Health Literacy and Design:

Adapting Public Health Design in Response to Trauma

Submitted by:

Megan Losey

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Mentor: Meaghan Barry

Art and Art History Department

Oakland University

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Abstract

This study explores the interaction between design principles and health literacy in relation to public health design and its effectiveness in communicating information. It considers factors such as literacy, design principles, history, and trust, to determine how to better public health designs when communicating information to communities who have experienced chronic trauma. The discussion of health literacy explores literacy levels in the U.S. and Flint, Michigan, and their correlation to health literacy levels in these areas. Discussion of Flint, Michigan will review the history and impact of the Flint Water Crisis on both communities and on design.

Keywords: Health literacy, Flint Water Crisis, public health, design, trauma

Adapting Public Health Design in Response to Trauma

The public has been bombarded with visual messages since the Industrial Revolution, but now with the rise of the digital age, people are interpreting visual messages more often than ever before. This increase calls for the need to investigate how people are interpreting these visual messages and how the design of the message itself can impact the public. The effectiveness of a message can be critical, especially within the field of public health. When understanding how audiences interact with these messages, one must consider the audience's levels of health literacy. Numerous studies have been conducted on health literacy, to better understand how audiences are interacting, understanding, and comprehending health information (Baker, 1999; DeWalt, 2007; Wilson & Wolf, 2009). Wilson and Wolf (2009) define health literacy to be an individual's ability to both understand and retain health information and information regarding the health services offered. Many studies have been conducted to examine the interactions between literacy and health literacy levels; however, a need still exists for research that discusses the influence of design principles on health literacy materials, and in turn, how design can be implemented to positively impact the audiences' interaction with public health communication.

This paper will discuss the intersections between health literacy and public health material design, using the response to the Flint Water Crisis as a case study. It will discuss the importance of health literacy, specifically within the current context of the low literacy levels of Flint, Michigan. Additionally, it will discuss the influence of design on health literacy and public health materials. It will further review the current principles of public health design and the ways that they currently utilize the principles of design. Moreover, it will review how design has impacted public health throughout history, continuing into the present to examine the impact of design on the 2020 COVID-19 pandemic. Finally, it will discuss the opportunities for change

in public health design in response to a public health crisis, with the goal of reestablishing trust between audiences and the media.

Health Literacy

Health literacy is becoming a more prevalent topic in the field of public health as researchers consider the ways in which audiences are interacting and understanding the medical information presented to them (DeWalt, 2007). DeWalt (2007) discusses the need to address communication within public health materials due to the low health literacy levels that point to almost half of the population struggling to understand health information. This lack of health literacy impacts the health of the population. If patients are unable to understand their diagnoses, treatment plans, or medicine instructions, it can lead to health detriments and a decrease in overall population health (DeWalt, 2007). Improving health literacy is crucial to continued success in the public health field, as well as an increase in health among populations.

As aforementioned, multiple studies have explored the relationships present between literacy and health literacy (Baker, 1999; DeWalt, 2007; Wilson & Wolf, 2009). To observe the relationship between literacy and health literacy, it is important to distinguish between the two term's definitions. According to a U.S. Department of Education data set, the "[Program for the International Assessment of Adult Competencies] defines literacy as 'the ability to understand, evaluate, use and engage with written texts to participate in society, to achieve one's goals, and to develop one's knowledge and potential'" (as cited in Mamedova & Pawlowski, 2019). Health literacy builds on this definition of literacy by applying these principles specifically to health-related information and understanding of materials. Baker (1999) points out several potential relationships between literacy and health literacy. While low literacy may lead to external factors that influence low health literacy, such as unemployment or lack of health insurance, it is

also likely that less education is correlated with low literacy and impacts the ability to

comprehend new information, especially in the context of medical conditions, treatments, or

drug information. An additional correlation may exist according to research done by Baker,

Parker, and Williams where low literacy leads to the inability to read items such as prescription

labels, thus leading to medication errors (as cited in Baker, 1999). A direct correlation has been

made in numerous studies that people with lower literacy die quicker due to mistakes and errors

with medication, resulting in fatalities or severe medical mishaps (DeWalt, 2007). It is because

of this correlation that both literacy levels and health literacy levels must be accounted for when

examining the public health efforts of a community.

When looking specifically at prescription design, Target pharmacy's prescription bottle

designs can be discussed. Primarily, Deborah Adler investigated the flaws of the commonly

used prescription bottle design in 2005 to design a more successful solution, aiding in health

literacy (Bernard, 2005). Adler recognized that in the pharmacy industry, standard prescription

label design had many inconsistencies; it prioritized branding over key drug information, the text

was too small, the numbers and colors were confusing, and the cylindrical shape of the bottle

itself caused reading difficulties (Bernard, 2005; Appendix A1). All of these exist as design

features that cause lower health literacy levels and in turn, a higher number of medical mistakes

for patients. Adler's solution was to design a different prescription bottle to address each

inconsistency and increase health literacy for the user. Her design is effective for many reasons;

most predominantly because she designed with "function over form" in mind, prioritizing drug

information most needed by the patient (Bernard, 2005). Alder's redesigned bottle featured

seven new features to increase health literacy and can be seen in detail in Appendix A2. Her

design was picked up by Target's pharmacy, prior to CVS Pharmacy's acquisition of Target's pharmacy in 2015.

When redesigning the bottle, Adler first ensured that the name of the prescription could easily be identified, including it in bold text as the focal point of the label (Appendix A2). This is effective because it gives the patient the information needed quickly and clearly. Second, she colored the bottle red instead of the standard orange, functioning dually as a universal caution color and a branding color for Target (Appendix A2). Third, she successfully used heirarchy in her design, placing crucial information at the top of the label and separating secondary information below a line lower down on the label (Appendix A2). Fourth, she designed the prescription bottle to sit upside down and to be a flatter, triangular-like shape (Appendix A2). This upside-down, flattened bottle design increased readability and saved paper. Fifth, and possibly the most memorable aspect of her design, was the inclusion of colored user bands for the prescription bottles (Appendix A2). This feature allowed patients to assign a different colored band to each member of their family, decreasing confusion and risk. Sixth, she changed the placement of the information card, adding it to the label itself instead of attaching it to the prescription bag (Appendix A2). Seventh, she replaced the phrase "take once" with "take daily" (Appendix A2). This modification shows her attention to versatility across languages as "once" means "eleven" in Spanish. Adler's successful redesign shows how design decisions directly impact the health literacy of the patient and their experience with their prescriptions.

Health Literacy of Flint, Michigan

In order to accurately discuss public health and health literacy in Flint, Michigan, it is crucial to mention the current literacy levels of the area. A literacy fact sheet published in 2018 estimated that 10% of Flint, Michigan residents were living with low literacy rates (Flint &

Genesee Literacy Network, 2018). This fact sheet included additional statistics about Genesee County residents' literacy levels, stating that 19.5% of adults did not graduate high school and 30% of children under the age of 18 live in poverty. When considering these statistics and the previously stated correlations between literacy levels and health literacy, the low literacy levels of Flint residents point to a lower health literacy level. This potential connection exists as an area where additional research is needed before confirming any direct correlation specific to the Flint area.

Research has been collected on other factors that impact the health and well-being of Flint residents finding that "socioeconomic factors" such as education, poverty, and housing inequality appear to have the largest impact on the public's health (Greater Flint Health Coalition et al., 2019, p. 18). This research was collected by numerous institutions in Genesee County concerned with improving public health efforts in both Genesee County and Flint. According to Greater Flint Health Coalition et al. (2019), Flint experiences exceedingly low high school graduation rates with only 66.8% of high school students graduating in 2018. Additionally, only 11.9% of Flint residents over the age of 25 have a bachelor's degree. Moreover, factors such as the high unemployment rate in Flint, which at 8.4% is more than double the United States' average of 3.9%, the high violent crime rate, and the high poverty rate, which is 38.9%, are all examples of the socioeconomic factors that heavily impact an individual's health. These external factors not only impact an individual's health, but also their health literacy levels. The high impact of all of these factors points to the problem of low health literacy in Flint.

History of Flint

The history of Flint is full of environmental and racial injustice, leading to a culture of systemic social inequality that has impacted residents' well-being, safety, and trust. Dr. Mona

Hanna-Attisha (2018), pediatrician and director of pediatric residency at Hurley Medical Center,

detailed the history of Flint as it led to the Flint Water Crisis in her book *What the Eyes Don't*

See: A Story of Crisis, Resistance, and Hope in an American City. Within her novel, Hanna-

Attisha recalls a common story told about the origin of the City of Flint. She states how this

origin story includes the details of John Smith, who bought land from the Ojibwe tribe in 1819

that later became Flint, but often omits information about the Treaty of 1819 that forced Native

Americans off their land (Hanna-Attisha, 2018, p. 116). Throughout her novel she describes

many situations similar to this origin story, where oppressive histories are retold as fairytales,

ignoring deep roots of brokenness that make up the foundation of Flint. She notes that these

practices of overlooking oppressed people groups have led to the systemic injustice laced

throughout Flint's history, setting a foundation for the more apparent injustices that have taken

place recently.

In 1880, General Motors (GM) was said to set up its first plant, manufacturing carriages

and providing jobs to the people of Flint (Hanna-Attisha, 2018). Throughout history many

people continued to move to Flint, especially during World War II, when GM employed workers

to make tanks. Hanna-Attisha (2018) includes that there was a large migration of African

American workers who moved North to escape the Jim Crow laws, and found work with GM,

despite unjust work practices. GM supported the racial injustice that led to housing

discrimination throughout Flint (Hanna-Attisha, 2018). According to Thomas J. Sugrue, this

discrimination and hate was fueled by white violence, especially in surrounding areas such as

Detroit (as cited in Hanna-Attisha, 2018, p. 120).

A defining moment for both GM and the City of Flint occurred in 1936, when GM

workers organized for the Flint Sit-Down Strike at Fisher Body Plant No. 1 (Hanna-Attisha,

2018). This strike followed strikes of previous organizations in 1913 and 1930. However, during this strike workers barricaded themselves in the factory for multiple weeks, eventually extending to an additional strike at the Chevrolet No. 4 plant. The strike continued for 45 days until the government recognized the United Automobile Workers (UAW) as a formal union and representation for the workers (Hanna-Attisha, 2018). Moments such as these speak to the resilience and hope that is built into the people of Flint amidst injustice.

As housing desegregation legislation began to pass, African American families moved into Flint neighborhoods, and white residents responded with pushback, violence, and moving out of Flint (Hanna-Attish, 2018). As the population fell, the GM plants began to close and throughout the 1970s, "GM cut its workforce in the city from 80,000 to 8,000," leaving workers without jobs or income (Burgoyne, 2018). This drastic fall of Flint led to increases in crime and the continuation of systemic injustice throughout the city, which in turn, led to the events now known as the Flint Water Crisis.

The Flint Water Crisis

In 2011, Dayne Walling was reelected as the mayor of Flint, as Michigan Governor Rick Snyder declared the city to be "in a state of 'local government financial emergency' and appointed an unelected emergency manager (EM) to run the city" (Hanna-Attisha, 2018, p. 28). In order to save money, in 2014 a board of officials decided to change the water source for the City of Flint. Flint city water had previously come from Lake Huron, pretreated by the Detroit Water and Sewerage Department. However, this decision would change the water source, pulling all of Flint's water from the Flint River (Hanna-Attisha, 2018, p. 29). The water source was official switched on April 25, 2014. The city reported that the water source had been tested by the Michigan Department of Environmental Quality (MDEQ) and the Environmental

Protection Agency (EPA) and that the water was safe for drinking. However, soon following this water switch, Flint residents began speaking up about their water being discolored and odorous (Hanna-Attisha, 2018, p. 29). In response to these complaints, the city assured Flint residents that the water was safe to drink.

In July of 2015, Miguel Del Toral, who worked for the EPA, leaked a memo that Flint was not using corrosion control in their water treatment and the water, in turn, was testing to show the presence of high levels of lead (Hanna-Attisha, 2018, p. 38-39). This memo was brought to the attention of Dr. Mona Hanna-Attisha in August of 2015. Dr. Hanna-Attisha (2018) then began research on Flint children's blood levels through Hurley Medical Center data with a research team. After receiving IRB approval, Dr. Hanna-Attisha retrieved blood level data from all of Genesee County in order to compare blood lead levels of children from before and after the water source switch in 2014. After conducting research, her team reported the "incidence of elevated blood lead levels increased from 2.4 to 4.9 percent (p <0.05 percent), with some neighborhoods having the highest water lead levels with a 6.6 percent increase" (Hanna-Attisha & O'Connell, 2016). Her team attempted to reach out to the EPA, the MEDQ, and the mayor, but after numerous dismissals, Dr. Hanna-Attisha (2018) shared her research publicly during a press conference on September 24, 2015.

Following high levels of skepticism and push-back, a public health emergency was declared on October 1, 2015, by the Genesee County Health Department (Hanna-Attisha, 2018, p. 279). On October 8, 2015, it was announced that the City of Flint would be switching its water source back to Detroit water and it made this switch on October 16, 2015 (Hanna-Attisha, 2018, p. 287-288, 290). A federal emergency was declared in Flint by President Obama on

January 16, 2016, allowing more resources to be distributed throughout Flint to residents and

children (Hanna-Attisha, 2018, p. 300).

Though the water source was switched back, that did not mean that Flint water was safe

to drink. After over a year of corrosion, the pipes in residents' plumbing were still leaching lead

(Hanna-Attisha, 2018). The pipes of Flint are being inspected and replaced, but until every pipe

has been inspected and replaced if necessary, residents have been advised to continue drinking

filtered or bottled water (Winowiecki, 2019). Flint residents distrust the water and they distrust

the government. After years of government officials claiming that the water was safe and then

revealing that they were twisting and hiding data, there now exists a large distrust in public

statements about the water (Winowiecki, 2019). The consequences of the Flint Water Crisis not

only bring physical health concerns, but also mental and emotional health concerns including

Post Traumatic Stress Disorder (PTSD), toxic stress, and trauma (Hanna-Attisha, 2018).

Flint's Response

In response to the Flint Water Crisis, the Flint Registry was launched in January 2019 in

order to provide for the needs of those affected by the water crisis from 2014-2015 (ABC12

News Team, 2019). This Flint Registry was an initiative led by Dr. Mona Hanna-Attisha to care

for the residents who were affected, especially children who drank lead contaminated water, in

order to help them have a successful future. The registry aids in development by offering

support such as neurodevelopmental assessments and other resources to children exposed to lead

(Flint Registry Team, 2019). Though this registry itself is helpful to residents, its design and

timeline are also noteworthy. Though the registry, once implemented, has been a successful

resource, it opened to residents for pre-registration in 2018, and finally officially opened in

January of 2019. As a response to a public health crisis primarily impacting residents from 2014

to early 2016, this response was not timely. However, this timeline lead to a more considered and developed design for the Flint Registry.

At first, the release of the Flint Registry seems untimely, since the Flint water switch occurred in 2014, the lead was discovered in 2015, the water source was switched back, a federal emergency was declared in 2016, and the pipes began to be replaced following all of these events. This may lead one to believe that the Registry should have opened in 2016, following the announcement of the federal emergency declaration. However, upon further review, it seems that the timeline used for the release of the Flint Registry led to a more developed design than materials that were released immediately after the announcement in 2015-2016. This distinction can be seen by first examining the design and consideration of a public service announcement (PSA) that was mailed to Flint residents on May 4, 2017 (Moore, 2017). This PSA was released in both English and Spanish, which can be found in Appendices B1 and B2, respectively. This PSA was sent to inform residents about water source information, pushing to keep the water source with Great Lakes Water Authority (GLWA) instead of taking on an additional water source change, as well as asking residents for their feedback (Moore, 2017). The design of this PSA is incredibly text heavy, with only the English design including the City of Flint's logo on the right side of the page (Appendix B1 & B2). This PSA is not effective for a community with low literacy levels as it leads to confusion and misinformation. The design could be improved by including more visuals describing the potential risks of the water switch and the options open to residents. This use of visual heavy design helps to increase health literacy by communicating information in a way that requires no prior knowledge or skill.

In comparison to this PSA, the design of the Flint Registry's resources showcases heavy use of illustration and clear branding that offers potential for use across many media platforms.

When examining the Registry's brochure, seen in Appendix C, several design characteristics are seen that were absent in the previous PSA including language accessibility, effective use of illustrations, clear next steps, and a consistent brand design (Appendix C). First, the design is effectively accessible across various languages, redesigned and released in both Spanish and Arabic in addition to English (Appendix C2 & C3). These redesigns go further than simply translating the written messages, but rather adjust the design; for instance in the Arabic brochure, formatting the design to be read right to left (Appendix C3). Moreover, the Flint Registry's design effectively uses illustrations to communicate information, including icons to supplement the qualifications for the registry such as living and working in Flint, as well as supplementing the next steps (Appendix C1). These icons are clear and easy to understand, using simple figures to represent people and an icon such as a pencil over top of a rectangle to visualize "complete your survey" (Appendix C1). Along with these illustrations, next steps are clearly included so that residents understand how to join the registry. These steps are located in the right-side column for the English and Spanish brochures and the left-side column for the Arabic brochure, are supplemented with illustrations, and are clearly identified with bold heading text that reads "STEP 1," "STEP 2," "STEP 3," and "STEP 4" (Appendix C1). Underneath these bold headings are subheadings in all capitalized text that describe the step, for instance, "COMPLETE YOUR SURVEY," and then smaller body text underneath the subheadings that includes further details (Appendix C1). Finally, the Flint Registry has an established brand design, including their logo, which the brochure describes so residents understand that it represents a Sankofa bird, symbolizing forward movement (Appendix C1). This effective branding strategy has potential as it is established and can be transferred across multiple media platforms.

Principles of Design

In order to analyze the materials created in response to the Flint Water Crisis and the ways in which audiences interacted with them, we must discuss the principles of design and how they structure visual messages. As defined by the J. Paul Getty Trust (2011), the principles of design "describe the ways that artists use the elements or art in a work of art." These principles typically include balance, emphasis, movement, pattern, repetition, proportion, rhythm, variety, and unity. Not only do these principles describe the art and the artist's design, but they can also be utilized in discussions about how audiences are interacting with the design.

Furthermore, these principles can be combined and used strategically to design for effectiveness, especially in the field of public health. In order to understand how these principles are interwoven to benefit public health design, one may turn to the work of designer Marie Neurath. Neurath worked with a company called Isotypes in the mid-1920s to late 1950s, seeking to construct uniform design icons to be used within the health fields to communicate information (Inglis, 2019). Her designs sought to simplify what are now known to be health literacy materials, reducing the amount of text and communicating ideas clearly through icons and pictograms that illustrated the main concerns of health professionals (Roberts, 2020). One example of Neurath's work can be seen in a leprosy pamphlet she designed in 1955 (Appendix D1). This pamphlet features simple figures, using colors of yellow and red to clearly identify the figures as healthy or unhealthy, respectively. Simple icons such as a red plus sign are also used to represent medical facilities (Appendix D1). Her designs intertwined the principles of emphasis, unity, and pattern, to effectively convey public health messages to widescale audiences. When analyzing public health design, these design principles are integral in understanding the effectiveness of a design to communicate a key public health message, especially when accounting for various health literacy levels.

Current Flint Design

In response to the Flint Water Crisis, there's a large gap in design, lacking effective public health design. This lack of intentional public health design in response to crisis leads to an increase of distrust and miscommunication throughout the community. The designs that do exist include a graphic art piece by Valerie Bourdon (2017) and a digitally illustrated infographic by Buckfire Law Firm (2016). It is also key to discuss how the response to this crisis impacted all Flint residents, including the Hispanic population who did not have easy access to public health information in their native language (Zarowny, 2016). Aspects such as language accessibility must be considered in effective public health design.

Valerie Bourdon's (2017) artwork titled "Flint Water Crisis" is an example of designing in response to the trauma of Flint communities. Bourdon's design was recognized in 2016, winning the Applied Arts Creative Excellence Student Award. The piece features a figure's silhouette created with chalk-like brush strokes (Appendix E1). Negative space creates a tract from the figure's mouth, down their suggested esophagus. However, the use of visual pun shows this tract to be a pipe or tap pouring water. The background color that fills this negative space is a murky yellow, representing the color of Flint's water during the crisis. The figure is surrounded by additional black markings, suggesting the uncleanliness of Flint's water. Underneath the figure, the text "FLINT, MI. 2016" is centered in a bold, sans-serif typeface (Appendix E1). Bourdon stated her piece "[depicts] the parallel between the corrosion of water pipes to the detrimental effects the toxic water has on the human body" ("Valerie Bourdon," 2017). Limited use of text and an emphasis on illustration make this piece particularly effective in response to the Flint Water Crisis, especially as a low literacy community can interpret its message clearly. The murky yellow color is easily understood as the color of Flint's water and

the black markings are easily seen as lead from the pipes. This piece appeals to the residents of

Flint who are familiar with these signs, requiring little literacy skill to understand the message.

Buckfire Law Firm has represented the people of Flint during and after the Flint Water

Crisis, defending residents who were poisoned by the water. The infographic designed by

Buckfire Law Firm (2016) presents a full timeline of the Flint Water Crisis beginning in 2013

and continuing through 2016. This timeline infographic begins with a large water faucet located

in the top left corner next to the text "THE FLINT, MICHIGAN WATER CRISIS A Chronology

of Events," all showcasing variant hues of blue, gray and white (Appendix E2). Starting at the

water faucet and splitting the infographic vertically all the way down the page, is a large flow of

murky-yellow "water". Along this water flow are the years 2013-2016, each outlined by a blue

water droplet. As the viewer continues down the infographic vertically, each significant event of

the Flint Water Crisis is listed under its specific date, many accompanied by smaller illustrations.

Most of these illustrations are black, using only blue and yellow coloring if needed (Appendix

E2). Throughout this infographic, color is used skillfully to portray the expectation of clean or

blue water, against the reality of Flint's murky-yellow unclean water. The use of these colors

remains consistent even through the smaller illustrations that accompany the individual events

throughout the timeline. The design emphasizes clarity as it presents the events of the crisis in

clear language with illustrations to help guide a viewer. The inclusion of these illustrations can

be important when designing for a community such as Flint, which as aforementioned, has lower

literacy levels (Flint & Genesee Literacy Network, 2018).

While considering this response to the Water Crisis, it is critical to discuss how the public

health materials impacted the variety of residents that make up Flint's population, including the

"nearly 4,000 Hispanic residents among Flint's population of 99,000, according to recent data

collected by Michigan's Department of Technology, Data, and Budget" (as cited in Zarowny, 2016). According to Zarowny (2016), many Hispanic residents, especially those whose native language is Spanish, struggled to find clear information about the lead in the water when the news first broke in Flint. Due to the lack on Spanish media, many Spanish speaking individuals receive their news updates from English media platforms, leading to misinformation or a lack of understanding, especially when technical public health jargon is used by media. In the instance of the Flint Water Crisis, there was already a significant amount of confusion in warnings and procedures to take due to the government wrongly ensuring the safety of the water for so long. One resident saw that there was concern about the water, but misunderstanding the instructions, she believed her water would be safe if she simply boiled it (Zarowny, 2016). This method was not safe, as lead cannot be boiled out of water.

In an attempt to communicate the warnings of lead in the water, two billboards featured bilingual messages, the first designed separately in both English and Spanish and the second design containing both English and Spanish text together (Appendix F1 & F2). The first of these billboards, seen in Appendix F1, shows an illustration of a boiling pot with a large "X" crossing it out, located to the left of the text "Hervir Agua NO ELIMINA EL PLOMO". This text is the Spanish translation of the message "boiling water does not remove lead," a key public health message that was released when it was first announced that Flint's water contained lead, countering previous warnings that boiling water would ensure safety (Appendix F1). The use of icons aids in this design's effectiveness, communicating a clear message visually, especially to a moving viewer who may see the billboard from a car. Moreover, the message is communicated to the target audience of the Hispanic community by including Spanish text. The second billboard can be seen in Appendix F2 and contains a similar message, warning residents, "DO

NOT RUN HOT WATER THROUGH YOUR FILTER". This design features a water filter

with red, wavy lines above it and a large "X" over it, showing the message in English on the left

side of the graphic and in Spanish on the right side (Appendix F2). While this design effectively

communicates a bilingual message, the busyness of the design could lead to difficulty for

viewers glancing at the billboard while driving; thus, this design may serve better for print

materials. While these billboard designs consider bilingual messages, many materials do not,

preventing many Hispanic residents, as well as other non-native English speaking residents, from

receiving timely news. Therefore, public health design must consider language accessibility in

order to function effectively.

Adapting Design

When considering the community of Flint, Michigan post-water crisis, it is important to

recognize the trauma the members of this community have experienced. Flint residents

vocalized concerns about the water for months and were ignored by the government consistently.

Even after many concerns were brought forward, organizations in power such as the EPA

released statements reassuring residents that the water was safe to drink (Hanna-Attisha, 2018).

When it was later announced that the water had unsafe levels of lead, it was clear that these

statements were false and that many organizations in power and the state government had

deliberately covered up information and lied to the public. In response to the trauma this

community is facing, the way materials and visual messages are designed must be adapted to

rebuild trust.

Public Health Design

In order to understand how to design in response to a public health crisis, it is possible to

look to history as design materials were used to communicate public health information about

many crises such as Ebola and Leprosy (Roberts, 2020). These examples of design showcase how design plays a pivotal part in the communication of information and the spread of disease. Finally, the response to COVID-19, a current pandemic taking place globally in 2020, can be evaluated in discussion of helpful design tactics that could be implemented in Flint (Roberts, 2020). Design principles from these examples can be used to understand how to design in response to the Flint Water Crisis.

Throughout history, design has held a critical role within public health, especially in the event of public health crises. During the occurrence and throughout the aftermath of public health crises, design has proven to be crucial in the communication of disease information, prevention tactics, and procedures. Roberts (2020) examines the impact of design on previous public health crises, as well as the communication and design tactics used in the 2020 COVID-19 pandemic. This research also builds on prior findings from Gosling (2017) investigating the impacts of design on general well-being and health interventions. Both Roberts (2020) and Gosling (2017) also emphasize the connections between design and health literacy.

One significance instance of design's ability to educate publics on the spread of disease and treatment was Marie Neurath's Leprosy pamphlet in 1955 as previously discussed (Roberts, 2020). This pamphlet includes clear imagery showing a figure at a doctors' clinic located at the top of the page. The image of the clinic is located in the center of the pamphlet, intentionally on top of the pamphlet's fold. Above the image of the clinic, the text "Leprosy *can* be stamped out! HOW? Go and see the doctor early" is included, and beside the clinic the text "He will find out what leprosy you have" is featured (Appendix D1). Continuing down the page, on the left side of the fold there is a yellow figure with red dots labeled "mild leprosy" and on the right side of the fold there is a red figure labeled "bad leprosy" (Appendix D1). The mild leprosy figure

continues down a straight path alongside a pill bottle until he is clear of red dots; the bad leprosy

figure follows a curved path alongside a pill bottle and shelters until it eventually changes colors

into a yellow figure. Both figures arrive at the bottom of the page on either side of the word

"CURED" (Appendix D1). Underneath the previously mild leprosy and bad leprosy figures are

the statements "*Either* you can go on with your work and get treatment at home and will be

cured—" and "*Or* you can go to a segregation village where you will be cured and at the same

time learn useful trades", respectively (Appendix D1). Finally, underneath both of these

statements, located at the bottom of the page is the statement "If everyone helps, all leprosy cases

can be cured and no new cases will occur" (Appendix D1). The design of this pamphlet

emphasizes elements of clarity, user experience, and honesty. The figures and language are

clear, communicating the treatment options to the public, and the use of the fold accounts for

hold the user will interact with the material itself. Finally, the message clearly states that by

taking these actions steps, leprosy can be cured, which is an honest statement that builds trust

with a community during a public health crisis.

Furthermore, there is a clear connection between design and health literacy, with design

increasing the health literacy due to the ability to organize and present information. From the

design of recognizable symbols such as a cross that represents a pharmacy, to clearly

understandable instructions on prescriptions, graphic design is at the core of health literacy

(Gosling, 2017). Moreover, earlier in this paper the connections between literacy levels and

health literacy were discussed. Design has a significant impact on the effective communication

of health information in areas that have low literacy levels (Roberts, 2020). For instance, when

observing the Ebola public health crisis of West Africa in 2014, one can observe the

effectiveness of posters that illustrated symptoms to their audience. These posters, designed by

Cisse in partnership with The United Nations Children's Fund (UNICEF), displayed illustrations

of symptoms such as chills, diarrhea, headaches, and vomiting, in order to communicate the

symptoms of Ebola to communities with low literacy rates (Appendix D2). These posters also

showcase clear and uncluttered design, the only words present reading "CALL 117 IF THESE

SYMPTOMS DEVELOP" with "117" in red colored type to emphasize the action step

(Appendix D2). Thus, when examining this public health design in response to Ebola, it is

possible to recognize design principles such as clarity and clear focal point that should be used

when designing for low literacy communities such as Flint.

COVID-19 Response

In late December of 2019 and January of 2020, a coronavirus labeled COVID-19 broke

out in Wuhan, China and began what quickly became a global pandemic. Though information

about this pandemic and virus is available and will be discussed, not all information will be

conclusive due to the relevance and currency of COVID-19 virus throughout the globe at the

time of this study. Additionally, information regarding the COVID-19 pandemic may update

and change as the pandemic progresses over time and more information and research is released.

This virus began in Wuhan, with medical professionals recognizing an outbreak of

pneumonia cases, leading the World Health Organization (WHO) to be notified, soon

understanding this virus to be a coronavirus, named COVID-19 (Wu & McGoogan, 2020). The

virus quickly spread across the country of China within just 30 days, quickly continuing to

Europe and then countries around the world, including the United States in early March of 2020.

As the world experiences this pandemic, there are many reactions of fear, panic, stress, and

confusion present. In order to address these concerns and clearly communicate the prevention

techniques, symptoms, and information of government regulations, public health communities

have considered design choices in the communication of their messages. In order to ensure design clarity, a global call was made to designers around the world to submit design work that represented these ideas to communities worldwide.

In late March 2020, the United Nations (UN) launched a global call to creatives for design work that would help communicate messages about COVID-19 clearly in order to help stop the spread of the virus (United Nations, 2020). Within this call to designers, the UN requested designs to "help in translating critical public health messages, into work that will engage and inform people across different cultures, languages, communities and platforms" (United Nations, 2020). The prompt for creative work asked that designs encompass at least one of the "UN key messages" which include "personal hygiene, physical distancing, know the symptoms, kindness contagion, myth-busting, [and] do more, donate" (United Nations, 2020). The UN call accepted submissions in a variety of mediums ranging from illustration and graphic design to written copy or activity concepts.

This global call to designers is a key example of the intersection between public health needs, health literacy, and design. The COVID-19 pandemic presents a large amount of need within the global public health community, especially in the area of health literacy. As the virus spreads quickly, fear and confusion also spread quickly, causing barriers to communities clearly receiving the health messages being conveyed by health professionals. This situation also highlights a need for messages that are clear and easy to understand in order to approach all levels of health literacy, especially those of low health literacy communities. Clear design allows these key messages to be communicated, despite varying levels of health literacy, aiding in reducing fear and confusion throughout the world. The UN's call for designs received hundreds of submissions, showcasing the potential for the role of public health design in

combating low health literacy in times of public health crises. Thus, this situation suggests the potential for design to convey key public health messages with clarity and efficiency, despite low literacy levels in communities experiencing public health crises, such as Flint, Michigan.

Potential Design Interventions for Flint

After reviewing various design examples through both historic and present public health crises, there is clear potential for design to help rebuild trust amongst the communities affected by the Flint Water Crisis, despite low health literacy levels. As seen through these aforementioned public health crises, clarity and illustration-heavy designs prove to be effective when designing for low literacy communities. In order to be successful, both the design and its message must be clear. For the design to achieve clarity, it must highlight design principles of balance and emphasis, inherently directing those without any artistic training to the key message of the design. Moreover, it must contain a message that is clear and easy to understand. This means that successful designs should contain easily recognizable images and graphics, allowing the viewer to understand the message without requiring literacy skill. If copy or text is included, it should be approachable, without any type of jargon, and containing honest and focused language. Furthermore, effective design needs to be easily transferrable across a variety of languages and media platforms, increasing the accessibility. Effective design also needs to be cohesive, taking time to develop a clear and considered brand.

In the case study of the Flint Water Crisis, these design strategies can be used to recommend a public health design campaign, able to be implemented in efforts to rebuild trust in public health messages throughout the Flint community. Primarily, it is possible to begin by establishing the strengths of the Flint Registry's current branding strategy to set a foundation for a proposed design. The Registry's design presents a considered brand strategy, using two

primary colors (both varieties of blue), a clean logo, and heavy illustration use. Within their brand they have an established slogan "Get connected. Get supported. Get counted." (Appendix C1). This is important to consider when crafting a campaign message, making sure to keep the messages consistent. Additionally, it is key to use clear illustrations in any future campaigns, as seen in Neurath's public health designs (Appendix D1). The use of recognizable icons and figures aids in clear communication of public health messages despite low literacy levels. Along with this use of illustration, text should be used only to convey essential messages. For instance, when reviewing Bourdon's design, the reliance on illustration and limited text allows the viewer to understand the message without literacy skills (Appendix E1). Both the text and illustrations of this campaign must be organized with a clear visual hierarchy, as seen in Adler's redesign of prescription bottles (Appendix A2). These messages should also avoid public health jargon and communicate messages using direct and easily understood statements. Finally, this campaign must be transferrable across several media platforms and a variety of languages to effectively communicate with all of Flint's residents. As seen with the few Hispanic designs and the Arabic design by the Flint Registry, Flint's population presents a need for multilingual campaign messages (Appendix B, C, & F). To achieve this accessibility, it is crucial that this campaign design be focused and simple, able to transfer easily across languages and be manipulated through print, web, and multimedia platforms while retaining clarity. Therefore, by implementing these recommendations, a successful design campaign can be built to continue rebuilding the trust in public health messages throughout Flint.

Limitations and Implications

Examining design interventions in both past and current public health crises provides a framework for future design interventions to be implemented to help rebuild trust in the Flint

community. This study presents the opportunity for a public health campaign to be designed and distributed in Flint, seeking to rebuild trust throughout the community amongst residents who have been afflicted by the Flint Water Crisis. However, though this study identifies the potential for a campaign, limited resources keep this campaign from being a present reality. Thus, this provides the opportunity for further research to build on this study, implementing this design campaign and examining the success of its ability to reestablish trust and transparency. Further research on the intersections between the disciplines of public health and design is also encouraged by the findings of this study.

Conclusion

After discussing literacy, health literacy, and design principles, it is clear that a significant relationship exists between these elements and their impact on public health crises. This Flint Water Crisis case study illuminates the impact that effective design has on communities within the occurrence and recovery of public health crises. When design is considered and well developed, key public health messages can be communicated efficiently, sharing information of symptoms, warnings, and resources with residents, despite low literacy. As the global COVID-19 pandemic spreads, improved health literacy is essential and the need for effective public health design is ever growing. Successful public health design has the power to increase health literacy and decrease fear, leading to more effective communication throughout crises and increased trust in health messages.

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Appendix A

A1: The standard bottle and label design for prescription medicines before the redesign proposed

by Deborah Adler in 2005. Photo credited to Davies + Starr (as cited in Bernard, 2005).

A2: Deborah Adler's solution to redesigning Target's prescription bottles in 2005.

 Photo credited to Davies + Starr (as cited in Bernard, 2005).

Appendix B

WE NEED TO HEAR FROM YOU

As the City of Flint continues to recover from the water emergency, officials must determine a permanent primary and back-up drinking water source. It is important that you are informed and involved in the process before a final decision is made.

What is being recommended?
City officials are recommending the City of Flint stay with Great Lakes Water Authority (GLWA) as its primary source of water and use Genesee County as its back-up water source.

What are some highlights of this recommendation?
- **Protects public health:** There would not be another water switch, which reduces concerns that may result from another change in the water source;
- **Relief for residents:** Flint residents would gain access to a low income assistance program to help pay their water bills;
- **Lowest cost option:** This is the lowest cost option, which could help minimize water rates;
- **Pipe replacement:** More funding for the FAST Start pipe replacement initiative and other improvements to Flint's water quality monitoring and delivery system; and
- **Upgrades to the system:** Helps Flint position itself to build a state-of-the-art, 21st-century water distribution system that is right-sized and equipped with features such as real-time monitoring of water quality, new pumps, and smart meters.

How can I get more information?
There is a 30-day comment period, visit CityofFlint.com for more information.

How can my voice be heard?
Questions and comments can be shared at flintwatersourceinfo@cityofflint.com during the 30-day comment period ending on May 20, 2017.

B1: Flint PSA mailed to residents on May 4, 2017, in reference to a potential additional water switch and requesting feedback.

City of Flint. (2017). Flint resident PSA English. [Print PSA].

https://www.cityofflint.com/2017/05/04/psa-airing-postcards-to-be-sent-to-help-inform-

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NECESITAMOS OÍR DE USTED

Mientras la ciudad de Flint sigue recuperándose de la emergencia de agua, los oficiales deben determinar una fuente de agua potable que sea principalmente permanente. Es importante que usted este informado y participe en el proceso antes de una decisión final.

¿Que es lo que se recomienda?
Los oficiales de la ciudad están recomendando que la ciudad de Flint siga usando el Great Lakes Water Authority (GLWA) como su fuente primaria de agua y utilizar el condado de Genesee como su fuente alternative de agua.

¿Cuáles son algunos aspectos destacados de esta recomendación?
- **Protege la salud del público:** No habría otro interruptor de agua, que reduce la preocupación de que pueda resultar otro cambio en la fuente de agua;
- **Alivio para los residentes:** Los residentes de Flint podrían acceder un programa de asistencia para personas de bajos ingresos para ayudar a pagar sus facturas de agua;
- **Opción de costo más bajo:** Esta es la opción de costo más bajo, que podría ayudar a reducir al mínimo las tarifas de agua;
- **Reemplazo de tuberías:** Más fondos para la iniciativa de sustitución de tubería FAST Start y otros mejoramientos de Flint en el monitoreo de la calidad del agua y sistema de entrega; y
- **Mejoramientos al sistema:** Le ayuda a Flint a posicionarse para construir un estado técnico, un sistema de distribución de agua del siglo 21 que es adecuado y equipado con funciones como la monitorización en tiempo real de calidad de agua, bombas nuevas e medidores inteligentes.

¿Cómo puedo obtener más información?
Hay un periodo de 30 días para comentarios, visite CityofFlint.com para más información.

¿Que se necesita para que se oiga mi voz?
Preguntas y comentarios pueden ser compartidos en flintwatersourceinfo@cityofflint.com durante el período de comentarios de 30 días que terminará el 20 de mayo de este año.

B2: Spanish design of Flint PSA mailed to residents on May 4, 2017, in reference to a potential additional water switch and requesting feedback.

City of Flint. (2017). Flint resident PSA Spanish. [Print PSA].

https://www.cityofflint.com/2017/05/04/psa-airing-postcards-to-be-sent-to-help-inform-residents-of-water-source-recommendation/

Appendix C

C1: English Flint Registry overview brochure released to the public in 2018.

Flint Registry. (2018). Spanish Flint Registry brochure. [PDF]. Retrieved from

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C2: Spanish Flint Registry overview brochure released to the public in 2018.

Flint Registry. (2018). Spanish Flint Registry brochure. [PDF]. Retrieved from

       https://www.flintregistry.org/wp-content/uploads/2019/04/FR_trifold-V3-
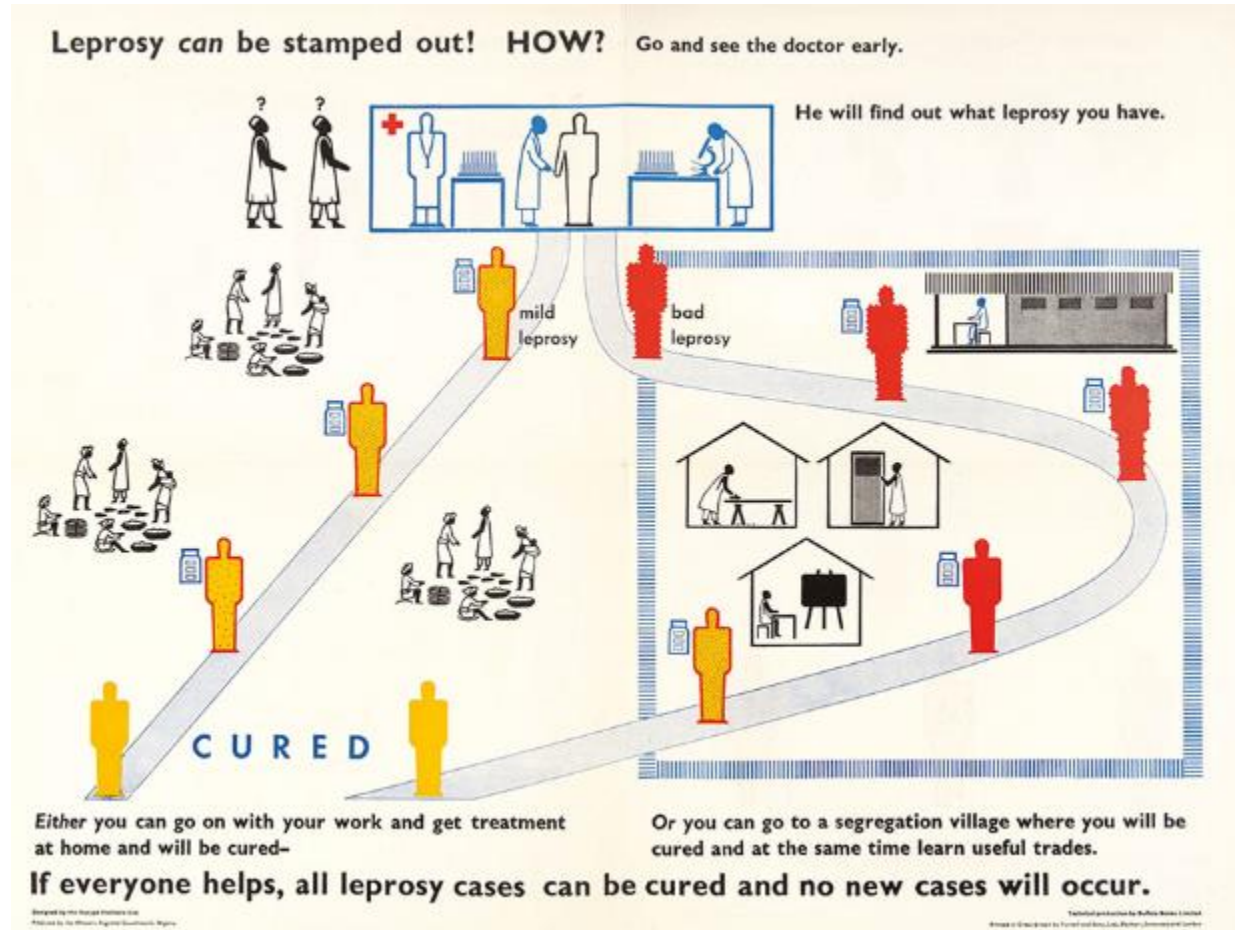
       Outreach_Translation_es-MX.pdf

C3: Arabic Flint Registry overview brochure released to the public in 2018.

Flint Registry. (2018). Arabic Flint Registry brochure. [PDF]. Retrieved from

   https://www.flintregistry.org/wp-content/uploads/2019/04/FR_trifold-V3-

   Outreach_Translation_ar-SA-1.pdf

Appendix D

D1: Leprosy pamphlet showcasing use of effective use of icons and color.

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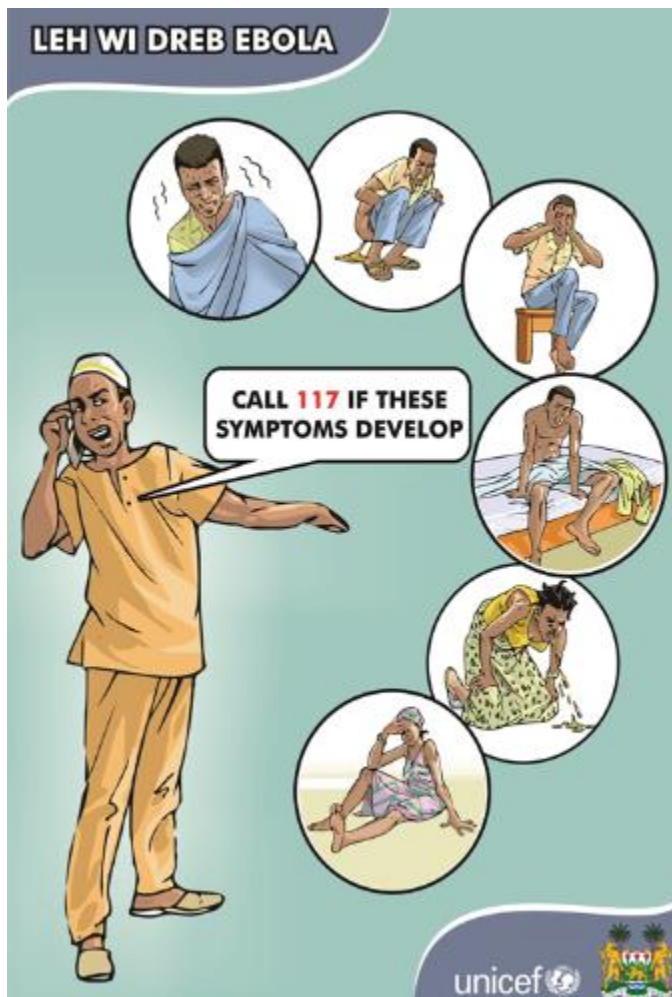
D2: Ebola poster showing illustration heavy design used in low literacy communities.

Cisse, S. (Illustrator). (2014). Ebola poster [Graphic design]. In Roberts, L. (2020). What role

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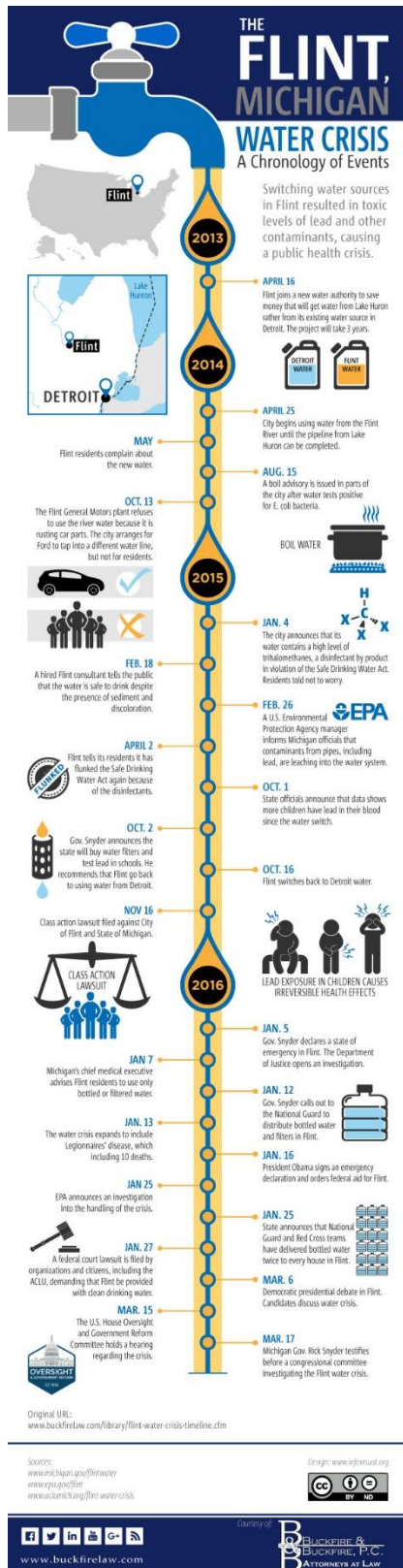
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Appendix E

E1: Flint Water Crisis piece designed in response to Flint residents' experiences.

Bourdon, V. (Designer). (2017). Flint water crisis [Graphic design]. Retrieved Jan. 28, 2020

from *Applied Arts Magazine.*

E2: Buckfire Law Firm. (2016). Flint water crisis timeline [Infographic]. Retrieved from

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Appendix F

F1: Spanish billboard warning residents that boiling water does not remove the lead.

Zarowny, N. (Photographer). (2016). [Spanish Flint Water Crisis boiling billboard]

    [Photograph]. Retrieved from https://www.vice.com/en_us/article/3b48xn/what-its-like-

    to-live-through-flints-water-crisis-when-you-dont-speak-english

F2: Bilingual billboard warning residents to avoid running hot water through filters.

Zarowny, N. (Photographer). (2016). [Bilingual Flint Water Crisis billboard] [Photograph].

Retrieved from https://www.vice.com/en_us/article/3b48xn/what-its-like-to-live-through-

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