

Community Assessment for Public Health Emergency Response (CASPER)

After the Flint Water Crisis: May 17–19, 2016

Flint, Michigan

Final Report: July 2016



Centers for Disease Control and Prevention
National Center for Environmental Health,
Division of Environmental Hazards and Health Effects
Health Studies Branch

Acknowledgements

We would like to acknowledge the following persons for their contributions, without which, this endeavor would not have been possible.

Flint Community Resilience Group, Mental Health Workgroup, Data & Gap Analysis Sub-Workgroup

Michigan Department of Health and Human Services

- Kenyetta Jackson
- Jody Lewis
- Price Pullins

Genesee Health System

- Patricia Reynolds

University of Michigan–Flint

- Vicki Johnson-Lawrence

Genesee County Health Department

Substance Abuse and Mental Health Services Administration

- Jeffrey Coady

Centers for Disease Control and Prevention, Health Studies Branch

- Tesfaye Bayleyegn
- Sherry Burrer
- Gamola Fortenberry
- Reba Griffith
- Ariana Hanchey
- Zuha Jeddy
- Stephanie Kieszak
- Kristin Marks
- Amy Schnall
- Alice Wang
- Amy Wolkin

Centers for Disease Control and Prevention, Lead Poisoning and Prevention Program

- Mary Jean Brown

Interview Teams

Survey Respondents

Executive Summary

On April 25, 2014, the City of Flint, Michigan changed their municipal water supply source from the Detroit-supplied Lake Huron water to the Flint River. The switch resulted in the corrosion of water distribution pipes and leaching of lead and other contaminants into municipal drinking water. On October 1, 2015, Genesee County Board of Commissioners and Genesee County Health Department declared a public health emergency and advised residents of Flint, Michigan not to drink the municipal water. On October 15, 2015, funding was authorized to switch the municipal water source back to Detroit-supplied Lake Huron water. On January 10, 2016, The Michigan Department of Health and Human Services (MDHHS) activated the Community Health Emergency Coordinating Center (CHECC) to coordinate all state-level public health emergency response activities. On January 13, 2016, the CHECC behavioral health team requested federal resources and technical assistance from the Substance Abuse and Mental Health Services Administration (SAMHSA) Disaster Technical Assistance Center. The behavioral health team immediately formed a partnership with Genesee Health System (GHS), the local community mental health agency responsible for emergency behavioral health response, to help support behavioral health initiatives for community recovery. Subsequently, the following emergency activities were initiated through this partnership: activation of the Disaster Distress 24/7 hotline and a community hotline for immediate disaster crisis counselling, offering of crisis counseling to community members through GHS, provision of training on Psychological First Aid to staff and volunteers at GHS and community service agencies, application and award of the SAMHSA Emergency Response Grant, provision of \$28 M in supplemental funds including \$500,000 in emergency aid for crisis behavioral health services from the State of Michigan, request for expansion of Medicaid for those affected, expansion of the Head Start program, and creation of the Flint Community Resilience Group (FCRG).

On January 16, 2016, President Obama declared a state of emergency for the City of Flint and Genesee County.

In addition to health effects from lead exposure, there were concerns about the behavioral health consequences of the Flint Water Crisis (FWC) for Flint residents, such as anxiety, depression, and substance abuse. The FCRG, Mental Health Workgroup, Data & Gap Analysis Sub-Workgroup, comprised of members from the MDHHS, Genesee County Health Department, GHS, and the University of Michigan–Flint, requested technical assistance from Centers for Disease Control and Prevention (CDC) to investigate behavioral health effects from the FWC. A formal request for assistance for a Community Assessment for Public Health Emergency Response (CASPER) in the City of Flint came from MDHHS on April 6, 2016.

To aid in the recovery efforts, a CASPER was conducted May 17–19, 2016 within the City of Flint, Michigan. Specifically, the CASPER was conducted to assess the following: 1) household- and individual-level, self-reported behavioral health concerns; 2) household access to behavioral health services, including substance abuse and mental health services, and perceived barriers to access; 3) self-reported physical health concerns; 4) water-related resource needs and barriers to resources; and 5) communication with the affected community. CDC provided interview teams with a three-hour training prior to conducting interviews over three days in the field. A total of 182 household interviews were completed. A weighted cluster analysis was conducted to report the projected percent of households; for all results the percentages in the text represent weighted percentages. The major findings of the survey fall under the following categories:

Self-Reported Behavioral Health Concerns

Of households with one or more members aged 21 years or older (n = 179), 65.6% (95% CI [57.8, 73.5]) reported at least one member within that age group had one or more behavioral health concerns more than usual since October 2015, with 44.9% reporting at least one household member

needed behavioral health services. Of households with one or more members aged less than 21 years (n = 81), 54.3% (95% CI [40.4, 68.2]) reported at least one member within that age group had one or more behavioral health concern more than usual since October 2015, with 51.7% reporting at least one household member needed behavioral health services. Of households needing services (n = 43), the following barriers to seeking services were reported: 47.3% reported having a hard time trusting providers, 29.7% said services were too expensive and 25.9% said they had no transportation.

Several behavioral health questions were used from the Behavioral Risk Factor Surveillance System (BRFSS) and administered at an individual level to respondents aged 18 years or older on self-reported negative quality of life indicators. An increased prevalence of individuals who had 14 or more days of poor physical health days, poor mental health days, or limited activity days within the past 30 days was reported for the City of Flint compared to the reported prevalence for the state of Michigan in the 2014 BRFSS.

Self-Reported Physical Health Concerns

Of all households (n = 182), half (50.5%) reported at least one person believed their physical health had been worsened by the FWC, and among those with a worsened health condition the most commonly mentioned condition was skin rash or irritation (49.6%).

Water-Related Resources

Respondents reported using multiple sources for water (n = 182). A high percentage of households reported currently using bottled water for drinking and cooking including use of bottled water from distribution sites (75.0%), bottled water from store (51.6%), and bottled water from home distributors (35.4%). Additionally, filtered tap water (41.1%) was also used for drinking and cooking. Of the 16.9% of households that reported having difficulty obtaining bottled, filtered, or well water, the most commonly reported reason was no transportation (62.3%). Because of the FWC, many household behaviors surrounding hygiene and water use have changed, including the following: reducing water

usage, decreasing the duration and frequency of showering/bathing, and changing the method of showering/bathing (e.g., using baby wipes or hand sanitizer for washing).

Communication

Information on the FWC was most commonly received by households (n = 182) via television (76.6%) and through neighbors, friends, or family (32.5%). The most trusted source of information was news media (26.4%).

Based on these findings, FCRG could consider the following to guide the ongoing recovery efforts in the City of Flint: focus resources on behavioral health intervention and follow-up surveillance of behavior health concerns, consider economic costs to participants when implementing behavioral health interventions, decrease dependence on bottled water by encouraging filtered tap water use in order to return to normalcy, focus on less mobile populations (e.g., disabled, lack of transportation) in terms of water and filter distribution, and increase community involvement and engagement in the recovery phase of the FWC to assist with disseminating information on the FWC in City of Flint.

Background

On April 25, 2014, the City of Flint, Michigan changed their municipal water supply source from the Detroit-supplied Lake Huron water to the Flint River (1). The switch in the water source resulted in the corrosion of the water distribution pipes and leaching of lead and other contaminants into municipal drinking water. Lead toxicity can affect every organ system and results in neurological, renal, hematological, endocrine, gastrointestinal, cardiovascular, reproductive, and developmental effects, including mental retardation and growth failure (2). In children, lead remains a common, preventable, environmental health threat. Children are more susceptible than adults to the adverse effects of lead exposure, due to hand-to-mouth actions, higher physiological uptake rates, and developing biological

systems (3). On September 24, 2015, results of a study were released by a Hurley Medical Center researcher that demonstrated after the water source change, there was an increased incidence of elevated blood-lead levels in children who were residents of Flint, Michigan (4). Subsequently, the City of Flint, Michigan issued a lead advisory on September 25, 2015 that advised residents to use water only from the cold water tap for drinking, cooking, and making baby formula (1). On October 1, 2015, Genesee County Board of Commissioners and Genesee County Health Department declared a public health emergency and advised residents of Flint, Michigan not to drink the municipal water unless it had been filtered through a National Sanitation Foundation (NSF) approved filter certified to remove lead that meets American National Standards Institute (ANSI) standard 53 (5). On October 15, 2015, funding was authorized to switch the municipal water source back to Detroit-supplied Lake Huron water (1). On January 16, 2016, President Obama declared a state of emergency for the City of Flint and Genesee County (1). In addition to health effects from lead exposure, there were concerns about the behavioral health consequences of the Flint Water Crisis (FWC) for Flint residents.

On January 10, 2016, The Michigan Department of Health and Human Services (MDHHS) activated the Community Health Emergency Coordinating Center (CHECC) to support Flint Water Crisis response efforts. The CHECC coordinates all state-level public health emergency response activities. On January 13, 2016, due to the unique challenges and behavioral health implications of the crisis, the CHECC behavioral health team requested federal resources and technical assistance from the Substance Abuse and Mental Health Services Administration (SAMHSA) Disaster Technical Assistance Center. The behavioral health team immediately formed a partnership with Genesee Health System (GHS)—the local community mental health agency responsible for a disaster and emergency behavioral health response in Flint—to help support strategic planning and funding of behavioral health initiatives for community recovery. Subsequently, the following emergency activities were initiated through this partnership:

- 1) At the request of the CHECC behavioral health team, SAMHSA activated the Disaster Distress 24/7 hotline [January 15, 2016]. Additionally, GHS established a community hotline dedicated to providing immediate disaster crisis counselling to assist distressed Flint residents affected by the water crisis.
- 2) GHS clinicians began offering crisis counseling to community members [January 23, 2016].
- 3) GHS and the CHECC behavioral health team provided training on Psychological First Aid (PFA) and other rapid behavioral health prevention and intervention protocols to staff and volunteers at GHS and community service agencies, such as Catholic Services [January 27, 2016]. These train-the-trainer sessions were implemented to mitigate the immediate behavioral health needs of the Flint community.
- 4) On January 19, 2016, the SAMHSA Emergency Response Grant (SERG) application was requested, and subsequently submitted on April 5, 2016. SAMHSA awarded the SERG to Michigan on May 25, 2016.
- 5) The State of Michigan (SOM) provided \$28 M in supplemental funds including \$500,000 in emergency aid for crisis behavioral health services [January 20, 2016]. The SOM also requested expansion of Medicaid to provide health services to everyone 21 years and under affected by the water crisis. This also expanded the availability of the Head Start program to provide enriched educational environment for young children to help mitigate the effects of the emergency.
- 6) In early February 2016, federal partners, GHS, and the CHECC behavioral health team established the Flint Community Resilience Group (FCRG) to plan and mount a robust and coordinated behavioral health response, inclusive of the whole community. The first full meeting of the FCRG was held on February 2, 2016 and attended by 150 community partners. One of the first priorities identified by the FCRG was to ensure the health and behavioral health services being initiated would meet the emerging needs in Flint. After examining several needs assessment methods, the FCRG requested the CASPER.

On March 31, 2016, the FCRG, Mental Health Workgroup, Data & Gap Analysis Sub-Workgroup, comprised of members from MDHHS, Genesee County Health Department, GHS, and the

University of Michigan–Flint, contacted Centers for Disease Control and Prevention (CDC) to discuss the use of a CASPER to investigate behavioral health effects from the FWC. A formal request for assistance for a Community Assessment for Public Health Emergency Response (CASPER) in the City of Flint, Michigan came from the MDHHS on April 6, 2016. On May 16, 2016, EIS Officers Gamola Fortenberry and Alice Wang, and CDC staff Sherry Burrer and Amy Schnall departed for Flint, Michigan. They provided technical assistance to the FCRG members in conducting a CASPER.

CASPER is an epidemiologic technique designed to provide household-based information about a community's needs in a timely, inexpensive, and representative manner (2). This information can be used to initiate public health action, facilitate disaster planning, and assess new or changing needs during the recovery period (6). The goals of this CASPER were to assess the following: 1) household-level, self-reported behavioral health concerns for adults (21 years and older) and children (under 21) and individual-level, self-reported behavioral health concerns; 2) household access to behavioral health services and perceived barriers to access; 3) self-reported physical health concerns; 4) water-related resource needs and barriers to resources; and 5) communication with the affected community, including receipt of FWC information, primary communication methods, trusted sources, and understanding of English.

Materials and Methods

The FCRG Data & Gap Analysis Sub-Workgroup, with technical assistance from CDC, conducted a CASPER in Flint, Michigan on May 17–19, 2016. The FCRG Data & Gap Analysis Sub-Workgroup, with consultation from CDC and other stakeholders, developed a two-page questionnaire (Appendix A). The questionnaire included questions on household demographics; communications; water sources and uses; household behavioral health concerns by Medicare healthcare coverage defined age categories; household access and perceived barriers to behavioral health services; health care

professional diagnosed chronic disease; self-reported physical health concerns worsened by the FWC; and individual behavioral health concerns. MDHHS Institutional Review Board determined that this CASPER was not research; therefore, it was exempt from human subjects review.

A two-stage cluster sampling methodology was used to select a representative sample of households to be interviewed within the sampling frame (7). The sampling frame was defined as the geographic city limits of Flint, Michigan (Appendix B), with a total of 24,983 housing units based on updated housing data provided by the Flint City Planning and Development Office including households regularly serviced by the municipal water supply system. First, 30 blocks (clusters) were selected with a probability proportional to the number of housing units within the clusters from the predefined sampling frame (Appendix B) using the Geographic Information Systems CASPER tool. Second, interview teams used systematic random sampling to select seven households from each of the 30 selected clusters, for a goal of 210 total interviews (30 clusters of 7 households each). Two-person interview teams were assigned to two or three clusters, provided with detailed maps of their clusters, and instructed to go to every n^{th} household (where “n” is the total number of housing units in the cluster divided by seven) to select the seven households per cluster to interview. Teams made three attempts at each selected household before replacement of a household.

On Tuesday, May 17, 2016, CDC provided the interview teams with a three-hour just-in-time training on the overall purpose of CASPER, household selection methods, questionnaire content, interview techniques, safety, and logistics. There were a total of 11 teams on the first interview day, 12 on the second interview day, and 4 on the third interview day. All interview teams had at least one person with public health and survey administration experience, and one person from the community. Teams conducted interviews between 2:00 pm and 7:30 pm Eastern Standard Time. All potential respondents approached were given a copy of the consent sheet containing contact telephone numbers for Genesee Health System. Teams also provided public health informational materials regarding the

FWC (Appendix C), a rubber jar gripper, water bottle, stress ball, pen, pencil, and baby wipes to all potential respondents and interested persons. Eligible respondents were 18 years of age or older and resided in the selected household. At the completion of the interview, respondents were given a pre-stamped postcard to receive a \$30 gift card to the Flint Farmers' Market. Additionally, the interviewers were instructed to complete confidential referral forms whenever they encountered urgent physical or behavioral health needs.

We conducted weighted cluster analysis to report the projected number and percent of households with a particular response in the sampling frame. Two weighting variables were calculated: one to account for the probability that the responding household was selected and one to account for the probability that the individual respondent within the household was selected. We weighted results appropriately based on whether the question referred to the individual or to the household. Data analysis was conducted in Statistical Analysis Software (SAS; version 9.3; SAS Institute Inc., Cary, NC) to calculate the unweighted frequencies, unweighted percentages, weighted frequencies, and weighted percentages with 95% confidence intervals. For all results, unless otherwise stated, the percentages in the text represent weighted percentages.

Several questions regarding behavioral health were used from the national Behavioral Risk Factor Surveillance System (BRFSS) and administered at an individual level to respondents who were aged 18 years or older, present at the time that the household-level interview was conducted, and had an upcoming birthday nearest to the date of interview. We compared quality of life questions to the identical question in the 2014 BRFSS in Michigan. We took the depressive symptom questions from the Patient Health Questionnaire-2 (PHQ-2) module in BRFSS and the anxiety questions from the Generalized Anxiety Disorder-2 (GAD-2) module in a hospital-based Patient Health Questionnaire study. Responses for the PHQ-2 and GAD-2 are scored from zero (not at all) to 3 (nearly every day), and a combined score is calculated by adding the scores from the two questions within each module.

Total PHQ-2 scores of ≥ 3 have a sensitivity of approximately 80% and a specificity of approximately 90% for major depressive disorder (8); total GAD-2 scores of ≥ 3 have a sensitivity of 86% and a specificity of 83% for generalized anxiety disorder, and a sensitivity of 65% and a specificity of 88% for any anxiety disorder (9). It has been a decade since the PHQ-2 depressive symptom questions have been asked as part of a BRFSS optional module in Michigan; we chose not to compare the PHQ-2 depressive symptom questions data collected as part of this CASPER to BRFSS data collected 10 years ago. The GAD-2 is not currently available in the BRFSS questionnaire, neither the core section nor the optional modules; therefore, it has no population-based data available for comparison.

Results

Response Rates and Demographics

The interview teams conducted 182 interviews on May 17–19, 2016, for a completion rate of 86.7% (Table 1). Teams completed interviews in 42.8% of the houses approached. However, excluding vacancies (i.e., vacant lots and vacant homes), the contact rate was 52.8%. Of the households with an eligible participant answering the door, 75.2% completed an interview. Table 2 shows the frequency and weighted percentage of household demographics. Of the households, 93.4% lived in a single family home and 66.2% owned their residence. The majority of households (88.3%) had one or more members aged 21–64 years, 20.4% of households had one or more children aged five years or younger, and 25.2% of households had one or more members aged 65 years or older. Of the households, 4.5% had at least one pregnant woman living in the home at the time of the interview. The average number of household members is 3, with a minimum of 1 and maximum of 10 people living in a household.

For questions asked at the individual level, 182 individuals were interviewed. The majority of respondents identified as black (57.7%) or white (42.9%), and non-Hispanic (97.6%) (Table 3). The majority of individuals (79.5%) had lived in the community for greater than 12 years. The mean age of

respondents was 49.4 years and 69.0% of respondents were female.

Household Self-Reported Behavioral Health Concerns

Of all households, 65.6% (95% CI [57.8, 73.5]) reported that one or more household members aged 21 years or older had at least one behavioral health concern more than usual since October 2015; 44.9% of these households perceived a need for behavioral health services. Among households with members aged 21 years or older, many reported these members experiencing the following more than usual: anxiety/stress (49.1%), problems sleeping (47.3%), depressed mood (42.6%), and trouble concentrating (33.9%) (Table 4). Of these households with at least one household member under 21 years, 54.3% (95% CI [40.4, 68.2]) reported that one or more household members aged less than 21 years had at least one behavioral health concern more than usual since October 2015; 51.7% of these households perceived a need for behavioral health services. Among households with members of this age range, many reported these members experiencing the following more than usual: problems sleeping (39.0%), aggressiveness (38.4%), trouble concentrating (37.5%), and anxiety or stress (35.3%) (Table 5). The majority of households did not report increased use of substances (i.e., nicotine, alcohol, illicit drugs, or off label use of prescription or over-the-counter drugs) since October 2015. However, households reported at least one member increasing the use of nicotine products (e.g., cigarettes, e-cigarettes, chewing tobacco) (23.7%), alcohol (13.6%), marijuana (10.1%), prescription or over-the-counter drugs used not as directed or not their own (4.3%), and other illicit drugs (1.1%) (Table 6).

Since April 2014, 26.4% of households reported *a lot* of stress related to compromised health while 37.6% of households reported no stress related to compromised health due to FWC (Table 7). Half (50.0%) of households reported *a lot* of stress related to feeling overlooked by decision-makers and also feeling that the FWC will never be fixed. Many households (41.2%) experienced *a lot* of fear due to the FWC in regard to drinking or cooking with filtered tap water while 57.9% experienced *a lot* of fear drinking or cooking with unfiltered tap water (Table 8). Also, 22.6% of household felt *some* fear of

drinking or cooking with bottled water. The majority of households felt *a lot* of fear in bathing (55.2%) and brushing their teeth (55.1%) with unfiltered tap water (Table 8).

Individual Self-Reported Behavioral Health Concerns

Twenty-nine percent of individuals self-reported depressive symptoms and 33.7% self-reported symptoms of anxiety (Table 9). While 43.2% *never or rarely* worried or stressed about paying their rent or mortgage, 22.6% reported being *always or usually* stressed or worried. In regards to buying nutritious meals, 49.7% were *never or rarely* worried or stressed; however, 25.4% reported being *always or usually* stressed or worried (Table 9). Approximately 37.0% of individuals living in the City of Flint reported having a physical illness and/or injury for 14 or more days within the last 30 days, compared to 12.6% of 2014 Michigan BRFSS respondents representing the total population of Michigan (Table 10). In the City of Flint, 38.0% of individuals reported having poor mental health (e.g., stress, depression, and emotional problems) for 14 or more days within the last 30 days, compared to 12.9% for the total population of Michigan as reported in the 2014 Michigan BRFSS. In the City of Flint, 29.1% of individuals reported that poor physical and mental health limited their usual activities (e.g., self-care, work, or recreation) for 14 or more days within the last 30 days, compared to 8.7% for the total Michigan population as reported in the 2014 Michigan BRFSS (Table 10).

Household Access to Behavioral Health Services and Perceived Barriers to Access

Of those households with at least one member aged 21 years or older, 54.2% had members who felt they did not need help, while 44.9% of members felt that they needed help with 21.6% of those members seeking out help for behavioral health concerns from a counselor, pastor/clergy member, therapist, or case/social worker (Table 4). Of the households with at least one household member under age 21 years, 48.3% had members who felt they did not need help, while 51.7% of members felt that they needed help. Of those households that needed behavioral health services for members aged less than 21 years, 28.4% sought help from a counselor, pastor/clergy member, therapist, or case/social

worker (Table 5). Regardless of age, among the 22.5% (95% CI [15.5, 29.5]) of households reporting difficulties seeking help, 47.3% had a hard time trusting in the healthcare system or health care providers, 29.7% thought services were too expensive, 25.9% had no transportation, 13.4% were disabled or homebound, 13.1% worried about what others would think, and 11.5% lacked health insurance (Table 11).

Self-Reported Physical Health Concerns

When household respondents were asked if they or a member of their household had ever been told by a healthcare professional that they had a selected list of chronic diseases, 38.6% reported hypertension or heart disease; 32.3% reported physical disability, 31.7% reported asthma, chronic obstructive pulmonary disease, or emphysema; and 31.7% reported diabetes (Table 12). Approximately half (50.5%) of households reported worsened physical health of one or more members of a household due to the FWC (Table 13). Among those households, the top physical health effects reported via open-ended responses included: skin rash or irritation (49.6%), hair loss (9.4%), and muscle aches or pain (4.9%) (Table 13).

Water-Related Resource Needs and Barriers to Resources

Table 14 and Figure 1 show the frequency and weighted percentage of household responses related to household water source for drinking and cooking. Before April 2014 (before the City of Flint, Michigan changed their municipal water supply source from the Detroit-supplied Lake Huron water to the Flint River), the top three household sources of water for cooking and drinking were unfiltered tap water (78.2%), bottled water from the store (29.6%), and filtered tap water (7.5%). Between April 2014 and October 2015 (after the City of Flint, Michigan changed their municipal water supply source, but before residents of Flint, Michigan were advised not to drink the municipal water), the top three household sources of water for cooking and drinking were unfiltered tap water (59.3%), bottled water from store (49.7%), and filtered tap water (12.3%). Though advised not to consume unfiltered municipal

tap water since October 1, 2015, of those households reporting unfiltered tap water use, 15.0% of households reported use of unfiltered tap water for drinking and 20.2% of households reported use for cooking after that time (Table 15). Also, since October 2015, the majority of households (82.7%) have not faced barriers in obtaining bottled water, filtered water or well water (Table 16). Of the 16.9% of households that faced barriers, the top three barriers reported were no transportation (62.3%), distribution sites do not give out enough water (39.5%), and being disabled or homebound (25.4%).

In May 2016 (at the time of interview), the top three household sources of water for cooking and drinking were bottled water from distribution sites (75.0%), bottled water from the store (51.6%), and filtered tap water (41.1%) (Table 14, Figure 1). If using water filters for drinking and cooking, 91.4% of household respondents reported having filters on the kitchen faucet, and 12.6% on the bathroom sink (Table 17). When asked about specific behavioral changes, the majority of households interviewed reported changing their behavior; 78.2% of households reduced water usage, 67.0% decreasing duration of bathing/showering, 58.9% decreasing frequency of bathing/showering, and 58.1% changing bathing/shower methods altogether (Table 18).

Communication with the Affected Community

The main types of information received by households interviewed regarding the FWC included the following: lead in Flint water (92.0%), bottled water/filter distribution (89.7%), water filter use instructions (80.0%), water testing resources (78.7%), and nutrition (57.1%) (Table 19). The main sources of this information were television (76.6%), neighbor/friend/family (32.5%), social media (27.1%), radio (24.1%), newspaper (20.7%), and publically available information fliers (21.5%) (Table 20). The main most trusted household sources of information about the FWC were news media (26.4%), Genesee County Health Department (9.3%), health professionals (8.6%), faith-based organizations (6.4%) and social media (5.1%) (Table 21). However, many respondents chose “Other” as their most trusted source of information (24.9%). Of those reporting “Other”, their open-ended responses included

trusted self/did not trust anyone (31.1%), did not trust any of the listed sources (26.9%), and no trust in government (9.9%). According to respondents, in 96.9% of households all members understood English (Table 22).

Greatest Need for Households

When asked about the current greatest household need, the top three open-ended responses were related to financial concerns (33.6%), safe water (27.5%), and plumbing/repair (14.7%) (Table 23). Of those expressing financial concerns, 18.9% reported paying for utilities being of greatest concern.

Referral Needs

Interview teams submitted 8 referrals for additional needs or services directly to the local GHS lead for the CASPER. Needs or services were categorized as the following: basic needs (i.e., food, water and finances) (n=2), filter needs (n=2), furniture (n=2), lead resources (n=1), job placement (n=1), and water delivery (n=1). Participants requesting services were referred to the GHS customer services, GHS targeted case management, Flint Cares, and Michigan-211.

Discussion

These results represent the community responses captured via the CASPER surveys conducted in Flint, Michigan during the recovery phase of the FWC. Six topic areas formed the basis of this CASPER: 1) demographics, 2) self-reported household physical health and behavioral health concerns for adults (21 years and older) and children (under 21 years) related to the FWC, 3) self-reported individual behavioral health concerns, 4) water sources and use, 5) difficulties obtaining water and water-related resources, and 6) communications.

Demographics of the sampling frame (i.e., the geographic city limits of Flint, Michigan) were similar to the most recent U.S. Census estimates, except for the frequency of female respondents (69.0%) (10). According to the U.S. Census estimates for 2010, female persons represent 52.0% of the

Flint, Michigan population, which suggests that an oversampling of females occurred and the sample of interviewed individuals may not be representative of the sampling frame. However, the City of Flint population has steadily declined in recent years, which may have changed the demographic makeup (10).

The majority of households had one or more of their members self-report worsening of their physical health because of the FWC; skin rashes or irritations were the most cited physical health effect. However, the association between lead exposure and skin rash or irritation is unclear, and MDHHS and CDC are investigating these self-reported symptoms. Health effects such as fatigue, nausea, forgetfulness, and muscle ache or pain were reported by households; these symptoms have previously been associated with lead exposure (2). Some households also reported physical injury, including muscle aches or joint pain, due to the repetitive motion of opening many bottles of water or lifting heavy cases of water. This was typically noted in the households with elderly members.

At the household level, 51.7% of households perceived a need for behavioral health services for one or more members younger than aged 21 years and 44.9% perceived a need for members aged 21 years or older. This need for services is supported at the individual level, including an increase in prevalence of negative quality of life indicators. An increased prevalence of individuals had 14 or more days of poor physical health days, poor mental health days, or limited activity days within the past 30 days compared to the reported prevalence for the state of Michigan in the 2014 BRFSS (11). In this survey, respondents reported almost three times more physical and behavioral health concerns than reported by the state of Michigan BRFSS. The percent of individuals reporting symptoms of depression and anxiety is comparable or higher, respectively, than results from the 2010 Alabama Gulf Spill CASPER (12). Due to the increased prevalence of negative quality of life indicators, depressive symptoms, and symptoms of anxiety, additional recovery resources might be considered for behavioral health intervention and follow-up surveillance of behavior health concerns. Because almost one-fourth

of households and individuals indicated worry or stress about finances, the economic cost of access to behavioral health services might also be considered.

Of the households reporting use of unfiltered tap water after October 2015, 20.2% were still using unfiltered tap water for cooking and 15.0% were still using it for drinking despite the public health emergency declaration that advised residents of Flint not to drink the municipal water unless it had been filtered. Though household respondents were not directly asked why they were still using the unfiltered tap water, it is possible that they were experiencing one or more barriers to acquiring water other than unfiltered tap. Of those who had difficulty obtaining water other than unfiltered Flint municipal tap water, 62.3% did not have transportation and 25.4% were disabled or homebound. Despite efforts to establish distribution sites around the city and visiting homes to distribute bottled water, from these results, it is possible that certain less mobile household members were not reached; therefore, a focus on less mobile populations is important. It could also be possible that there was minimized concern in the community despite restrictions in municipal water consumption. Perceived risks of drinking tap water might be low in areas where there are usually reliable water supplies (13). As of May 2016 when the CASPER was conducted, residents of Flint had been advised since October 2015 not to drink unfiltered municipal tap water, and households were relying mostly on bottled water for drinking and cooking (14). Yet more than two thirds of households have at least one member who feels *some* or *a lot* of fear using filtered tap water for drinking or cooking, and some households reported fear in using bottled water for drinking or cooking. This may be due to continued distrust, stress, and anxiety that households are reporting since the FWC took place. Encouraging the community to use filtered tap water is important in decreasing dependence on bottled water in order to return to normalcy. Additional reasons for encouraging use of filtered tap water use are: to decrease physical health complaints surrounding opening water bottles and lifting heavy water cases, environmental reasons regarding increasing plastic

waste, and economic sustainability. In addition, fear and mistrust needs to be acknowledged in messaging.

The main household source of information about the FWC was television, which is consistent with a disaster or emergency that does not affect communication infrastructure. Gaining information from neighbors, friends, or family was another common source of information. Similarly, media and family/friends are typical sources of information about tap water reported when considering factors that influence public perception on drinking water quality (13). Additionally, common information sources during the FWC may reflect the community's lack of trust with officials and reliance on themselves for information. The most trusted source of information about the FWC was the news media (26.4%). Of those who responded "Other" for trusted information resource, more than half (58.0%) of household respondents reported in open-ended responses, trusting no one, only trusting themselves, or trusting none of the listed sources. This percentage of distrust maybe be underestimated because the data were gathered for "Other" using an open-ended format. Half of households had one or more members who experienced a lot of stress because they felt overlooked by decision-makers and fear that the FWC would never be fixed. Because households commonly use family and friends as a source of information and the most trusted sources of information include local people and organizations (Genesee County Health Department, health professionals, and faith-based organizations), increased community involvement and engagement in the recovery phase of the FWC could assist in communicating information in the City of Flint.

Conclusions

This CASPER was an initial step in assessing behavioral health needs of the community of Flint, Michigan and establishing a baseline on 1) demographics, 2) self-reported household physical health and behavioral health concerns for adults (21 years and older) and children (under 21 years) related to the

FWC, 3) self-reported individual behavioral health concerns, 4) water sources and use, 5) difficulties obtaining water and water-related resources, and 6) communications.

Based on the results of this CASPER, FCRG could consider the following to guide the ongoing recovery efforts in the City of Flint: focus resources on behavioral health interventions and follow-up surveillance, repeat the CASPER in one year to follow-up on behavioral health concerns, consider the impact of economic factors when implementing behavioral health interventions, decrease dependence on bottled water by encouraging filtered tap water use, focus on less mobile populations in terms of water and filter distribution, and increase community involvement and engagement in the recovery phase of the FWC to assist with disseminating information on the FWC in City of Flint.

References

1. Dixon, Jennifer. Detroit Free Press. *How Flint's water crisis unfolded*. [Online] Detroit Free Press. <http://www.freep.com/pages/interactives/flint-water-crisis-timeline/>
2. Agency for Toxic Substances & Disease Registry (ATSDR). *Lead Toxicity: What are the physiologic effects of lead exposure?* [Online] August 20, 2007. [Cited: May 25, 2016.] <http://www.atsdr.cdc.gov/csem/csem.asp?csem=7>.
3. Murata K, Iwata T, Dakeishi M, Karita K. *Lead Toxicity: Does the Critical Level of Lead Resulting in Adverse Effects Differ between Adults and Children?* J Occup Health, 2009, Vol. 51, pp. 1-12.
4. Hanna-Attisha M, LaChance J, Sadler RC, Schnepf AC. *Elevated Blood Lead Levels in Children Associated With the Flint Drinking Water Crisis: A Spatial Analysis of Risk and Public Health Response*. American Journal of Public Health, 2016, 106 (2).
5. Genesee County Board of Commissioners. *Public Health Emergency Declaration for People Using the Flint City Water Supply with the Flint River as the Source*. [Online] http://www.gc4me.com/docs/public_health_emergency_announcement_10_1_15.pdf.
6. Malilay J, Flanders WD, Brogan D. *A modified cluster-sampling method for post-disaster rapid assessment of needs*. Bulletin of the World Health Organization, 1996, 74 (4): 399-405.
7. Centers for Disease Control and Prevention (CDC). *Community Assessment for Public Health Emergency Response (CASPER) Toolkit: Second edition*. Atlanta, Georgia: CDC, 2012.
8. Kroenke K, Spitzer RL, Williams JB. *The Patient Health Questionnaire-2: validity of a two-item depression screener*. Med Care. 2003 Nov; 41 (11): 1284-92.
9. Kroenke K, Spitzer RL, Williams JB, et al. *Anxiety disorders in primary care: prevalence, impairment, comorbidity, and detection*. Ann Intern Med, 2007; 146: 317-25.

10. United States Census Bureau. *Flint City, Michigan Quick Facts from the US Census Bureau*. [Online] 2016. [Cited: June 3, 2016.]
<http://www.census.gov/quickfacts/table/PST045215/2629000,00#flag-js-X>.
11. Michigan Department of Health and Human Services (MDHHS). Statistics, Division of Vital Records & Health. *Deaths and Crude Death Rates for the Ten Leading Causes of Death, Michigan 2013 and United States Residents*. [Online] 2012.
http://www.michigan.gov/documents/mdch/2014_MiBRFS_EP_Region_Tables_FINAL_500162_7.pdf
12. Centers for Disease Control and Prevention (CDC). *Community Assessment for Public Health Emergency Response (CASPER) after the Gulf Coast Oil Spill: Alabama, 2010*. [Online]
https://www.adph.org/CEP/assets/CASPER_report.pdf.
13. Doria, M. de Franca. *Factors influencing public perception of drinking water quality*. *Water Policy*, 2010; Vol. 12: 1-19.
14. United States Environmental Protection Agency (USEPA). *Flint Drinking Water Response*. [Online] 2016. <https://www.epa.gov/flint>

Table 1. Questionnaire response rates for the 2016 Flint CASPER

Questionnaire response	Percent	Rate	Description
Completion¹	86.7	$\frac{182}{210}$	$\frac{\textit{Total completed}}{210}$
Contact²	42.8	$\frac{182}{425}$	$\frac{\textit{Total completed}}{\textit{Total selected}}$
Contact (excluding vacancies)²	52.8	$\frac{182}{345}$	$\frac{\textit{Total completed}}{\textit{Total selected} - \textit{vacancies}}$
Cooperation³	75.2	$\frac{182}{242}$	$\frac{\textit{Total completed}}{\textit{Total contact made}}$

¹ Percent of surveys completed in relation to the goal of 210

² Percent of households randomly selected and completing an interview, vacancies (i.e., vacant lots and vacant houses) were marked by interview teams

³ Percent of contacted households that were eligible and willing to participate in the survey

Table 2. Household (HH) demographic

	Frequency	% of HH	Projected HH	Weighted %	Weighted 95% CI
Type of structure (n=182)					
Single family	168	92.3	23327	93.4	87.0–99.7
Multiple unit	11	6.0	1299	5.2	0.0–11.3
Mobile home	1	0.5	119	0.5	0.0–1.5
Other ¹	2	1.1	238	1.0	0.0–2.9
Ownership of residence (n=182)					
Own	120	65.9	16536	66.2	59.8–72.6
Rent	60	33.0	8224	32.9	26.8–39.0
Other ²	2	1.1	223	0.9	0.0–2.2
Number (%) of households with members in each age category (n=182)					
≤5 years old	37	20.3	5090	20.4	13.1–27.6
6-17 years old	55	30.2	7501	30.0	24.1–36.0
18-20 years old	19	10.4	2622	10.5	5.2–15.8
21-64 years old	161	88.5	22071	88.3	83.9–92.7
≥65 years old	44	24.2	6297	25.2	17.5–32.9
Household pregnant (n=182)					
Yes	8	4.4	1136	4.5	1.6–7.5
No	174	95.6	23847	95.5	92.5–98.4
Number of people living in household					
	mean	median	min	max	95% CI
Weighted	3.0	2.2	1	10	2.7–3.3

¹ Other types of structures mentioned included: townhouses (n=2)

² Other ownership of residence mentioned included: Son owns the property, land contract

Table 3. Individual Demographics

	Frequency	Weighted %	Weighted 95% CI		
Sex (n=182)					
Male	60	31.0	23.6–38.5		
Female	122	69.0	61.5–76.4		
Time lived in City of Flint (n=182)					
≤ 2 years	14	6.5	2.8–10.2		
>2–7 years	13	8.3	3.6–12.9		
8–12 years	7	5.8	0.3–11.3		
>12 years	148	79.5	72.3–86.7		
Race (n=172)¹					
Black or African American	99	57.7	42.1–73.3		
White	75	42.9	27.3–58.4		
American Indian/Alaska Native	5	1.8	0.0–3.7		
Asian	1	0.2	0.0–0.7		
Native Hawaiian or Other Pacific Islander	0	0.0	---		
Hispanic or Latino (n=182)					
Yes	5	2.4	0.0–4.8		
No	177	97.6	95.2–100.0		
Age of individual respondents					
	mean	median	min	max	95% CI (mean)
Weighted age statistics	49.4	51.0	18	90	46.8–52.0

¹ Multiple responses could be selected; some responses were missing (n = 1) or respondents refused (n = 9)

Table 4. Household self-reported behavioral health concerns for members aged 21 years or older

	Frequency	% of HH	Projected HH	Weighted %	Weighted 95% CI
Behavioral Health: 21 years and older (n=179)¹					
Anxiety/stress	90	50.3	12092	49.1	41.8–56.5
Problems sleeping	87	48.6	11644	47.3	39.1–55.5
Depressed mood	77	43.0	10473	42.6	33.4–51.7
Trouble concentrating	64	35.8	8336	33.9	25.8–42.0
Emotional outbursts	58	32.4	7956	32.3	23.6–41.1
Aggressiveness	55	30.7	7254	29.5	21.2–37.8
Decreased appetite	55	30.7	7073	28.7	20.7–36.8
None	58	32.4	8095	32.9	25.2–40.6
Sought help (n=174)²					
Yes	40	23.0	5122	21.6	15.7–27.4
No, but needed help	40	23.0	5544	23.3	15.7–31.0
No, did not need help	93	53.4	12884	54.2	46.3–62.2

¹ Multiple responses could be selected; Not applicable (n=3); Don't know (n=3)

² Not applicable (n=8); Don't know (n=1)

Table 5. Household self-reported behavioral health concerns for members aged less than 21 years

	Frequency	% of HH	Projected HH	Weighted %	Weighted 95% CI
Behavioral Health: Under 21 years (n=81)¹					
Problems sleeping	31	38.3	4285	39.0	26.5–51.4
Aggressiveness	30	37.0	4222	38.4	26.2–50.5
Trouble concentrating	30	37.0	4119	37.5	23.8–51.1
Anxiety/stress	29	35.8	3883	35.3	22.1–48.5
Problems in school	24	29.6	3347	30.4	19.1–41.8
Depressed mood	24	29.6	3236	29.4	17.5–41.3
Emotional outbursts	24	29.6	3152	28.7	17.4–39.9
Decreased appetite	19	23.5	2598	23.6	13.4–33.8
None	37	45.7	4963	45.1	31.0–59.2
Sought help (n=81)²					
Yes	22	27.2	3134	28.4	16.5–40.4
No, but needed help	19	23.5	2572	23.3	11.1–35.6
No, did not need help	40	49.4	5321	48.3	35.1–61.4

¹ Multiple responses could be selected; Not applicable (n=100); Don't know (n=1)

² Not applicable (n=101)

Table 6. Household increased use of substances since October 2015

	Frequency	% of HH	Projected HH	Weighted %	Weighted 95% CI
Nicotine (n=178) ¹	45	25.3	5810	23.7	16.9–30.5
Alcohol (n=175) ²	26	14.9	3259	13.6	9.1–18.1
Marijuana (n=174) ³	19	10.9	2429	10.1	5.1–15.2
Other illicit drugs (n=172) ⁴	2	1.2	258	1.1	0.0–2.6
Prescription or OTC drugs not as directed or not your own (n=171) ⁵	8	4.7	999	4.3	1.5–7.0

¹ Nicotine products including: cigarettes, e-cigarettes, and chewing tobacco; Missing (n=4); Refused (n=2)

² Missing (n=7); Refused (n=1)

³ Missing (n=8); Don't know (n=8); Refused (n=2)

⁴ Missing (n=10); Don't know (n=3); Refused (n=1)

⁵ Missing (n=11); Refused (n=2)

Table 7. Household stress due to the Flint water crisis

	Frequency	% of HH	Projected HH	Weighted %	Weighted 95% CI
Compromised health (n=181)¹					
None	66	36.5	9347	37.6	30.7–44.5
Some	58	32.0	8009	32.2	27.6–36.9
A lot	50	27.6	6555	26.4	19.2–33.5
Financial worries (n=181)²					
None	79	43.6	10983	44.2	36.0–52.4
Some	37	20.4	5321	21.4	14.7–28.1
A lot	62	34.3	8179	32.9	25.4–40.4
Added stressors to daily routine (n=182)³					
None	55	30.2	7498	30.0	23.1–36.9
Some	52	28.6	7450	29.8	23.3–36.4
A lot	73	40.1	9792	39.2	32.0–46.4
Feeling overlooked by decision makers (n=180)⁴					
None	46	25.6	6461	26.1	18.1–34.1
Some	38	21.1	5411	21.9	14.1–29.6
A lot	92	51.1	12387	50.0	41.8–58.3
Feeling that crisis will never be fixed (n=181)⁵					
None	36	19.9	5272	21.2	15.7–26.7
Some	46	25.4	6197	24.9	18.6–31.3
A lot	92	50.8	12444	50.0	42.7–57.4

¹ Missing (n=1); Don't know (n=6); Refused (n=1)

² Missing (n=1); Don't know (n=2); Refused (n=1)

³ Don't know (n=1); Refused (n=1)

⁴ Missing (n=2); Don't know (n=3); Refused (n=1)

⁵ Missing (n=1); Don't know (n=6); Refused (n=1)

Table 8. Household fear due to the Flint water crisis

	Frequency	% of HH	Projected HH	Weighted %	Weighted 95% CI
Drinking/cooking with filtered tap (n=182)¹					
None	53	29.1	7862	31.5	25.0–38.0
Some	50	27.5	6574	26.3	20.6–32.0
A lot	77	42.3	10304	41.2	33.7–48.8
Drinking/cooking with bottled water (n=182)²					
None	118	64.8	16393	65.6	57.6–73.6
Some	42	23.1	5650	22.6	15.4–29.8
A lot	21	11.5	2836	11.4	6.7–16.0
Drinking/cooking with unfiltered tap (n=182)³					
None	39	21.4	5363	21.5	15.0–27.9
Some	34	18.7	4854	19.4	12.9–25.9
A lot	107	58.8	14453	57.9	50.6–65.1
Bathing w/unfiltered tap (n=182)⁴					
None	39	21.4	5786	23.2	15.9–30.4
Some	40	22.0	5023	20.1	13.9–26.3
A lot	100	54.9	13784	55.2	47.9–62.4
Brushing teeth w/unfiltered tap (n=181)⁵					
None	44	24.3	6778	27.2	18.8–35.7
Some	34	18.8	4168	16.8	11.1–22.4
A lot	101	55.8	13710	55.1	48.6–61.6

¹ Don't know (n=2)² Don't know (n=1)³ Don't know (n=2)⁴ Don't know (n=3)⁵ Missing (n=1); Don't know (n=2)

Table 9. Self-reported individual behavioral health concerns

	Frequency	Weighted %	Weighted 95% CI
Depression (n=182)			
Yes	57	29.6	21.2–38.0
No	125	70.4	62.0–78.8
Anxiety (n=182)			
Yes	62	33.7	25.5–41.8
No	120	66.3	58.2–74.5
Worried or stressed about paying rent/mortgage (n=179)¹			
Never/Rarely	87	43.2	34.3–52.2
Sometimes	52	34.1	25.7–42.5
Always/Usually	40	22.6	14.7–30.6
Worried or stressed about buying nutritious meals (n=180)²			
Never/Rarely	96	49.7	39.1–60.3
Sometimes	40	24.9	16.9–32.9
Always/Usually	44	25.4	15.7–35.2

¹ Missing (n=3)

² Missing (n=2)

Table 10. Self-reported individual behavioral health concerns of respondents and 2014 Michigan Behavioral Risk Factor Surveillance System (BRFSS) comparison

	Frequency	Weighted %	Weighted 95% CI	Michigan BRFSS 2014 Weighted % (95% CI) ¹
Physical illness and injury during the past 30 days (n=178)²				
≤13 days	113	63.0	52.5–73.4	---
≥14 days	65	37.0	26.6–47.5	12.6 (11.8-13.6)
Poor mental health during the past 30 days (n=176)³				
≤13 days	111	62.0	55.6–68.4	---
≥14 days	65	38.0	31.6–44.4	12.9 (11.9-14.0)
Interruption of normal activities during the past 30 days (n=180)⁴				
≤13 days	128	70.9	62.7–79.2	---
≥14 days	52	29.1	20.8–37.3	8.7 (8.0-9.6)

¹ BRFSS asked respondents if experienced health indicator “on at least 14 days in the past month”

²Missing (n=4)

³ Missing (n=6)

⁴ Missing (n=2)

Table 11. Household difficulties in seeking services for behavioral health concerns

	Frequency	% of HH	Projected HH	Weighted %	Weighted 95% CI
Difficulties in seeking help (n=43)¹					
Hard time trusting in providers	20	46.5	2754	47.3	29.7–64.9
Too expensive	12	27.9	1728	29.7	16.7–42.6
No transportation	12	27.9	1507	25.9	12.5–39.3
Disabled/homebound	5	11.6	778	13.4	0.0–29.0
Worried what others will think	6	14.0	761	13.1	0.7–25.5
No health insurance	5	11.6	669	11.5	1.2–21.7
Goes against beliefs	3	7.0	357	6.1	0.0–13.0
Not aware of resources	2	4.3	238	3.9	0.0–9.5
No child care	1	2.3	119	2.0	0.0–6.3
Language barriers	1	2.3	119	2.0	0.0–6.1
Other ²	3	7.0	357	6.1	0.0–13.0

¹ 139 of respondents either had no difficulties seeking help (n=115) or no need for services (n=24); Missing (n=3)

² Multiple responses could be selected; Other difficulties included: need to hire advocate for children, provider believes no problems and denied care, refused help

Table 12. Household chronic health conditions diagnosed by a healthcare professional

	Frequency	% of HH	Projected HH	Weighted %	Weighted 95% CI
Asthma/COPD/Emphysema (n=182) ¹	58	31.9	7921	31.7	23.5–39.9
Diabetes (n=182) ²	55	30.2	7913	31.7	25.3–38.1
Developmental Disability (n=181) ³	18	9.9	2427	9.8	5.0–14.5
Hypertension/Heart Disease (n=182) ⁴	66	36.3	9643	38.6	28.7–48.5
Physical Disability (n=182)	59	32.4	8062	32.3	24.5–40.0
Psychosocial/Mental Illness (n=181) ⁵	36	19.9	4673	18.8	12.5–25.1

¹ Don't know (n=2)

² Don't know (n=2)

³ Missing (n=1); Don't know (n=4)

⁴ Don't know (n=3)

⁵ Missing (n=1); Don't know (n=2), Refused (n=2)

Table 13. Self-reported worsening of physical health due to the Flint water crisis reported by one or more household members

	Frequency	% of HH	Projected HH	Weighted %	Weighted 95% CI
Physical Health Worsened by FWC (n=182)¹					
Yes	93	51.1	12613	50.5	43.4–57.5
No	69	37.9	9446	37.8	29.7–45.9
Specified Health Effects (n=93)²					
Skin rash/irritation	46	49.5	6256	49.6	37.9-61.3
Hair loss	9	9.7	1185	9.4	1.8-17.0
Muscle aches/pain	4	4.3	619	4.9	0.0-13.1
Fatigue	4	4.3	481	3.8	0.1-7.5
Other ³	41	44.1	5437	43.1	30.4-55.8

¹ Don't know (n=20)

² Categorized open-ended responses; Multiple responses could be selected

³ Other includes: low immune system, Crohn's Disease, lupus flare up, mental illness, nausea, forgetfulness, weight, cancer, Kawasaki disease, Scarlet Fever, liver enzymes up, nodules on thyroid

Table 14. Household water sources for drinking and cooking in Flint, Michigan

	Frequency	% of HH	Projected HH	Weighted %	Weighted 95% CI
Water sources before April 2014 (n=182)					
Unfiltered tap water	144	79.1	19548	78.2	71.7– 84.8
Bottled water from store	52	28.6	7407	29.6	21.1–38.2
Filtered tap water	12	6.6	1867	7.5	3.3– 11.6
Well water	0	0.0	0	0.0	---
Other ¹	7	3.8	913	3.7	1.1– 6.2
Water sources between April 2014 and October 2015 (n=182)					
Unfiltered tap water	109	59.9	14808	59.3	51.9– 66.7
Bottled water from store	88	48.4	12411	49.7	41.2– 58.1
Filtered tap water	22	12.1	3082	12.3	7.4– 17.3
Well water	1	0.5	167	0.7	0.0– 2.0
Other ²	6	3.3	684	2.7	0.3– 5.2
Current Water sources (n=182)					
Distribution site	135	74.2	18730	75.0	64.4–85.5
Bottled water from store	96	52.7	12883	51.6	40.3–62.8
Filtered tap water	71	39.0	10265	41.1	30.1–52.1
Home distributors	62	34.1	8839	35.4	26.1–44.6
Unfiltered tap water	4	2.2	476	1.9	0.1–3.7
Well water	0	0.0	0	0.0	---
Other ³	6	3.3	732	2.9	0.4–5.5

¹ Multiple responses could be selected; Other sources included: distilled alkaline, water cooler, boiling, distributed water, not applicable (n=3)

² Multiple responses could be selected; Other sources included: parent's house to fill jugs, damaged new faucet, water cooler, distribution site, not applicable (n=2)

³ Multiple responses could be selected; Other sources included: parents' house, baby water, Culligan, water cooler, church, husband from other

Table 15. Use of unfiltered water Flint municipal tap water by households

	Frequency	% of HH	Projected HH	Weighted %	Weighted 95% CI
Unfiltered tap water use between April 2014 and October 2015 (n=175)¹					
Bathing/showering	171	97.7	23487	97.8	95.6–100.0
Washing dishes	164	93.7	22374	93.2	88.8–97.5
Brushing teeth	139	79.4	18404	76.6	66.0–87.3
Cooking	123	70.3	16937	70.5	61.0–80.0
Drinking	114	65.1	15213	63.3	53.4–73.3
Use with infant formula	12	6.9	1803	7.5	3.0–12.1
Other ²	7	4.0	905	3.8	1.1– 6.4
Unfiltered tap water use since October 2015 (n=167)³					
Bathing/showering	150	89.8	20736	90.9	86.9– 94.9
Washing dishes	137	82.0	18638	81.7	74.3–89.1
Brushing teeth	76	45.5	10043	44.0	35.2– 52.9
Cooking	34	20.4	4609	20.2	13.0– 27.4
Drinking	28	16.8	3411	15.0	8.6–21.3
Use with infant formula	7	4.2	940	4.1	0.8– 7.4
Other ⁴	9	5.4	1349	5.9	2.2– 9.6

¹ Multiple responses could be selected; Missing (n=7)

² Multiple responses could be selected; Other sources included: feeding pets (n=2), water plants (n=3), doing laundry (n=2)

³ Multiple responses could be selected; Missing (n=15)

⁴ Other sources included: laundry (n=7), watering plants, safe to shower

Table 16. Household difficulty obtaining bottled water, well water, or filtered water

	Frequency	% of HH	Projected HH	Weighted %	Weighted 95% CI
Difficulty obtaining water since October 2015 (n=182)¹					
Yes	32	17.6	4219	16.9	10.8–23.0
No	149	81.9	20660	82.7	76.7–88.7
Difficulties obtaining water (n=30)²					
No transportation	18	60.0	2467	62.3	42.4–82.1
Sites do not give out enough water	12	40.0	1564	39.5	18.5–60.4
Disabled/homebound	8	26.7	1004	25.4	6.9–43.8
Sites do not give out enough filters	8	26.7	957	24.1	6.5–41.8
Not enough money to purchase water	7	23.3	865	21.8	5.1–38.6
Not enough money to purchase filters	6	20.0	766	19.3	3.3–35.4
Store out of water	2	6.7	238	6.0	0.0–14.5
Store out of filters	0	0.0	0	0.0	---
Other ³	9	30.0	1208	30.5	12.4–48.5
<i>Inconvenience⁴</i>	5	55.6	684	56.7	17.8–95.5

¹ Don't know (n=1)

² Responses from those that had difficulties; Missing (n=2)

³ Multiple sources could be selected; Other difficulties obtaining water included: store out of lead testers, location of knowledge sites, medical, and not specified

⁴ Subset of other difficulties to obtaining water

Table 17. Location of water filters within households whose members used filtered water for drinking and cooking

	Frequency	% of HH	Projected HH	Weighted %	Weighted 95% CI
Location of filters (n=71)¹					
Kitchen sink	65	92.9	1140	91.4	84.5-98.4
Bathroom sink	10	14.3	1277	12.6	4.6–20.5
Pitcher filter	5	7.1	862	8.5	1.6–15.4
Shower head	5	7.1	751	7.4	0.3–14.5
Water valve	3	4.3	424	4.2	0.0–8.8
Other ²	4	5.7	613	6.0	0.0-12.1

¹ Multiple responses could be selected; Missing (n=16); Refused (n=1)

² Other sources included: washing machine, basement tub, basement sink, bottled water, fridge, cannot use filter on the faucet, landlord does not allow filter installation

Table 18. Household behavior change regarding use of water due to the Flint water crisis since October 2015

	Frequency	% of HH	Projected HH	Weighted %	95% CI
Reduced water usage (n=181) ¹	142	78.5	19449	78.2	73.6–82.8
Decreased frequency of shower/bath (n=182)	110	60.4	14710	58.9	52.3–65.5
Decreased duration of shower/bath (n=182)	123	67.6	16741	67.0	61.4–72.6
Changed method of shower/bath (n=180) ²	107	59.4	14333	58.1	52.3–63.8
Decreased frequency of hand washing (n=181) ³	69	38.1	9212	37.0	29.9–44.2
Decrease duration of hand washing (n=179) ⁴	80	44.7	10607	43.1	35.4–50.9
Used baby wipes/sanitizer for washing (n=182) ⁵	122	67.0	16964	67.9	60.6–75.2
Bathe/shower outside of home (n=182) ⁶	55	30.2	7234	29.0	21.2–36.7
Bathe/shower with bottled water (n=181) ⁷	61	33.7	8565	34.4	26.0–42.9

¹ Missing (n=1)

² Missing (n=2); Don't know (n=1)

³ Missing (n=1); Don't know (n=1)

⁴ Missing (n=3); Don't know (n=1)

⁵ Don't know (n=1)

⁶ Don't know (n=1)

⁷ Missing (n=1)

Table 19. Type of information received by households regarding the Flint water crisis

	Frequency	% of HH	Projected HH	Weighted %	Weighted 95% CI
Types of information received (n=181)¹					
Lead in Flint water	165	91.2	22885	92.0	87.9–96.2
Bottled water/filter distribution	160	88.4	22303	89.7	81.5–97.9
Filter instructions	142	78.5	19901	80.0	71.3–88.8
Water testing resources	140	77.3	19570	78.7	70.1–87.3
Nutrition	101	55.8	14194	57.1	45.0–69.2
How to keep home lead-safe	95	52.5	12755	51.3	41.7–60.9
Lead prevention for children	88	48.6	12027	48.4	38.9–57.8
Physical health services	85	47.0	11948	48.1	37.4–58.7
Behavioral health services	68	37.6	9522	38.3	28.9–47.7
Did not receive information	1	0.6	139	0.6	0.0–1.7
Other ²	9	5.0	1163	4.7	1.1–8.2

¹ Multiple responses could be selected; some responses were missing (n = 1)

² Other sources included: freedom works, 2014 water report, attorney, fire hall, copper in water, letter, church, text message from council woman, copper testing

Table 20. Flint water crisis household information sources, open-ended responses categorized

	Frequency	% of HH	Projected HH	Weighted %	Weighted 95% CI
Sources of information (n=182)					
Television	138	75.8	19129	76.6	68.0–85.1
Neighbor/friend/family	58	31.9	8121	32.5	24.7–40.3
Social media	51	28.0	6781	27.1	18.3–36.0
Radio	42	23.1	6014	24.1	17.0–31.2
Newspaper	38	20.9	5177	20.7	13.9–27.5
Public Flier	40	22.0	5369	21.5	12.7–30.3
Faith Based Organization	31	17.0	4583	18.3	12.4–24.3
Internet	33	18.1	4516	18.1	12.0–24.1
Health Professional	23	12.6	3379	13.5	7.2–19.8
Text message	0	0.0	0	0.0	---
Other ¹	29	15.9	3753	15.0	9.2–20.9
<i>Community Engagement</i> ²	13	44.8	1547	41.2	19.9–62.5
<i>Mail</i> ²	6	20.7	722	19.2	0.0–43.3
<i>School</i> ²	4	13.8	565	15.1	0.0–30.8

¹ Open-ended responses were categorized: Other types of information mentioned included: lawyer, city employee, legal meetings, news, work, multiple sources/everywhere (e.g., health professional, internet, social media, and fliers)

² Subset of other sources of Flint water crisis information

Table 21. Most trusted source of information for households regarding the Flint water crisis

	Frequency	% of HH	Projected HH	Weighted %	Weighted 95% CI
Trusted sources of information (n=182)					
News media	48	26.5	6572	26.4	19.8–33.0
Genesee County Health Department	16	8.8	2313	9.3	4.8–13.8
Health professionals	14	7.7	2137	8.6	3.7–13.5
Faith-based organizations	12	6.6	1590	6.4	2.3–10.5
Social media	10	5.5	1269	5.1	1.4–8.8
Aid organizations	9	5.0	1213	4.9	1.1–8.7
School system	8	4.4	1135	4.6	0.4–8.7
Don't know	7	3.9	1087	4.4	0.6–8.2
Federal agencies	3	1.7	357	1.4	0.0–3.1
Genesee Health System	2	1.1	327	1.3	0.0–3.3
Michigan Dept. of Health and Human Services	2	1.1	286	1.1	0.0–2.8
City of Flint Water Department	2	1.1	223	0.9	0.0–2.2
Refused	1	0.6	167	0.7	0.0–2.0
Other ¹	47	26.0	6188	24.9	16.7–33.1
<i>Trusted self/Did not trust anyone²</i>	16	34.0	1926	31.1	12.3–49.9
<i>None²</i>	11	23.4	1664	26.9	8.2–45.5
<i>Not Government²</i>	5	10.6	613	9.9	0.2–19.6
<i>Friend/family²</i>	4	8.5	543	8.8	0.5–17.1
<i>Local/City Government²</i>	2	4.3	238	3.8	0.0–9.5
<i>Internet²</i>	2	4.3	382	6.2	0.0–16.1

¹ Open-ended responses were categorized; other sources that were not categorized (n=7) included: door to door helpers, person who broke the news about crisis, lead abatement program, conference, Water defense team, self/world news, and refused; missing (n=1)

² Subset of other trusted sources

Table 22. Household Understanding of English

	Frequency	% of HH	Projected HH	Weighted %	Weighted 95% CI
At least one household member does not understand English language (n=181)¹					
Yes	5	2.8	773	3.1	0.2– 6.0
No	176	97.2	24091	96.9	94.0–99.8

¹ Missing (n=1)

Table 23. Current greatest household needs at time of interview (May 2016)

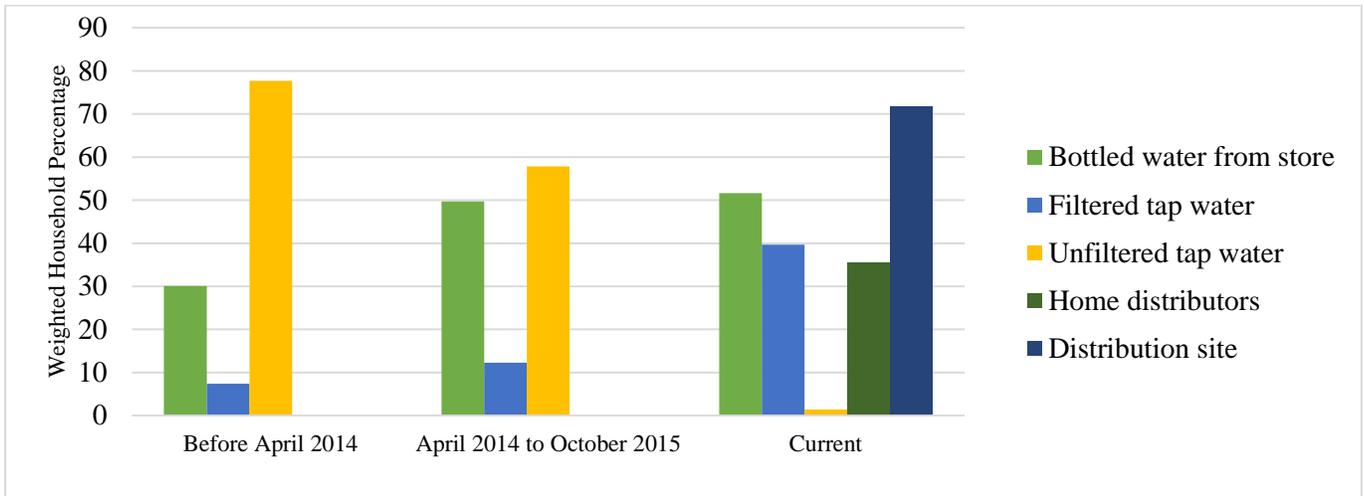
	Frequency	% of HH	Projected HH	Weighted %	Weighted 95% CI
Greatest current household needs (n=178)¹					
Financial	60	33.7	8224	33.6	26.4–40.7
<i>Utilities</i> ²	10	16.7	1553	18.9	7.4–30.4
Safe Water	48	27.0	6745	27.5	19.8–35.2
Plumbing/Repair	27	15.2	3614	14.7	8.0–21.5
Food	12	6.7	1717	7.0	3.2–10.9
Filters	8	4.5	1039	4.2	0.8–7.7
Health-related	8	4.5	1136	4.6	1.6–7.7
Other ³	38	21.3	4936	20.1	12.3–28.0
Nothing	17	9.6	2372	9.7	4.8–14.6

¹ Missing (n=4)

² Subset of financial needs; Denominator is n = 60

³ Other includes: maintenance on structure of home, stability, just wants things to become stable, baby sitter, transportation, home improvement, bed and dressers, yard work assistance, for those that lead us to straighten this out fast, humanely, follow up, home repairs and sewage line repairs, summer, get out of Flint

Figure 1. Household water sources for drinking and cooking at different time periods¹



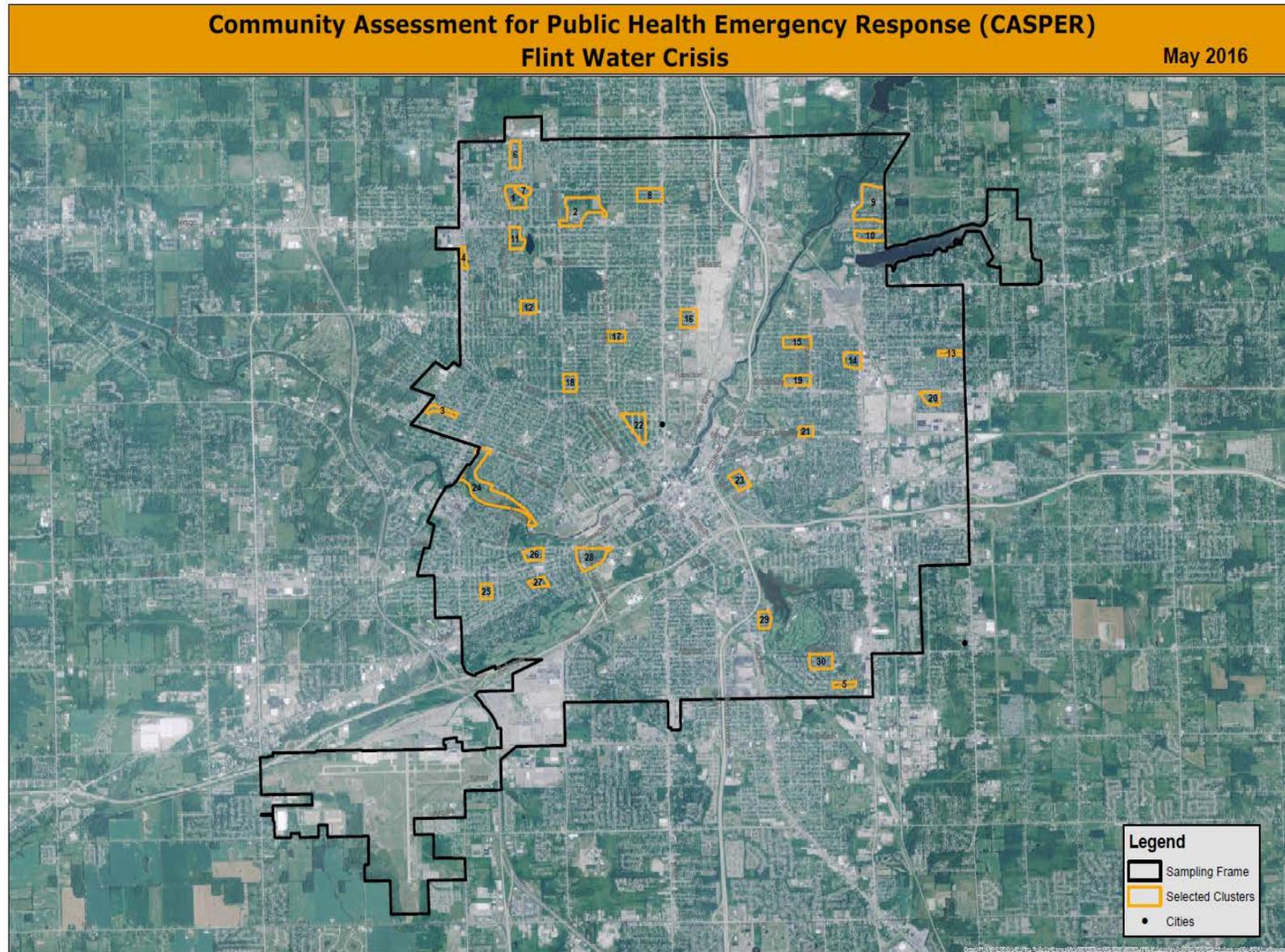
¹ Before April 2014, before the City of Flint, Michigan changed their municipal water supply source from Detroit-supplied Lake Huron water to the Flint River; April 2014 to October 2015. After the City of Flint, Michigan changed their municipal water supply source, but before residents of Flint, Michigan were advised not to drink the municipal water; Current, after residents of Flint, Michigan were advised not to drink the municipal water

Appendices

Appendix A. Flint CASPER Questionnaire

Flint CASPER Questionnaire			
Q1. Date:	Q2. Team Initials:	Q3. Cluster Number:	Q4. Survey Number:
Demographic Information			
Q5. Type of structure <input type="checkbox"/> Single family <input type="checkbox"/> Multiple unit <input type="checkbox"/> Mobile home <input type="checkbox"/> Other _____		Q8. How many people currently living in your household are 5 yrs and under? ___#___ 18-20 years? ___#___ 65+ yrs? ___#___ 6-17 yrs? ___#___ 21-64 years? ___#___ <input type="checkbox"/> DK <input type="checkbox"/> Ref	
Q6. Do you own or rent this residence? <input type="checkbox"/> Own <input type="checkbox"/> Rent <input type="checkbox"/> Other _____ <input type="checkbox"/> DK <input type="checkbox"/> Ref		Q9. Is anyone in your household pregnant? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> DK <input type="checkbox"/> Ref	
Q7. How many people currently live in your household? ___#___		Q9a. If yes, how many are pregnant? ___#___	
Communications			
Q10. What type of information have you or members of your household received regarding the Flint water crisis? (Check all that apply) <input type="checkbox"/> Lead in Flint water <input type="checkbox"/> Nutrition <input type="checkbox"/> Water testing resources <input type="checkbox"/> Physical health services <input type="checkbox"/> Filter instructions <input type="checkbox"/> Behavioral health services <input type="checkbox"/> Bottled water/filter distribution (i.e., mental health/substance abuse) <input type="checkbox"/> How to keep home lead-safe <input type="checkbox"/> Other _____ <input type="checkbox"/> Lead prevention for children <input type="checkbox"/> None <input type="checkbox"/> DK <input type="checkbox"/> Ref		Q11. In your opinion, what is the most trusted source of information about the Flint water crisis? (Pick one) <input type="checkbox"/> School system (i.e., Flint community schools, universities) <input type="checkbox"/> Aid organizations (i.e., American Red Cross, United Way) <input type="checkbox"/> Federal agencies, specify _____ (e.g., EPA, CDC, FEMA) <input type="checkbox"/> Michigan Department of Health and Human Services <input type="checkbox"/> Genesee County Health Department <input type="checkbox"/> Genesee Health System <input type="checkbox"/> Social media <input type="checkbox"/> Faith-based organizations <input type="checkbox"/> News media <input type="checkbox"/> Health professionals <input type="checkbox"/> Other _____ <input type="checkbox"/> City of Flint Water Department <input type="checkbox"/> DK <input type="checkbox"/> Ref	
Q10a. What was the source of this information? (pick top 3) <input type="checkbox"/> TV <input type="checkbox"/> Internet <input type="checkbox"/> Radio <input type="checkbox"/> Social media <input type="checkbox"/> Newspaper <input type="checkbox"/> Text message <input type="checkbox"/> Neighbor/friend/family <input type="checkbox"/> Publically available flyer <input type="checkbox"/> Faith-based organization <input type="checkbox"/> Other _____ <input type="checkbox"/> Health professional <input type="checkbox"/> DK <input type="checkbox"/> Ref		Q12. Is there anyone in your household that does not understand English? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> DK <input type="checkbox"/> Ref Q12a. If yes, what is the primary language of that person? _____	
Water			
Q13. Before April 2014, before the water source for City of Flint was switched, what was your household's source of water for drinking and cooking? (Check all that apply) <input type="checkbox"/> Bottled water from store <input type="checkbox"/> Well water <input type="checkbox"/> Filtered tap water <input type="checkbox"/> Other _____ <input type="checkbox"/> Unfiltered Flint tap water <input type="checkbox"/> DK <input type="checkbox"/> Ref		Q17. Since October 2015, have you or anyone in your household used the unfiltered tap water for any of the following? (Check all) <input type="checkbox"/> Drinking <input type="checkbox"/> Bathing/showering <input type="checkbox"/> Washing dishes <input type="checkbox"/> Use with infant formula <input type="checkbox"/> Brushing teeth <input type="checkbox"/> Other _____ <input type="checkbox"/> Cooking <input type="checkbox"/> N/A <input type="checkbox"/> DK <input type="checkbox"/> Ref	
Q14. After April 2014, but before October 2015, after the water source for City of Flint was switched, but before it was announced that tap water was unsafe to drink, what was your household's source of water for drinking and cooking? (Check all that apply) <input type="checkbox"/> Bottled water from store <input type="checkbox"/> Well water <input type="checkbox"/> Filtered tap water <input type="checkbox"/> Other _____ <input type="checkbox"/> Unfiltered Flint tap water <input type="checkbox"/> DK <input type="checkbox"/> Ref		Q18. Since October 2015, have you or anyone in your household Reduced water usage <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> DK <input type="checkbox"/> Ref Decreased how often you shower/bathe <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> DK <input type="checkbox"/> Ref Shortened bathing/showering time <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> DK <input type="checkbox"/> Ref Changed how you bathe/shower <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> DK <input type="checkbox"/> Ref Washed your hands less often <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> DK <input type="checkbox"/> Ref Shortened hand washing time <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> DK <input type="checkbox"/> Ref Used baby wipes/sanitizer for washing <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> DK <input type="checkbox"/> Ref Bathe/shower outside of your home <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> DK <input type="checkbox"/> Ref Bathe/shower with bottled water <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> DK <input type="checkbox"/> Ref	
Q15. Currently, what are your household's sources of water for drinking and cooking? (Check all that apply) <input type="checkbox"/> Bottled water from store <input type="checkbox"/> Well water <input type="checkbox"/> Filtered tap water <input type="checkbox"/> Unfiltered Flint tap water <input type="checkbox"/> Water from home distributors <input type="checkbox"/> Other _____ <input type="checkbox"/> Water from distribution site <input type="checkbox"/> DK <input type="checkbox"/> Ref		Q19. Since October 2015, have you or anyone in your household experienced difficulty obtaining bottled water, well water, or filtered water? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> DK <input type="checkbox"/> Ref	
Q15a. If using "Filtered tap water", where are filters installed? <input type="checkbox"/> Kitchen sink <input type="checkbox"/> Pitcher filter <input type="checkbox"/> Shower head <input type="checkbox"/> Water valve (e.g. whole house filter) <input type="checkbox"/> Bathroom sink <input type="checkbox"/> Other _____ <input type="checkbox"/> DK <input type="checkbox"/> Ref		Q19a. If yes, what are some difficulties in obtaining bottled water, well water, or filtered water? (Check all that apply) <input type="checkbox"/> Not enough money to purchase filters <input type="checkbox"/> Not enough money to purchase bottled water <input type="checkbox"/> Distributors/sites do not give out enough filters <input type="checkbox"/> Distributors/sites do not give out enough bottled water <input type="checkbox"/> Store out of filters <input type="checkbox"/> Disabled/homebound <input type="checkbox"/> Store out of bottled water <input type="checkbox"/> Other _____ <input type="checkbox"/> No transportation <input type="checkbox"/> N/A <input type="checkbox"/> DK <input type="checkbox"/> Ref	
Q16. After April 2014, but before October 2015, did your household use the unfiltered tap water for any of the following? (Check all) <input type="checkbox"/> Drinking <input type="checkbox"/> Bathing/showering <input type="checkbox"/> Washing dishes <input type="checkbox"/> Use with infant formula <input type="checkbox"/> Brushing teeth <input type="checkbox"/> Other _____ <input type="checkbox"/> Cooking <input type="checkbox"/> N/A <input type="checkbox"/> DK <input type="checkbox"/> Ref			
Household Health and Behavioral Health Questions			
Q20. Have you or a member of your household ever been told by a healthcare professional that he/she has Asthma/COPD/Emphysema <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> DK <input type="checkbox"/> Ref Diabetes <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> DK <input type="checkbox"/> Ref Developmental disability <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> DK <input type="checkbox"/> Ref		Hypertension/heart disease <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> DK <input type="checkbox"/> Ref Physical disability <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> DK <input type="checkbox"/> Ref Psychosocial/mental illness <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> DK <input type="checkbox"/> Ref	

Appendix B. Sampling frame and selected clusters in the City of Flint, with selected clusters circled in yellow



Appendix C. Public Health Informational Materials in Participant Gift Bag

- “Childhood Milestones: 2 Months to 5 Years - Watch Your Child for Signs of Lead Exposure as They Grow”
- “Health Care Coverage for People Impacted by Flint Water”
- “Resources for Users of Flint Water”
- “Lead in Flint Water”
- “Fight Lead with Nutrition”
- “Adding Phosphate to Flint Water”
- “Installing a BRITA Filter”
- “Installing a PUR filter”
- “Lead Poisoning and Pregnant Mothers”
- “Keeping Your Home Lead-Safe: Clean Your Aerators”
- “Frequently Asked Questions about Fluoride, Bottled Water, and Oral Health”
- “Keep your Pet Safe from Lead”
- “Fight Lead with Healthy Food”
- “Flush for Flint: Take These Steps to Flush Pipes and Aid in Flint Water System Recovery” (in English and Spanish)
- Telephone list for Genesee County key departments
- Meal programs available listed by Catholic Charities
- Food bags announcement from Catholic Charities’ Center for Hope
- Center for Hope Community Closet one-pager