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Research Article

Flint's Water Infrastructure Violence: Resulting in 10 Years of Inequality

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Abstract

This paper delves into the complexities of the Flint Water Crisis, examining the environmental, moral, and systematic impacts of the crisis through the lenses of critical climate justice, structural violence, and public health regulations. By analyzing case studies from various regions in the United States, the paper highlights consistent patterns of environmental injustices and disparities that disproportionately affect marginalized communities. Scholars' discussions underscore the interconnectedness of social, economic, and environmental factors contributing to water crises and emphasize the urgent need for comprehensive reforms in governance and policy implementation. This paper calls for transparent governance, ethical decision-making, and proactive measures to prevent similar crises in the future and ensure equitable access to clean and safe water for all individuals.

Keywords: Water; Infrastructure; Environmental Justice; Structural Violence; Public Health; Flint water crisis; Critical Climate Justice.

Introduction

Have you ever had to worry about water insecurity? Have you ever wondered about having to look for clean drinking water and have to bear the financial repercussions? Flint residents did and still do. In April 2013, the decision was made to build a new pipeline and connect to a new system, The Karegnondi Water Authority [1]. This water infrastructure change was estimated to save '$200 million over 25 years' [1]. In April 2014, Flint, Michigan switched its water supply from Detroit's treated Lake Huron water to the Flint River as a temporary measure while a new pipeline was being built. This change led to several problems, including damaged water infrastructure, deadly bacterial outbreaks, and lead contamination of drinking water. Lead pipes have been used in water systems for centuries, but their use declined due to health concerns. Iron and Lead pipes were used until it became apparent this was toxic to water infrastructure [2]. Lead was then used because it was better than Iron, as it was easier to make and shape pipes until the 1920s when this too became toxic for water infrastructure [1]. Yet, many cities in the United States of America, including the city of Flint, still have lead pipes. For the context of this paper, the goal is to answer the questions "What were the environmental and moral impacts? And, how did government officials and structural violence integrate into public health regulations that are implemented by the state and how did agencies respond to the Flint Water Crisis?" To prove this type of violence is often integrated into the economic, political, and social systems of society, leading to inequalities and injustices that can have long-lasting effects on communities involved, such as Flint. I aim to do this by employing a theoretical approach that will consist of environmental governance which looks at the role and responsibilities of various actors in the Flint water crisis by using the critical climate justice approach from Sultana (2022) [3] and the structural violence concept from Rathanahan (2017) [4] to identify the moral and environmental implication. Along with linking how key factors such as government officials like former Michigan Governor Rick Snyder, emergency managers appointed by the state, officials from the Michigan Department of Environmental Quality, and officials from the Environmental Protection Agency contributed to this crisis. The crisis also involved residents, activists, and researchers who raised concerns about the water quality in Flint.

Theories and Approaches

Firstly, an approach used is Critical Climate Justice is described as "Climate justice fundamentally is about paying attention to how climate change impacts people differently, unevenly, and disproportionately, as well as redressing the resultant injustices in fair and equitable ways" (Sultana 2022) [3] and links to structural violence, which refers to when social structures, institutions, and systems harm individuals by preventing them from meeting basic human needs. This is highlighted in Ranganthan's article "The Environment as Freedom: A Decolonial Reimaging" when they say, "But lead leached from aging pipes is only one symptom of a longer history of federally-enforced segregation, the criminalization of poverty, and neoliberal austerity. Other symptoms include the lack of decent schools, poor food and nutrition, high maternal mortality, and the steady erosion of intergenerational wealth. This is the structural violence that marks environmental unfreedoms" (2017). This type of violence is often integrated into the economic, political, and social systems of society, leading to inequalities and injustices that can have long-lasting effects on communities involved, such as Flint. Similarly, Sultana (2022) [3] highlights structural inequalities and power relations of capitalist patriarchy occur across household community, state, and international levels revealing barriers and opportunities and vulnerable communities which we see in the Flint Water Crisis. Sultana uses the concept of Critical Climate Justice to invoke how it is a social and environmental issue. Sultana uses a framework of intersectionality to identify inequalities in water infrastructures. By examining power dynamics, policy frameworks, and regulatory practices, this study aims to uncover the systemic issues that perpetuated the crisis and hindered effective responses which were demonstrated during the Flint Water Crisis as government officials placed money at a higher need than low-income and minority communities' access to clean and safe drinking water. Considering Sultana's work as an example of Western influence on the developing world, it is essential to recognize the need for a critical and reflective approach to knowledge production and policy implementation. Sultana's scholarship emphasizes the importance of moving away from quick technomanagerialistic solutions and confronting capitalist extractives and climate colonialism. This approach aligns with the need to avoid imposing Western-centric solutions on unique problems faced by the rest of the world. Instead, Sultana's work advocates for collaborative planning, ethical research designs, and solidarity praxis that can draw from feminist and other critical bodies of scholarship and activism. The Flint water crisis is a pertinent example of environmental injustices and systematic failures. The crisis involved the contamination of the city's water supply with lead, disproportionately affecting marginalized communities and predominantly African American communities. The situation in Flint exemplifies the intersection of environmental, racial, and social injustices, as well as the consequences of inadequate governance and policy failures.

Infrastructure Challenges

In the Flint Water Crisis, several infrastructure challenges contributed to the crisis. Firstly, aging water infrastructure, Flint's water system was old and in need of new pipelines, leading to issues such as leaking pipes, and inadequate water treatment facilities. Corrosion of pipes, the decision to switch the water source to the Flint River without proper corrosion control measures caused lead to leach into the water supply from again pipes. Immense lack of transparency and communication from officials about the water quality issues and a failure to effectively communicate with residents about the risks they were facing. Social disparities in the crisis highlighted were access to clean and safe drinking water, with low-income and minority communities bearing the brunt of the health effects. However, The US Environmental Protection Agency's Lead and Copper Rule requires regular monitoring and action plans for old lead pipes [5]. Lead pipes are not inherently dangerous, but only if treated with anti-corrosion chemicals can they be beneficial. Orthophosphate is an anti-corrosion chemical that forms a protective layer inside pipes, preventing lead from leaching into the water [1]. Flint did not add Orthophosphate or any anti-corrosion chemicals when switching to Flint River water, despite the presence of iron and lead pipes. The water from the Flint River was known to have had higher than average chloride levels, which contributed to the corrosion of pipes and the leaching of lead [1]. The Flint River water contained high levels of chloride from road salt and a bacterial problem after the switch. The Flint treatment plant increased the amount of chlorine to kill bacteria, but it reacted with metals from corroding pipes, rendering it ineffective. The extra chlorine added to the water reacted with the chemicals from the river water to form disinfection byproducts called trihalomethane [2]. Trihalomethanes are linked to health problems and cancer. Through generations, similar water crises have happened which represents the patriarchal and colonial frameworks that have contributed to these events and allowed for unsafe water to continue to be an issue. America's water infrastructure is failing, with many communities served by outdated and deteriorating systems. 'Approximately 15 to 22 million people in the US rely on lead water lines despite the known health risks and exposures' (Clean Water and Reproductive Justice, 2020). Decreased federal funding for water infrastructure has shifted the burden to state and local governments, leading to inadequate funding and jeopardizing water quality and affordability for residents. The reading by Sultana on "Critical Climate Justice" emphasizes the unequal and uneven burdens of climate change across different communities and regions such as the city of Flint. It highlights the need for a more nuanced and responsive understanding of climate justice, which can benefit from greater engagement with feminist scholarship. This approach reframes debates away from reductionist solutions to more accountable

assessments and actions. In considering human relations to water, it is essential to recognize the interconnectedness of climate justice and environmental issues. Human intervention has indeed led to widespread contamination of water sources, disproportionately affecting marginalized communities which is seen in the racialized, gentrified, and underfunded city of Flint. This underscores the importance of addressing the social and environmental impacts of climate change, as well as the need for collective action and solidarity in pursuing equitable and transformative solutions. Incorporating critical climate justice perspectives can help in understanding and addressing the complex dynamics that contribute to water contamination and its differential impacts on communities.

Lasting Impacts

The socioeconomic impact of water contamination is extensive because it affects the affordability of clean, safe water. With water and water waste costs more than doubling since the 2000s, this has created financial instability for many. Women of color are disproportionately likely to have lower incomes and face higher out-of-pocket costs for healthcare, making the rising costs of drinking water a dire threat (Clean Water and Reproductive Justice, 2020). The intersectionality between water infrastructure and the socioeconomic impacts of contaminated water represents the concept of structural violence frameworks at play. As well, water shutoffs disproportionately affect women of color, particularly those who are heads of households, caregivers of children, and those not eligible for government assistance programs, this is reflected in the following case studies (Clean Water and Reproductive Justice, 2020). The article "Clean Water and Reproductive Justice: Lack of Access Harms Women of Color" by the National Partnership for Women and Families (2020) says the contamination "can damage children's nervous systems and hinder brain development" which highlights the structural violence this contamination has caused for many people in the community. Importantly, Ranganathan highlights how governments manipulate the concept of Freedom to adhere to what works in favor of the rich to make them richer through Structural Violence which relates to the infrastructural problem of lack of communication within Government officials. Ranganathan highlights Mainstream Environmentalism is not doing enough to support inequalities in non-white communities.

Irreverable harm challenges that are important to note are that this water switch is not only affecting homes but other infrastructures such as schools creating irreversible health issues in children such as reproductive "The water poisoning in Flint caused undeniable harm to residents' reproductive health. Analyzing health records from 2008 to 2015, researchers found that fertility rates in Flint dropped by 12 percent and fetal deaths rose by 58 percent after the water was switched to the Flint River in 2014" [6]. Anand's article reflects the making of urban inequalities within infrastructure and water infrastructure failures that led to structural violence against poor citizens. The article relates the incident in Flint to a similar issue in Mumbai [6]. This is important because it highlights these injustices and evaluates the wide level of water infrastructure violence against marginalized communities and how these incidents have been swept under the rug by government officials. Additionally, Sultana (2013) emphasizes how social relations and waterscapes are interconnected in producing inconsistent water infrastructures [7]. The text explores the complex relationships between water, technologies, social relations, and development in the Global South. We can relate this to Flint because of the similarities in the arguments. The contamination analyzed in the article challenges the narrative of progress and illustrates the unforeseen consequences of decisions made by government officials.

Case Studies

Three particular case studies highlighted in "Clean Water and Reproductive Justice | Lack of Access Harms Women of Color" by The National Partnership for Women and Families are San Gabriel Valley; San Joaquin Valley, California; and South Bend Indiana. These case studies provide an example of how the concepts of Structural Violence and Critical Climate Justice apply to the Flint Water Crisis and many other crises that Americans face. Representing structural violence through the disproportionate and inadequate healthcare and water systems that contribute to so many other socioeconomic issues mentioned before. Critical Climate Justice is represented through the way intersectionality is presented through poverty, sexism, racism, environmental racism, and healthcare institutional issues. This intertwines how we view these issues because of the intersectional lens and frameworks, society can better understand the way intersectionality is a domino effect in this setting. Firstly, in the San Gabriel Valley, over half a million Asian American people and 7,000 Native Hawaiian and Pacific Islander people live in an area with rampant pollution and contaminated drinking water. Again, American people in the San Gabriel Valley are more likely to die of cancer than any other racial group, and many face health disparities due to inaccessible healthcare and cultural barriers. 'In 2017, five companies agreed to finance the water cleanup in San Gabriel Valley' (Clean Water and Reproductive Justice, 2020), but this does not address the socioeconomic and health damage already done to Asian Passaic American communities. Secondly, the case of San Joaquin Valley has the highest rates of drinking water contamination in the state due to excess manure and fertilizer runoff from intensive agriculture and dairy production. 'Nitrate contamination" is the most prevalent contamination in San Joaquin Valley's water supply and poses serious health concerns'(Clean Water and Reproductive Justice, 2020). Tulare County, with a large Latinx population, faces reproductive health issues significantly higher than white residents within California, due to nitrate contamination

and groundwater contamination (Clean Water and Reproductive Justice, 2020). Lastly, another case study worth noting is the example by Beidinger-Burnett et. al which highlights the EBLL in South Bend Indiana, and surrounding areas to emphasize the risk factors and the inconsistent lead screening rates. This article provides research with relevant evidence that relates to the Flint water crisis, which was not an isolated event and indeed is an epidemic in the United States that has failed on multiple occasions to regulate lead levels in the drinking water of US communities. These case studies demonstrate consistent structural violence and critical climate injustices similar to the Flint water crisis through patterns of environmental racism, inadequate healthcare access, and disproportionate impacts on marginalized communities. The communities in the San Gabriel Valley, San Joaquin Valley, and South Bend Indiana, like those in Flint, face systematic barriers such as contaminated water sources, health disparities, and environmental hazards that result in socioeconomic inequalities and institutional neglect. By highlighting these parallels with the Flint water crisis, these cases underscore the broader issues of systematic injustices in access to clean water, healthcare, and environmental protection that significantly disproportionately impact marginalized communities across the United States. Furthermore, Nikki Anand in "The Banality of Infrastructure" ties these concepts together in a unique way when they state, "These rather spectacular events are not only sites for performances of environmental injustice. They also reveal how infrastructures operate with multiple temporalities that distribute life and harm. As they accrete and distribute resources over time, infrastructures call for an accounting of the world that recognizes how past histories of injustice are remade and realized anew" (2017). This statement represents how Critical Climate Justice and Structural Violence concepts apply through the intersectionality of colonialist histories and the current infrastructure epidemic. As explained before, we can relate this to Flint because of the similarities in the arguments and the contamination analyzed in the article challenges the narrative of progress and illustrates the unforeseen consequences regarding health, and healthcare decisions made by government officials that reflect Structural Violence in Institutionalized sectors.

Results Amongst Scholars

Scholars such as Miller and Wesley utilize the factors contributing to the Flint water crisis and relate them to local and global social justice concerning environmental toxins and biopolitics. The article contributes to advances in the environmental justice literature that allow the research to link critical climate justice frameworks to the Flint water crisis by stating, "Biopolitics is regarded as the interaction between biology and politics where a person's biological makeup predisposes them to a host of risks. The Michigan governor's decision to replace locally elected officials represents this new era of political modernity, wherein elected leaders are replaced by technocrats" [8]. This quote highlights the intersection of local and global social justice concerns regarding environmental toxins, biopolitics, and the impact of toxic exposure on communities. The replacement of locally elected officials in Michigan signifies a shift towards technocratic governance, where decisions are made based on expertise rather than a democratic process. This move reflects a form of biopolitics, where biological factors predispose individuals to various risks, influencing political decisions that affect public health and environmental well-being. Moreover, the concept of "community anomie" is as follows "Neighbors and friends who once lived in harmony may no longer trust elected officials, leaders, or each other after an exposure event because of the perceptions of benefits, or magnitude of loss in the aftermath of toxic exposure is related to what Bell cites as a form of "community anomie," which causes residents to distrust one another and withdraw from collective life" [80. This emphasizes the breakdown of trust and social cohesion within communities following toxic exposure events. This breakdown can lead to withdrawal from collective life such as social fragmentation and loss of trust exacerbating environmental injustices, as affected communities struggle to advocate for their rights, access resources, and address the health impacts of toxic exposure. All leading to a broader social justice implication of environmental toxins and biopolitics highlighting how power dynamics and community responses intersect to shape the disruption of environmental risks and impacts. Additionally, Hughes exposes the relevance of rationalized policy and reflects on how it played a major role in motivating, facilitating, incentivizing, and allowing mistakes and decisions that created the Flint water crisis. It expands on the failure of policies to protect public health and politics and power roles. Results of the power and issues with power in government officials. This specifically highlights the role of rationalized policy in two specific domains: drinking water protection under the federal Safe Drinking Water Act's Lead and Copper Rule and municipal financial distress response under Michigan's Local Financial Stability and Choice Act [5]. Hughes argues that elected officials and administrators in both domains prioritized technical and financial merits over the public interest, ultimately leading to the extended contamination of Flint's drinking water. Furthermore, this reflects on the failure of policies to protect public health and the role of politics and power in shaping these policies. She emphasizes that rationalized policy, which is framed as potentially neutral or solely technical, often prioritizes and empowers certain interests while marginalizing and disempowering others, particularly poor and minority communities. For example, the Flint water crisis, where inadequately treated Flint River water exposed residents to water contaminates, leading to elevated lead levels, persistently elevated levels of disinfection byproducts, and an outbreak of Legionnaires' disease [5]. Hughes also discusses the entrenchment of rationalization in policy domains and the lack of accountability in government responses to the crisis, highlighting the systematic

and policy-driven failures of governance. The crisis has been linked to adverse health effects, including elevated blood lead levels in children and higher rates of infertility and miscarriage in pregnant people, particularly affecting poor children and families [5]. Overall, Hughes' analysis sheds light on the deeply political nature of safe drinking water provision in the United States and the consequences of rationalized policy, particularly in the context of the Flint water crisis. She calls for a critical examination of policies and their impact on public health, as well as the need for alternative policy approaches to address the marginalizing effects of rationalized policies and ensure the protection of communities. Moreover, the article by Gostin about the crisis highlights a lack of oversight and potential criminal negligence, with significant costs now incurred to repair and damage water systems. Gostin raises questions about accountability, justice, and the need for systematic changes to prevent similar issues in other economically disadvantaged commentates across the country. The article highlights responsible systems and the interconnectedness of water infrastructure, marginalized communities, and systematic failures. The legal ramifications of the Flint water crisis have been significant, with criminal charges being filed against government officials and employees for their roles in the disaster. These legal actions have shed light on the failures of the system to protect the rights and health of the people of Flint, as well as the need for accountability and justice. Criminal charges and negligence are stated as "The Michigan attorney general has charged three men to date for covering up the health hazards. Two Michigan Department of Environmental municipal water regulars have pled not guilty to charges of misconduct, tampering with evidence, and violations of laws they were charged with enforcing" [9]. The legal ramifications of the Flint water crisis have not only brought accountability to those responsible but have also highlighted the need for systematic changes to prevent similar disasters in the future. Legal Hurdles and Sovereign Immunity is as stated "Governments claim sovereign immunity against civil liability, except for a few narrow exceptions. To overcome this hurdle, plaintiffs will have to demonstrate that officials were grossly negligent, perhaps even acting intentionally, which means that they would not be subject to immunity because they were not acting in good faith" [9]. By holding officials accountable and seeking justice for the affected residents, these legal actions contribute to the ongoing efforts to address the crisis and its lasting impact on the community. Conclusively, in the article by Sadler et al., the authors emphasize the importance of understanding the impact of social and built environmental variables on blood lead levels (BLL) in the context of the Flint water crisis [10]. They highlight the need to prioritize response efforts in neighborhoods with the highest risk levels based on these factors. The following reinforces the importance of responses to high-risk neighborhoods, "When we compared levels before and during the water crisis, we saw the highest estimates or predicted BLLs during the water crisis and the greatest changes in BLLs in neighborhoods with the longest water residence time in pipes, oldest house age, and poorest average neighborhood housing condition" [2]. As well as, "Key social and built environmental variables correlate with BLL; such information can continue to guide response by prioritizing older, deteriorating neighborhoods with the longest water residence time in pipes" [2,11]. These quotes highlight the significance of considering social and built environmental factors in deteriorating BLL and underscore the importance of targeting interventions in neighborhoods most at risk. The decision to change the water source without proper corrosion control measures in place led to the contamination of the water supply with lead, this decision disproportionately affected marginalized communities in Flint exacerbating existing social inequalities. The elevated BLLs in children from these communities can be seen as manifestations of structural violence, where systematic factors contribute to health disparities and harm [12,13]. Along with prioritizing response to neighborhoods with the highest risk levels of lead exposure, based on social and built environmental factors, there is an opportunity to address these injustices and work towards environmental justice. Critical climate justice frameworks emphasize the need to consider social, economic, and racial disparities in environmental decision-making and policy implementation. The link between BLL in the Flint water crisis, structural violence, and critical climate justice underscores the importance of recognizing and addressing the systematic factors that contribute to environmental harm and health disparities. By understanding and addressing these intersections, efforts can be made to promote equity, justice, and sustainability in environmental and public health interventions.

Conclusion

In conclusion, the environmental and moral implications of the Flint water crisis were profound and far-reaching. The decision to switch the water supply to the Flint River resulted in damaged water infrastructure, deadly bacterial outbreaks, and lead contamination of drinking water. This contamination had severe health implications, particularly for vulnerable populations, leading to long-term health issues and concerns. The Flint water crisis stands as a stark reminder of the intersectionality of environmental justice, structural violence, critical climate justice and public health regulations within society. The detrimental effects on human health, the prolonged lack of access to clean water, and the systematic inequalities highlighted by this crisis underscore the urgent need for comprehensive reforms in water infrastructure, management, and governance. Government officials and structural violence played significant roles in exacerbating the crisis. The critical climate justice approach and the concept of structural violence highlighted how social structures and systems harmed individuals by preventing them from meeting basic human needs. Government

officials, including former Michigan Governor Rick Snyder and emergency managers appointed by the state, failed to prioritize the well-being of Flint residents over cost-saving measures and bureaucratic processes. This neglect institutionalized forms of violence that perpetuated inequalities and injustices within the community. The discussion amongst scholars has significantly contributed to the claim by providing a comprehensive analysis of the systematic issues underlying the Flint water crisis and offering insights into the broader implications for environmental justice, public health, and governance. This paper has highlighted the intersectionality of environmental, racial, and social injustices in the context of water infrastructure crises, emphasizing the need for a critical and reflective approach to policy implementation and knowledge. By examining power dynamics, policy frameworks, and regulatory practices, this paper has uncovered and connected the systemic failures and injustices that perpetuated the crisis in Flint and hindered effective responses. The case studies evaluation amplifies the claim of Flint's water crisis by highlighting the consistent patterns of structural violence and critical climate justice injustices in the USA, similar to those experienced in Flint. The case studies strengthen the argument that issues of structural violence, critical climate justice, and institutional neglect are pervasive and recurring challenges faced by communities across the country.

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