Disproportional Effect of Congenital Heart Disease on People of Low Socioeconomic Status

A Research Paper submitted to the Department of Engineering and Society

Presented to the Faculty of the School of Engineering and Applied Science

University of Virginia • Charlottesville, Virginia

In Partial Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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Spring 2024

On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Introduction

During a routine check-up, a child's doctor listened intently to his heart, explaining that his fainting spells were likely due to a congenital heart defect, plunging him into a world of uncertainty and medical complexities he never imagined. Congenital Heart Disease (CHD) involves abnormalities that develop in the heart before birth and is the most common type of birth defect in the world (CDC, 2019). Pediatric CHD is a heterogeneous field with complex medical anatomy, surgical procedures and catheter based interventional care. Approximately 40,000 babies are born with congenital heart disease each year in the United States and it affects around 1% of all live births worldwide, making it one of the most prevalent conditions amongst newborns (CDC, 2023).

Within this disease, there is a disparity seen with people of a lower socioeconomic status having a higher likelihood of being diagnosed with Congenital Heart Disease. The caveat here is that CHD is a genetic disease, therefore insinuating that this disparity exists due low-income families being over exposed to a certain negative epigenetic factor leading to CHD. Epigenetic factors are environmental or behavioral factors that can cause changes affecting the way an individual's genes work, and in the case of CHD harmful environmental pollutants were found to be a significantly negative epigenetic factor. A thorough literature review detailed later in the paper revealed that low-income families are overexposed to harmful environmental pollutants due to the places they live. This leads to the question why is government and low-income housing overly exposed to harmful negative pollutants, why is the same not happening for higher income families?

I argue that historical housing policy and land desirability has led to low-income families systematically being forced to live near highly polluted or industrial areas. This has ultimately

led to years of being exposed to the negative epigenetic factor of air pollution, causing an increased chance of a CHD diagnosis in this population. The literature review first touches upon the evidence that this disparity exists in the first place, and then moves to proving that negative air quality has been linked to an increased risk of CHD. Given this information, it is then shown that people of a lower socioeconomic status are far more exposed to negative air quality therefore leading to this increase seen in CHD diagnosis. Through the use of historical analysis and policy research, I use a variety of primary and secondary sources to understand government zoning laws in urban contexts and why these areas are highly polluted. I analyze my research from the perspective of Langdon Winner's "Do Artefacts Have Politics?" framework (Winner, 1980). I explored government housing historically being built on cheap and undesirable land, historical exclusionary zoning laws, and policy on superfund sites. Finally, I end with a brief discussion of the implications of these findings and the ultimate goal of addressing systemic inequality on this subject of disparity seen with CHD diagnosis.

Literature Review

It is important to first understand that people of a lower socioeconomic status are disproportionately affected by CHD. This disparity is seen throughout not only the US, but the entire world. A California study found that "increased social deprivation and exposure to environmental pollutants are associated with the incidence of live‐born CHD" (Peyvandi et al., 2020). In this study social deprivation refers to socioeconomic status and includes variables such as income, education, and occupation. It was found that factors such as low-income and little education, often associated with families of a low socioeconomic status, led to an increased prevalence of CHD diagnosis. Moving to a more holistic perspective, a systematic review found that "the effect of socioeconomic status on the outcomes of congenital heart disease is profound

and reaches beyond the association with racial and ethnic minorities" (Nashed & O'Neil, 2022). Another systematic review found that social determinants of health, essentially meaning one's socioeconomic environment, are significantly associated with adverse CHD outcomes (Davey et al., 2021). There is a clear correlation between one's socioeconomic class and one's predisposition to being diagnosed with CHD.

I next wanted to understand exactly why this trend is occurring and what the epigenetic factor is that is causing this disparity, and that factor was found to be negative air quality. Epidemiological studies have strongly suggested that air pollution plays a role in the onset of Congenital Heart malformations (Vecoli et al., 2016). Additionally, a California population-based study found that environmental pollution exposure is associated with increased incidence of CHD amongst live born infants (Peyvandi et al., 2020). Another systematic review found that prenatal exposure to ambient air pollutants increases risk for various CHD subtypes (Michel et al., 2023). There is ample established research supporting the correlation between negative air quality and an increased risk of being diagnosed with CHD.

Further, I wanted to understand why people of a lower socioeconomic are the ones being consistently exposed to this air pollution. A study found that people of a lower socioeconomic status are exposed to far higher concentrations of harmful environmental pollutants across America, and the world shows a similar trend but is less researched (Hajat et al., 2015). Additionally, a recent 2023 study found that low income groups tend to be more exposed to environmental pollutants because they are more likely to depend on jobs with outdoor physical labor (Rentschler & Leonova, 2023). It was also found that households of low-socioeconomic status generally have poorer indoor air quality and worse ventilation leading to overall more exposure to harmful pollutants (Ferguson et al., 2020). The most surprising piece of evidence my

research builds upon is that an investigation revealed “more than 9,000 federally subsidized housing properties sit within a mile of a superfund site, and the government has failed to inform many residents of the potential threats they face” (Caputo & Lerner, 2021). Superfund sites are locations in the US that have been identified by the EPA as overly polluted with hazardous materials and negative contaminants. These sites include places like manufacturing facilities, processing plants, landfills and mining sites, and the surrounding areas. This is a very significant topic for the discussion in this paper as superfund sites are a core issue for low-income families and their exposure to these negative contaminants.

Given this established research on the topic, my paper plans to take this a step further by analyzing the reasons why these low-income families are being forced to live in areas that are far more exposed to harmful environmental pollutants and why the same is not happening for higher-income families. I plan to use Langdon Winner’s “Do Artefacts Have Politics?” (1980) framework to approach this analysis. Winner’s thesis posits that technological artifacts are not neutral tools but rather embody political and social values that shape and influence human behavior and power dynamics. Winner argues that design choices made during the development of technologies can have significant implications for society, influencing who holds power, who benefits, and who is marginalized. He emphasizes that the design and implementation of technologies reflect the values, interests, and biases of their creators, often embedding certain ideologies or promoting specific social arrangements. Winner's thesis underscores the importance of critically examining the socio-political dimensions of technology to understand its broader impacts on society and to ensure that technological development aligns with democratic values and principles of social justice. I consider my research from the lens of how the policy being written is implemented in a way that purposely leads to political biases. Winner accentuates the

design and arrangements of artifacts as a mechanism for the structure of the community, in this case the artifacts are low-income and government housing. In Winner's paper he uses an example of a bridge being built low enough so buses could not get to the beach, essentially racially segregating the beach. This is a similar case study to exclusionary zoning laws discussed in the analysis section.

This established research positions this paper well to further dive into the topic and get to the answer of "why" this trend in increased CHD diagnosis occurs in low-income households.

Methods

I performed a historical analysis on secondary sources focusing on the time period from after World War 2 to the late 1900s. This time period is what set up the neighborhoods to be in the position they are today as that is when almost all the housing laws and policies were written. I focused my search on the United States as that is where the most information on this subject is, and this problem predominantly occurs close to urban environments so I focused my search to examine history near cities such as Chicago. I wanted to determine why government and low-income housing is exposed to harmful negative pollutants, and why the same is not happening for higher income families.

A policy analysis goes hand in hand with the historical analysis in my case, as many of the policies write the story for why historically neighborhoods have been set up the way they are. I looked at first and secondary sources that emphasize government zoning laws in urban contexts. Exclusionary zoning laws have been around since the early 1900s, and they are largely responsible for the residential setups that we witness today. I also wanted to explore the environmental policy of today by reading policy directly from the Environmental Protection

Agency (EPA) and the Department of Housing and Urban Development (HUD). The EPA writes environmental policy and standards for the entire country to follow, so what policies have been initiated, or the lack thereof, to address the problems seen in low-income housing being in close proximity to harmful environmental pollutants. With respect to the HUD, I wanted to see if they have any policies that dictate where they are allowed to build low-income homes, and if policies exist that deem areas uninhabitable due to pollutants.

Analysis

Historically government subsidized housing, which is often the only option for low-income families, has been built on cheap land which lies in industrial and polluted areas. In the outskirts of Chicago a "346-unit complex was built in the footprint of a copper smelter run by Anaconda, which went bankrupt long ago, and next to the U.S. Smelter and Lead Refinery plant that operated from 1920 until it was shuttered for good in 1985" (Caputo et al., 2016). This government housing complex was knowingly built in the footprints of a copper smelter, and next to a lead refinery due to the cost of the land being extremely cheap. This led to soil that contained lead and arsenic levels 228 times higher than deemed safe by EPA standards, ultimately exposing the residents to extremely harmful chemicals that can contribute to increased CHD prevalence. Regarding the same Chicago housing project, "Executive Director Benjamin Lesniak said there was "little available land except in vacant areas which are surrounded by industries and undesirable residential areas," according to a 1966 Chicago Tribune article" (Burnett & Keyser, 2016). Benjamin Lesniak was the director for the East Chicago Housing Authority, and represented the views of local government choosing to build government housing in "undesirable" and industrial areas. This would of course lead to the low-income residents being exposed to far more pollutants directly due to the government choosing these locations for

their housing. The decision-making processes involved in the location of such housing complexes reflected political and economic bias. From Winner's perspective, the artifacts in this context, namely the housing complexes and zoning laws, embody the political and economic interests that prioritize cost-effectiveness and segregation over the health and well-being of low-income residents. Outside of Chicago being an example, the US Department of Housing and Urban Development (HUD) owns, operated, or subsidizes 18,158 properties located within one mile of superfund sites (Pattison, 2021). This is evidence from the HUD itself outlining the sheer number of government properties located close to locations that the EPA deems the most polluted and harmful places in the country. It is evident that when low-income individuals have no choice but to live in government housing, they are subject most of the time to living near or on a superfund site and being predisposed to a CHD diagnosis.

Additionally, there is no legislation explicitly deeming superfund sites uninhabitable or preventing people from living in the government housing near superfund sites. The EPA and HUD are well aware of the problem with government housing being near superfund sites, and in 2022 they claimed to have come to an agreement to "help ensure that residents of HUD properties located on superfund sites are not exposed to contamination above acceptable levels" (Bush et al., 2022). Despite the EPA and HUD acknowledging this issue, no real lobby efforts from them have taken place to pass legislation addressing it in congress most likely because of the costs. This document highlighted above seemed to simply be a crowd pleaser to tell the public that they will attempt to make a difference, but the only way this can really happen is with their efforts to get laws passed. Nothing has changed legislatively in the past 2 years since that document was written, and it was one of the only documents I could find where these two organizations even address this issue. For further emphasis of this, the fact that government

housing sites exist and continue to be built on superfund sites confirms that there is no real legislation disallowing low-income families to live in these areas. There are an estimated "77,000 people who live in federally assisted housing across the United States are at risk of being poisoned by dangerous toxic contamination and the federal government has been aware of this hazard for years but taken no action" (Holford & Pickett, 2020). The reality that the government, which should objectively follow every law and rule in place, allows many of their own housing areas to exist near superfund sites and continues to build more in the same areas is outright proof that there are no real rules in place to protect low-income families from living in highly polluted areas. If legislation passed that disallowed these housing sites to exist in the locations they do today, it would mean the government would have to relocate these housing sites and build new sites in areas that are deemed safe by the EPA, but that simply has not happened.

Continuing from a policy perspective, historical exclusionary zoning laws, which place restrictions on the types of homes that can be built in a particular neighborhood, have led to low-income individuals being forced to live in less desirable areas. St. Louis's 1919 zoning laws preserved residential areas that were often not affordable to African American and low-income families, and when too many people of those populations moved in the zoning was changed to industrial (Rothstein, 2014). This is a prime example of historical zoning laws designed to keep low-income and minority racial groups in pocketed undesirable areas, not allowing them to move near higher-income families. They would also turn places that these low-income families lived in into industrial zones in an attempt to move them out. This would create far more harmful industrial plants near where these people lived, ultimately aiding in the quantity of superfund sites that we see today near low-income housing. Winner's framework on the politics of artifacts

suggests that government subsidized housing and zoning laws are imbued with political and economic agendas, manifesting in the deliberate placement of low-income families in polluted areas. These artifacts not only reflect but also perpetuate power dynamics and inequalities, as seen in the laws designed to segregate low-income and minority groups. The National Bureau of Economic Research found that "measures of zoning strictness are highly correlated with high prices" and "it seems to suggest that this form of government regulation is responsible for high housing costs where they exist" (Glaeser & Gyourko, 2003, p. 35). This study shows a correlation between the use of zoning laws and an increase in housing prices in the area. This trend only accentuates the need for low-income families to live in more and more undesirable areas or in government housing. This also creates a barrier to entry in moving out of these polluted areas, and this historical policy ultimately leads to a systemic issue that becomes harder to fix as time goes on. In the book "*Handbook of Regional and Urban Economics*" the authors found that "in particular, regulation appears to raise house prices, reduce construction, reduce the elasticity of housing supply, and alter urban form … Over time, the types of regulations have expanded and now include urban growth boundaries, minimum lot sizes, density restrictions, and height restrictions, among many others" (Gyourko & Molloy, 2015, p. 1292). The local government's exclusive zoning tactics such as minimum lot sizes and height restrictions contribute to low-income housing not being able to be built in desirable areas. These factors, plagued with political bias, keep desirable areas too expensive for low-income families, therefore forcing them to live in outskirt areas where there is often industrial zoning.

It can be argued that the superfund law, which was passed in 1980 and aimed at cleaning up polluted areas and holding companies accountable for their pollutants, still exists today and therefore there is in fact existing legislation helping these low-income families not be exposed to

harmful pollutants that can predispose them to CHD. A professor at American University claims the program "is a success story" and that the "program is expensive, but it has huge social benefits" (Persico et al., 2020, p. 1087). The problem is the program does not really work anymore. Originally a tax on corporations that caused the pollution "funded the program in its early years, but it expired in 1995. Since then, the government has had to pay for these massive cleanups, many of which have stalled because of funding shortages" (Caputo & Lerner, 2021). In theory the plan sounds great with making the responsible organizations pay for their pollution cleanups, but that has not been the case in almost 30 years. Many of the local governments in these areas are already strapped for money, so there really is not much to spare on superfund area pollution cleanup, and therefore it simply doesn't happen. From an article written in 1996, "after fifteen years of activity, cleanup is still slow. High costs and litigation plague the program. At the end of 1995, 91 sites had been cleaned up, but 1,374 sites remained" (Stroup, 1996, p. 2). Even the EPA administrator at the time said the program "frequently moves too slowly, cleans up too little, has an unfair liability scheme and costs too much" (Stroup, 1996, p. 3). It is pretty clear that although the legislation existed, it was not accomplishing much with only 91 out of the 1,375 sites being cleaned up in 15 years. At that rate the job would never get done. These problems that plague the superfund act make it evident that a different legal solution is needed.

Conclusion

I have addressed where existing research lies, and have addressed policy analysis that provides insight into the "why" of the discrepancy seen with CHD diagnosis numbers in people of a lower socioeconomic status. In summary, the analysis of government-subsidized housing and zoning laws reveals a stark reality for low-income families in America. From deliberately placing housing complexes in polluted industrial areas to zoning practices that confine them to

undesirable neighborhoods, it's clear that systemic neglect and exploitation persist. The proximity of housing projects to superfund sites highlights the health risks faced by residents, despite acknowledgments from agencies like the EPA and HUD. The lack of legislative action leaves communities vulnerable and unprotected. While the superfund law theoretically addresses pollution, funding shortages and bureaucratic inefficiencies render it ineffective. The slow pace of cleanup efforts underscores the need for urgent solutions.

This research is intended to be seen by everyone in order to bring awareness to the issue, but most importantly this should be taken seriously by policymakers. The way to fix these systematic issues relating to superfund sites and historic exclusionary zoning laws is by changing the legislation for government housing locations and the effective cleanup of these superfund sites. Legislation that does not work has been put in place in the past such as the superfund law, therefore future research should build upon this paper by examining effective policy writing and dive a bit more into why existing/past policies relating to this issue were not effective.

Ultimately, addressing systemic inequality and environmental degradation is essential for solving the discrepancy seen with Congenital Heart Disease diagnosis in families of low-socioeconomic status, as well as being essential for moving towards a more just and sustainable world.

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