk, R., and S. Adams. 2018. Birth Outcomes in Flint in the Early Stages of the Water Crisis. *Journal of Public Health Policy* 39: 68-85.

* Christensen, P., D.A. Keiser, G.E. Lade. 2021. Economic Effects of Environmental Crises: Evidence from Flint, Michigan. Working Paper. Available at <https://drive.google.com/file/d/19PqBMoAfJ-QqGW-Ar6Yae5Ls-jGSFcgV/view> (last accessed August 25, 2021).

- * Danagouliau, S. and D. Jenkins. 2021. Rolling Back the Gains: Maternal Stress Undermines Pregnancy Health After Flint's Water Switch. *Health Economics* 30(3): 564-584.
- * Gorton, N, and M. Pinkovskiy. 2021. Credit Access and Mobility during the Flint Water Crisis. Federal Reserve Bank of New York Staff Reports, no. 960.
- * Roy, S., Edwards, M.A. Are there excess fetal deaths attributable to waterborne lead exposure during the Flint Water Crisis? Evidence from bio-kinetic model predictions and Vital Records. *J Expo Sci Environ Epidemiol* (2021).
- * Wang, R., Chen, X. & Li, X. Something in the pipe: the Flint water crisis and health at birth. *J Popul Econ* (2021)
- * Danagouliau, S., Grossman, D. and D. Slusky. 2020. Office Visits Preventing Emergency Room Visits: Evidence From the Flint Water Switch. NBER WORKING PAPER 27098
- * Trejo, S., Gloria Yeomans-Maldonado, Brian Jacob. 2021. The Psychosocial Effects of The Flint Water Crisis on School-Age Children. NBER Working Paper 29341
- * Pieper, Kelsey J., Min Tang, and Marc A. Edwards. 2017. "Flint Water Crisis Caused by Interrupted Corrosion Control: Investigating 'Ground Zero' Home." *Environmental Science and Technology*.

We thank Reviewer 1 for drawing our attention to additional studies on the health and economic impacts of the Flint Water Crisis. We now cite the Pieper et al. (2017) manuscript on p. 3 when describing how the failure to properly treat water from the Flint River resulted in corrosion of pipes and solder in the city's water distribution system. In addition, we now cite a number of the suggested papers (including Abouk and Adams 2018; Danagouliau and Jenkins 2021; Roy and Edwards 2021; and Wang et al. 2021) in the text on p. 4 under the heading "Health Impacts of the Flint Water Crisis." Since our manuscript is primarily focused on health, we did not cite papers examining economic impacts (Christensen et al. 2021; Gorton and Pinkovskiy 2021) or impacts on educational outcomes (Trejo et al. 2021).

6. I appreciate the authors putting the verbatim write-in responses in the appendix. But I think they can do more with these responses, including textual analysis of common words or sentiment.

We now include a summary of the write-in responses in the supplemental materials. We plan to include a more in-depth analysis of these responses in a future manuscript.

Reviewer 3

This article is important and demonstrates the "weathering" (leading to poor health) that Black people and other minorities experience related to structural racism.

We thank Reviewer 3 for providing positive feedback on our manuscript.

Experiences of the Flint Water Crisis among Reproductive-Age Michigan Women in Communities Outside of Flint:
Differences by Race and Ethnicity

Journal of Racial and Ethnic Health Disparities

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Supplementary Table S1. Textual analysis of write-in responses: "How did you hear about the Flint Water Crisis?"

Category	Frequency
Work	11
Online Source	8
School/University	18
Other Media (Book/Documentary)	3
Other Source	5
	<i>n</i> = 45

Note: *n* = 44 for the total number of respondents who provided write-in responses, *n* = 45 for the total number of analyzed responses as one respondent provided a response that was broken down into two categories. Categories that received less than three responses were categorized as "Other Source."

Supplementary Table S2. Textual analysis of write-in responses: "In your opinion, who was responsible for the Flint Water Crisis?"

Category	Frequency
Governor	7
Emergency Manager	3
Individuals responsible for management/maintenance of water infrastructure	5
Unsure	9
Other	8
	<i>n</i> = 32

Note: Categories that received less than three responses were categorized as "Other."

Supplementary Table S3. Textual analysis of write-in responses: "Why do you think that government officials didn't care what happened to people in Flint?"

Category	Frequency	Examples of responses
Greed/selfishness	9	<i>"It didn't affect them. They were greedy and wanted to save money but at the expense of people's lives"</i>
More concerned about money than people's well being	23	<i>"I think they just didn't think about the effects it would have because they were thinking about money and not people."</i>
Lack of accountability/consequences for people in power	5	<i>"Most people operate without consequences and they just happened to get caught because people got sick. "</i>
Government officials are not serving interests of constituents	3	<i>"Not all government officials are in office for the people."</i>
Government cares more about special interest groups/business than people	4	<i>"Because of special interests and the interest in profit over people."</i>
Government didn't think through consequences of their actions	3	<i>"Because they didn't look into the details and instead turned a blind eye rather than specifically targeting Flint."</i>
Lack of funding/lack of funding for infrastructure	3	<i>"If they cared they would have fixed the problem sooner- Probably lack of money to make such huge infrastructure changes."</i>
Disconnected from the impacts/apathetic	5	<i>"Because the people in charge were apathetic as to the effects of their laziness, negligence, and cheapness"</i>
Systemic racism/environmental racism	3	<i>"Systemic and structural racism and inequality."</i>
Corruption	3	<i>"Because Government, in general, is corrupt. It ALWAYS serves to gain power/money, and RARELY is about the people/community it serves".</i>
Other	14	
Inadequate answer	8	
	<i>n = 83</i>	

Note: *n* = 64 for the total number of respondents who provided write-in responses, *n* = 83 for the total number of analyzed responses as some respondents provided several categories of responses that were split up. Responses that did not adequately respond to the question were categorized as "Inadequate answer." Categories that received less than three responses were categorized as "Other."

Supplementary Table S4. Textual analysis of write-in responses: "Why do you think that government officials wanted to hurt people in Flint?"

Category	Frequency	Examples of Responses
General apathy	15	<p><i>"I don't think they consciously wanted to hurt people from Flint but they definitely didn't care that it was a potential outcome."</i></p> <p><i>They just don't care. If government officials cared they would've fixed the problem. Plain and simple. Clean drinking water should be available to everyone regardless of race, income status, and even educational level. It's a right not a privilege.</i></p>
Greed	3	<p><i>"The government officials exuded their on power to get ahead, and gain, despite hurting the Flint community. They hurt the community for their own gain."</i></p> <p><i>"The answer to all of these are they're in it for themselves."</i></p>
To save/make money	4	<p><i>"I don't think they intended to hurt them, but I don't believe they valued their lives/health when they became aware of the issue and I believe money was more important to them than ensuring the peoples safety."</i></p> <p><i>"They wanted the lowest cost solution available"</i></p>
Inadequate answer	9	
	<i>n = 31</i>	

Note: $n = 30$ for the total number of respondents who provided write-in responses, $n = 31$ for the total number of analyzed responses as one respondent provided a response that was broken down into two categories. " Responses that did not adequately respond to the question were categorized as "Inadequate answer."

Supplementary Table S5. Descriptive statistics for the study sample by recruitment wave				
	All Participants	Wave 1	Wave 2	
	(n,%)	(n,%)	(n,%)	p-value
Racial/Ethnic Group (n,%)				<0.0001
Black	244(26.2)	96(21.7)	148(30.3)	
White	564(60.5)	287(64.8)	277(56.7)	
Hispanic	71(7.6)	21(4.7)	50(10.2)	
Other race	53(5.7)	39(8.8)	14(2.9)	
Age, in years (M, SD)	31.8(6.1)	32.8(6.7)	30.8(5.3)	<0.0001
Educational attainment (n, %)				<0.0001
High school or less	153(16.4)	56(12.6)	97(19.8)	
Some college/Associate's degree	423(45.3)	148(33.3)	275(56.2)	
Bachelor's degree or more	357(38.3)	240(54.1)	117(23.9)	
Note: P-values for differences by recruitment wave calculated by chi-square tests for categorical variables and by one-way ANOVA for continuous variables.				

Supplementary Table S6. Descriptive statistics for personal connections to Flint by race/ethnicity					
	Black	White	Hispanic	Other race	p-value
Ever lived in Flint, Michigan (n,%)					
No or don't know/not sure	237(97.1)	557(98.8)	71(100.0)	53(100.0)	0.16
Yes (Before 2014)	7(2.9)	7(1.2)	0(0)	0(0)	
Did you have family or friends who lived in Flint when the Flint Water Crisis happened? (n,%)					
No or don't know/not sure	136(60.7)	467(84.1)	55(88.7)	39(75.0)	<0.0001
Yes	88(39.3)	88(15.9)	7(11.3)	13(25.0)	
Note: P-values for differences by race/ethnicity calculated by chi-square tests.					

Supplementary Table S7. Descriptive statistics for perceived knowledge about the Flint Water Crisis and sources of information about the Flint Water Crisis by race/ethnicity

	Black	White	Hispanic	Other race	p-value
Knowledge level of the Flint Water Crisis (n,%)					
Slightly or not at all knowledgeable, or don't know/not sure	109(47.8)	320(57.7)	34(53.1)	28(54.9)	0.09
Moderately or very knowledgeable	119(52.2)	235(42.3)	30(46.9)	23(45.1)	
How did you hear about the Flint Water Crisis? (n,%)					
Friend or family member	117(51.3)	260(46.9)	28(43.8)	20(38.5)	0.32
Television	207(90.8)	466(84.0)	54(84.4)	41(78.9)	0.04
Newspaper	97(42.5)	249(44.9)	26(40.6)	25(48.1)	0.80
Radio	113(49.6)	270(48.7)	25(39.1)	24(46.2)	0.49
Social media (Twitter, Facebook, etc.)	161(70.6)	424(76.4)	48(75.0)	43(82.7)	0.21

Note: P-values for differences by race/ethnicity calculated by chi-square tests for categorical variables.

Supplementary Table S8. Descriptive statistics for opinions about who was responsible for the Flint Water Crisis by race/ethnicity

	Black	White	Hispanic	Other race	p-value
In your opinion, who was responsible for the Flint Water Crisis? (n,%)					
No one was responsible- it was an accident	6(2.7)	28(5.1)	3(4.8)	0(0)	0.20
The Michigan government	162(72.3)	407(73.5)	40(64.5)	38(73.1)	0.52
The Flint government	147(65.6)	355(64.1)	36(58.1)	37(71.2)	0.51
The United States government	99(44.2)	174(31.4)	20(32.3)	15(28.9)	0.006
People who live in Flint	14(6.3)	27(4.9)	1(1.6)	3(5.8)	0.51
Business owners in Flint	21(9.4)	35(6.3)	9(14.5)	5(9.6)	0.09

Note: P-values for differences by race/ethnicity calculated by chi-square tests.

Supplementary Table S9. Descriptive statistics for opinions about what contributed to the Flint Water Crisis by race/ethnicity					
	Black	White	Hispanic	Other race	p-value
In your opinion, how much did the following contribute to the Flint Water Crisis? (n,%)					
<i>Government officials didn't care about what happened to people in Flint</i>					
Not at all	23(10.1)	33(6.0)	3(4.7)	1(1.9)	0.07
Somewhat or a great deal	205(89.9)	522(94.1)	61(95.3)	51(98.1)	
<i>Government officials wanted to hurt people in Flint</i>					
Not at all	58(25.4)	322(58.1)	31(48.4)	29(56.9)	<0.0001
Somewhat or a great deal	170(74.6)	232(41.9)	33(51.6)	22(43.1)	
<i>People in Flint didn't fight hard enough to make their voices heard</i>					
Not at all	124(54.4)	425(76.7)	42(65.6)	39(75.0)	<0.0001
Somewhat or a great deal	104(45.6)	129(23.3)	22(34.4)	13(25.0)	
<i>Government officials didn't know how to make water from the Flint River safe to drink</i>					
Not at all	82(36.1)	214(38.6)	16(25.0)	19(37.3)	0.20
Somewhat or a great deal	145(63.9)	340(61.4)	48(75.0)	32(62.8)	
<i>Government officials were greedy</i>					
Not at all	8(3.6)	39(7.0)	4(6.3)	1(2.0)	0.17
Somewhat or a great deal	217(96.4)	515(93.0)	60(93.8)	50(98.0)	
<i>Flint's emergency manager didn't listen to the people because he wasn't elected by them</i>					
Not at all	20(8.9)	101(18.5)	11(17.5)	4(7.8)	0.003
Somewhat or a great deal	204(91.1)	444(81.5)	52(82.5)	47(92.2)	
Note: P-values for differences by race/ethnicity calculated by chi-square tests.					

Supplementary Table S10. Descriptive statistics for opinions about why government officials didn't care about what happened to people in Flint by race/ethnicity

	Black	White	Hispanic	Other race	p-value
Why do you think that government officials didn't care what happened to people in Flint? (n,%)					
Because most people in Flint are poor	140(68.3)	334(64.0)	37(60.7)	36(70.6)	0.49
Because government officials don't care about the people they serve	111(54.2)	234(44.8)	33(54.1)	27(52.9)	0.09
Because most people in Flint don't vote	30(14.6)	45(8.6)	6(9.8)	4(7.8)	0.10
Because most people in Flint are Black	127(62.0)	228(43.7)	30(49.2)	24(47.1)	0.0002
Because the people in charge weren't from Flint	103(50.2)	274(52.5)	30(49.2)	29(56.9)	0.81

Note: P-values for differences by race/ethnicity calculated by chi-square tests.

Supplementary Table S11. Descriptive statistics for opinions about why government officials wanted to hurt people in Flint by race/ethnicity

	Black	White	Hispanic	Other race	p-value
Why do you think that government officials wanted to hurt people in Flint? (n,%)					
Because they wanted to make people spend more money on health care	62(36.5)	65(28.0)	11(33.3)	5(22.7)	0.25
Because most people in Flint are poor	101(59.4)	142(61.2)	23(69.7)	14(63.6)	0.73
Because they wanted to get more money from the federal government	85(50.0)	112(48.3)	14(42.4)	7(31.8)	0.39
Because most people in Flint are Black	94(55.3)	110(47.4)	21(63.6)	10(45.5)	0.19
Because they wanted to take power away from the people in Flint	45(26.5)	77(33.2)	17(51.5)	7(31.8)	0.04

Note: P-values for differences by race/ethnicity calculated by chi-square tests.

Supplementary Table S12. Logistic regression models examining race/ethnicity as a predictor of personal connections to Flint

	White (vs. Black)		Hispanic (vs. Black)		Other race (vs. Black)		n
	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	
Previously lived in Flint (vs. never lived in Flint)	0.42(0.13,1.34)	0.14	*	*	*	*	932
Family or friends lived in Flint during the Flint Water Crisis (vs. no loved ones directly affected)	0.32(0.22,0.46)	<0.0001	0.21(0.09,0.49)	0.0003	0.57(0.28,1.17)	0.12	893

Note: All models adjusted for age, educational attainment, and recruitment wave. OR = odds ratio. CI = confidence interval.

*No Hispanic women or women of other races previously lived in Flint; therefore there is no estimate.

Supplementary Table S13. Logistic regression models examining race/ethnicity as a predictor of perceived knowledge of the Flint Water Crisis and sources of information about the Flint Water Crisis							
	White (vs. Black)		Hispanic (vs. Black)		Other race (vs. Black)		n
	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	
Knowledge Level							
Moderately or very knowledgeable about the Flint Water Crisis (vs. slightly or not at all knowledgeable)	0.58(0.41,0.80)	0.0009	0.80(0.45,1.40)	0.43	0.56(0.30,1.06)	0.07	898
How did you hear about the Flint Water Crisis?							
Friend or family member (yes vs. no)	0.81(0.59,1.12)	0.21	0.68(0.38,1.20)	0.18	0.55(0.29,1.04)	0.06	899
Television (yes vs. no)	0.60(0.36,1.01)	0.06	0.63(0.28,1.43)	0.27	0.49(0.21,1.14)	0.10	899
Newspaper (yes vs. no)	0.95(0.69,1.32)	0.78	0.89(0.50,1.57)	0.68	1.03(0.55,1.93)	0.92	899
Radio (yes vs. no)	0.87(0.63,1.20)	0.38	0.63(0.35,1.11)	0.11	0.75(0.40,1.40)	0.36	899
Social media (Twitter, Facebook, etc.) (yes vs. no)	1.25(0.86,1.80)	0.24	1.26(0.65,2.42)	0.49	1.59(0.71,3.56)	0.26	899
Note: All models adjusted for age, educational attainment, and recruitment wave. OR = odds ratio. CI = confidence interval.							

Supplementary Table S14. Logistic regression models examining race/ethnicity as a predictor of opinions about who was responsible for the Flint Water Crisis

	White (vs. Black)		Hispanic (vs. Black)		Other race (vs. Black)		
In your opinion, who was responsible for the Flint Water Crisis?	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	n
No one - it was an accident (yes vs. no)	2.99(1.19,7.52)	0.02	2.20(0.52,9.26)	0.28	*	*	892
The Michigan government (yes vs. no)	0.75(0.51,1.09)	0.13	0.60(0.32,1.12)	0.11	0.56(0.27,1.16)	0.12	892
The Flint government (yes vs. no)	0.76(0.54,1.07)	0.12	0.65(0.36,1.18)	0.15	0.97(0.49,1.92)	0.92	892
The United States government (yes vs. no)	0.53(0.37,0.74)	0.0002	0.54(0.29,1.00)	0.05	0.41(0.21,0.82)	0.01	892
People who live in Flint (yes vs. no)	0.84(0.42,1.66)	0.61	0.22(0.03,1.72)	0.15	1.40(0.37,5.32)	0.62	892
Business owners in Flint (yes vs. no)	0.60(0.33,1.09)	0.09	1.53(0.66,3.58)	0.32	0.95(0.33,2.75)	0.92	892

Note: All models adjusted for age, educational attainment, and survey number. OR = odds ratio. CI = confidence interval.

*No women of other races responded yes; therefore there is no estimate.

Supplementary Table S15. Logistic regression models examining race/ethnicity as a predictor of opinions about what contributed to the Flint Water Crisis							
	White (vs. Black)		Hispanic (vs. Black)		Other race (vs. Black)		
In your opinion, how much did the following contribute to the Flint Water Crisis?	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	n
Government officials didn't care what happened to people in Flint (somewhat or a great deal vs. not at all)	1.39(0.78,2.47)	0.27	2.14(0.62,7.44)	0.23	3.64(0.47,28.20)	0.22	899
Government officials wanted to hurt people in Flint (somewhat or a great deal vs. not at all)	0.26(0.18,0.37)	<0.0001	0.38(0.21,0.68)	0.0012	0.28(0.15,0.54)	0.0001	897
People in Flint didn't fight hard enough to make their voices heard (somewhat or a great deal vs. not at all)	0.46(0.33,0.65)	<0.0001	0.70(0.38,1.28)	0.25	0.64(0.31,1.32)	0.23	898
Government officials didn't know how to make water from the Flint River safe to drink (somewhat or a great deal vs. not at all)	0.99(0.71,1.39)	0.97	1.80(0.96,3.40)	0.07	1.10(0.57,2.11)	0.78	896
Government officials were greedy (somewhat or a great deal vs. not at all)	0.40(0.18,0.89)	0.02	0.57(0.16,2.00)	0.38	1.30(0.16,10.91)	0.81	894
Flint's emergency manager didn't listen to the people because he wasn't elected by them (somewhat or a great deal vs. not at all)	0.42(0.25,0.70)	0.001	0.50(0.22,1.12)	0.09	0.99(0.32,3.10)	0.99	883
Note: All models adjusted for age, educational attainment, and recruitment wave. OR = odds ratio. CI = confidence interval.							

Supplementary Table S16. Logistic regression models examining race/ethnicity as a predictor of opinions about why government officials didn't care what happened to people in Flint

	White (vs. Black)		Hispanic (vs. Black)		Other race (vs. Black)		
Why do you think that government officials didn't care what happened to people in Flint?*	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	n
Because most people in Flint are poor (yes vs. no)	0.61(0.42,0.88)	0.008	0.67(0.36,1.24)	0.20	0.64(0.31,1.30)	0.21	839
Because government officials don't care about the people they serve (yes vs. no)	0.73(0.52,1.03)	0.07	1.04(0.58,1.87)	0.89	1.09(0.58,2.07)	0.79	839
Because most people in Flint don't vote (yes vs. no)	0.47(0.28,0.79)	0.005	0.59(0.23,1.52)	0.28	0.40(0.13,1.22)	0.11	839
Because most people in Flint are Black (yes vs. no)	0.31(0.21,0.45)	<0.0001	0.52(0.28,0.95)	0.03	0.26(0.13,0.51)	<0.0001	839
Because the people in charge weren't from Flint (yes vs. no)	0.81(0.57,1.15)	0.24	0.86(0.47,1.56)	0.61	0.82(0.43,1.59)	0.56	839

Note: All models adjusted for age, educational attainment, and recruitment wave. OR = odds ratio. CI = confidence interval.

*This question was only asked of respondents who agreed somewhat or a great deal with the following statement: Government officials didn't care what happened to people in Flint.

Supplementary Table S17. Logistic regression models examining race/ethnicity as a predictor of opinions about why government officials wanted to hurt people in Flint

	White (vs. Black)		Hispanic (vs. Black)		Other race (vs. Black)		n
	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	
Why do you think that government officials wanted to hurt people in Flint?*							
Because they wanted to make people spend more money on health care (yes vs. no)	0.79(0.51,1.23)	0.30	0.90(0.40,2.03)	0.80	0.57(0.19,1.68)	0.31	457
Because most people in Flint are poor (yes vs. no)	0.93(0.61,1.42)	0.74	1.45(0.64,3.28)	0.38	0.89(0.34,2.32)	0.82	457
Because they wanted to get more money from the federal government (yes vs. no)	1.07(0.70,1.62)	0.76	0.77(0.36,1.67)	0.51	0.51(0.19,1.35)	0.18	457
Because most people in Flint are Black (yes vs. no)	0.47(0.30,0.74)	0.001	1.16(0.52,2.62)	0.72	0.33(0.12,0.90)	0.03	457
Because they wanted to take away power from people in Flint (yes vs. no)	1.13(0.71,1.80)	0.62	2.58(1.17,5.69)	0.02	0.91(0.33,2.50)	0.85	457

Note: All models adjusted for age, educational attainment, and recruitment wave. OR = odds ratio. CI = confidence interval.

* This question was only asked of respondents who agreed somewhat or a great deal with the following statement: Government officials wanted to hurt people in Flint.

To address reviewer feedback, Dasha (Darya) Dokshina was added as a coauthor due to her leading the qualitative analysis on the free response questions and developing the related data tables.