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Environmental Justice for Children of Color: Energy Facility Pollution in Houston

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ABSTRACT

Extensive prior research has been conducted on the imbalance between environmental hazards in majority-minority communities and majority-white communities and its negative physiological, psychological, and economic effects. This existing body of literature has suggested a positive correlation between environmental hazards and poor childhood development indicators. The study of the field is called "environmental justice", founded on the belief that certain groups are disproportionately disadvantaged by negative environmental conditions induced by inequitable laws and policies. However, a clear correlation between environmental racism and minority childhood experiences has not been studied. This paper utilizes a proximity analysis between Houston-area schools and toxin-emitting energy facilities and survey-based research with a school community affected by such facilities in southeast Houston. Through this research, a clearer picture can be drawn of how policy and inaction have put children of color at a structural disadvantage over their wealthier, whiter counterparts. Results have established that urban development policies, the placement of energy production facilities, a lack of equitable urban planning boards, disinvestment in infrastructure, and carelessness by government officials have contributed to environmental inequality, with children being at a heightened risk of its negative effects. After assessing the findings of the inquiry concerning the negative developmental impacts of environmental inequality on children, future ramifications are discussed concerning suggestions for possible solutions.

Introduction

Environmental injustice has become a vital present-day concern in the city of Houston due to the city's high concentration of oil refineries and petrochemical plants - most of which are placed in majority-minority neighborhoods. This crisis has been caused by a complex interplay of social, political, and economic factors which have harshly impacted low-resource minority communities who face unsafe and unhealthy urban environments as a daily reality. A lack of political voice in these communities has further perpetuated the environmental decline of their neighborhoods, while economic motives have resulted in the construction of energy facilities that release airborne toxins and negatively impact residents' health outcomes. This paper examines the ways in which environmental justice is a necessity for majority-minority communities in Houston by exploring the negative effects of existing environmental hazards.

Definitions

In order to understand the necessity of environmental justice in Houston, it is important to gain an understanding of key terms used in the field of research. Environmental racism refers to situations in which minority communities are disproportionately affected by poor environmental conditions due to historically unjust man-made development. Environmental justice is the social, political, and economic movement to combat these situations. Urban development policies encompass a range of factors, including the provision of infrastructure for education and energy systems

which are examined in this paper. An energy facility refers to all buildings, equipment, and structures located on a single site for energy production. Additionally, the parameters of childhood development examined in this paper include the biological, psychological, and emotional changes that occur in humans from birth to the end of adolescence. By defining these key terms, a deeper understanding of the challenges faced by marginalized communities can be understood.

Cornerstone Work

Robert Bullard is widely known as a pioneer researcher of environmental justice in both Houston and the United States at large. His work, originating in the 1990s, has been used extensively as a basis for future research, including research conducted within this paper.

Arguments on Topic

Environmental injustice has been widely validated by researchers, with many scholars exploring the causes and effects of this phenomenon. However, there is a discourse on the root causes of environmental injustice in Houston. Some argue economic factors, such as the pursuit of profit when constructing petrochemical facilities, have resulted in non-adherence with Environmental Protection Agency (EPA) standards. Others contend that urban development policies such as zoning laws and infrastructure decisions have played a larger role. Many also attribute the disproportionate environmental harm faced by minority communities to historically racist social institutions which fueled redlining and suburbanization.

Gaps

While research has been conducted on the correlation between toxin inhalation and health defects, discussion has been scarce on how the placement of toxin-emitting energy facilities has impacted childhood development. Thus, it is important to investigate this gap and understand how factors behind environmental racism have intersected with environmental hazards in perpetuating childhood environmental inequality. By doing so, a nuanced understanding of the consequences of environmental injustice can be obtained.

Hypothesis

The null hypothesis is that a correlation does not exist between the concentration of Hispanic or African American children in an area, its proximity to energy facilities, and negative childhood development experiences. The alternate hypothesis is that a correlation exists between the concentration of Hispanic or African American children in an area, its proximity to energy facilities, and negative childhood development experiences.

Research Statement

Given the necessity for such research, this paper seeks to inquire: to what extent, if at all, have factors regarding environmental inequality disproportionately impacted children of color in the Houston metropolitan area in terms of unequal toxin exposure from toxin-emitting energy facilities?

Literature Review

In the mid-1950s, the disparity between the environments of majority-minority and majority-White neighborhoods was brought to public awareness prompting many researchers to consider the causes behind this and the implications of allowing this crisis to fester. This phenomenon, coined "environmental racism", is defined as minority communities being disproportionately disadvantaged by negative environmental conditions induced by unequal laws and policies (Bullard, 1993). Factors in this crisis include social factors resulting in segregation, political factors such as discriminatory housing and zoning policies, and economic motives such as the placement of industrial sites. These factors impact every aspect of minority communities' lives: their health, psychology, air quality, housing, neighborhoods, children, and infrastructure.

Social and Political Factors

Social factors include white flight and suburbanization as a result of racist attitudes. According to Dr. Laura Pulido, white residents have secured environments cleaner from pollutants by relocating from industrial cores (Pulido, 2000). Her methodology allows her to outline the various facets of racism that have shaped the urban environment and expose "functional relationships" between industrial zones and suburbs (Pulido, 2000). The development of such suburbs is thus a product and reproduction of a racist formation.

However, the HUD can offer assistance for individuals to move away from environmental hazards and incentivize state and local improvements through its funding power (Haberle, 2017). Success has been seen in public-private partnerships such as the "Green and Healthy Homes Initiative" when HUD partnered with think tanks, universities, and NGOs to take steps such as starting the AFFH, instituting energy improvements for subsidized housing, instituting programs to reduce lead and radon exposure, and instituting innovations for environmental disasters in public housing (Haberle, 2017).

A lack of political focus on infrastructure in majority-minority communities has also led to negative environmental outcomes. When localized control is taken away from minority groups, their infrastructure needs are often not met. For example, Flint, Michigan's decision to switch to the Flint River was made by a state official to save money. By allowing state control over a local matter, Flint's residents bore the burden of deteriorated water quality. Nevertheless, state programs to combat deteriorating infrastructure have succeeded, including Pennsylvania's PENNVEST effort (Kane & Puentes, 2017). Various majority-minority cities have also taken efforts such as Columbus through green infrastructure and Chicago through publicly and privately funded water upgrades. However, there has been a lack of diversity in planning and zoning commissions, rendering the concept of local control fruitless (Bullard, 1993).

Implications Today

A key environmental disparity in the lives of minority communities is their high exposure to air pollution. There is a correlation between poverty, non-white racial concentrations, and poor air quality. For example, people of color are found to be 1.5 times more likely to live in areas with low air quality than white people. Moreover, even minuscule amounts of air pollution can take a toll on an individual's immune system, making them 8% more likely to die when ill with an airborne respiratory illness (Ahlers, 2016). However, legal setbacks such as the Supreme Court's decision that there is no private right of action for discrimination based on disparate impact make litigation difficult.

The imbalance in toxin exposure has also led to a cancer differential between minority communities and their white counterparts. Over 80% of the US population lives in urban areas and minority groups in these areas have statistically higher estimated lifetime cancer risks from air toxins than whites (Tillet, 2006). 309 metropolitan areas and 45,000 Census tracts were divided into 6 groups based on their level of racial polarization. 1996 federal air toxin data was then used to derive the cancer risks using air pollutant concentrations. A positive correlation between the

degree of segregation and cancer risks was established. Moreover, Hispanics were found to be the most affected with a 6.4-fold increase in their lifetime cancer risk (Tillet, 2006). However, Census tracts are not representative of homogeneous communities and therefore the effects of environmental injustice have been downplayed due to the dilution of majority-minority areas into larger, majority-white Census tracts (Bullard, 1996). These irregularities have made present-day litigation more difficult.

A specific subpopulation has been found to be at an elevated risk of environmental hazards: African American children. In a study done by Dr. Robert Bullard (1993), it was found that - even when income is held constant - Black children were 2 to 3 times more likely to be at risk of lead poisoning than their white counterparts. Moreover, the ATSDR found that lead is the leading environmental health hazard to children. Even among similar income levels, African American families were 38% more likely to have elevated lead levels in their bloodstream (Bullard, 1993). Given that Houston is the only major city without zoning, a majority of landfills are located in black neighborhoods despite blacks making up the minority of the city's population (Chamberlain, 2017). This makes it imperative for additional research to be conducted regarding unequal toxin exposure among children as a facet of environmental justice.

Current research has also discovered the interaction of social and environmental variables as a cause of racial differences in mental health outcomes. Differential "vulnerability" may change the consequences of toxicants on biological systems, according to the long-standing exposure-disease paradigm (Gee & Payne-Sturges, 2004). Psychosocial stress may directly cause sickness as well as acute and chronic alterations in how some bodily functions like the immune system function. Unequal exposure to contaminants and experiences of stress in communities are consequences of environmental segregation. These stressors can increase sensitivity to environmental dangers if resources are not available to offset them.

Gap Analysis

Current environmental inequality research has been centered around race, but its effect on childhood exposure has gone understudied. Childhood development is the biological, psychological, and emotional changes that occur in human beings between birth and the end of adolescence (Strife & Downey, 2009). Few studies have questioned whether children are disproportionately impacted by pollution, or whether minority children are less likely to have clean urban spaces compared to their wealthier, White peers. Current research explains the cognitive, emotional, and physical importance of childhood exposure to the natural world and ties this to existing studies surrounding race and class - specifically how minorities and low-income communities have more constrained and polluted natural environments (Strife & Downey, 2009). However, research on the balance between environmental justice and childhood development has received minimal research attention. Correlations have been made between environmental hazards and psychological and biological health deficiencies, but these deficiencies have not been researched with adolescent subpopulation. However, an effective focal point in understanding this crisis in the context of unequal exposure is through the use of existing research on "privileged access" and toxin exposure racial disparities within the Houston metropolitan area (Chamberlain, 2017). According to the Union of Concerned Scientists, children living within two miles of the Houston Ship Channel have a 56 percent higher likelihood of developing lymphocytic leukemia (2016). Moreover, within the United States, roughly 200,000 children attend a school placed within two miles of a chemical plant (Mascarenhas, 2016). However, such figures do not currently exist for educational facilities in Houston. Thus, it becomes increasingly apparent that research must be conducted to identify whether children of color in Houston are truly placed at an environmental disadvantage in their daily lives.

Methods

My research design is a triangulated study intended to accurately answer the question: to what extent, if at all, have factors regarding environmental inequality disproportionately impacted children of color in the Houston metropolitan area in terms of unequal toxin exposure from toxin-emitting energy facilities?

Research Design

The first component of my research is a meta-analysis of originally computed data regarding facility locations and exposure proximity for Hispanic and African American majority high schools in the Houston area. Using this data, the correlations I have drawn demonstrate how the social and political factors established in my Literature Review have systematically put Houston's children of color at a disadvantage. The second part of my study is a sample of surveys with students and faculty at Cesar Chavez High School in the Houston Independent School District. Recently, the majority-Hispanic school has been in controversy due to pollution from three adjacent petrochemical plants affecting the environment of students attending the school. Through understanding the effects of having an environmental hazard adjacent to the school, I am tying existing environmental justice literature to a specific instance within Houston. The final segment of my research design is a comprehensive interpretation of my findings to explain the significance of childhood exposure to environmental hazards. The use of the aforementioned cluster sample and an originally derived meta-analysis allows me to analyze this trend.

This design fits into my body of knowledge by complementing existing research on the causes behind environmental racism. My Literature Review already established that the causes of this crisis are man-made. My research takes this a step further by filling in the gap in my body of knowledge: environmental racism specific to children in the Houston area. Although my research aims to purely establish a relationship between variables rather than propose a solution, it will still add a greater understanding to the body of knowledge. This is because current literature has failed to tie the concept of environmental racism directly to childhood victims' experiences (Strife & Downey, 2009). However, my interviews allow me to engage with the victims directly.

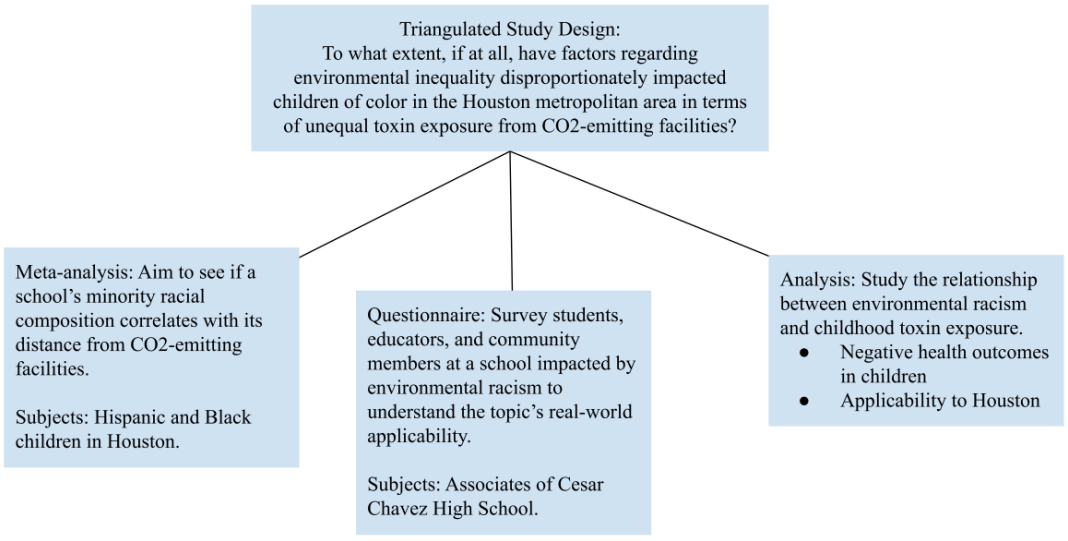

Figure 1. Triangulated Study Design

Variables

My meta-analysis establishes the correlation between the placement of energy facilities and the racial composition of schools in Houston. The independent variable is the school's racial composition, specifically the concentration of Hispanic and African American children. The dependent variable is the number of facilities proximate to the school, indicating environmental hazard exposure levels such as toxin exposure. The variables studied answer my research question by establishing whether there is a correlation between racial status and exposure within the Houston area.

Research Method

Existing correlational research has been conducted using this model in other metropolitan areas. For example, in one study, 309 metropolitan areas and 45,000 Census tracts were divided into 6 groups based on their level of racial polarization, and 1996 federal air toxin data was used to derive cancer risks using air pollutant concentrations (Tillet, 2006). However, Census tracts are not representative of homogeneous communities due to the dilution of majority-minority areas into larger, majority-white Census tracts (Bullard, 1996). Therefore, my research method utilizes ZIP Codes and other, more homogenous, units of geographic categorization.

My method collects both quantitative and qualitative data. Quantitative data collected includes the racial composition of Houston-area schools and the number of proximate facilities. A correlation coefficient is extracted from data sets comparing the exposure levels of Hispanic, Black, and White schoolchildren. Qualitative data collected through my interviews include the professional observations of students at Cesar Chavez High School in Houston. This data includes the firsthand experiences of students facing pollution, along with professional observations from staff. I first analyzed the correlation between exposure and racial concentrations. If there is a high correlation, my remaining research supports my hypothesis that Houston's minority children are being disadvantaged due to environmental racism. If my variables do not prove a correlation, my hypothesis is not proven.

Subjects of Study

The subjects of study in the meta-analysis are Hispanic and African American children in the Houston Independent School District. The subjects of study in the survey are Hispanic children attending Cesar Chavez High School. Specifically, these children fall in the range of 14 to 18 years old. The surveys also include educators and administrators who are above the age of 21.

The student body at Cesar Chavez High School is majority Hispanic while my correlational research also studies Black children. However, the use of a majority-Hispanic sample frame within my interviews is appropriate due to Hispanic Americans being at a greater overall cancer risk due to air pollution than any other racial group (Tillet, 2006). By researching the correlation between my variables, I directly argue that Houston's children of color face greater exposure levels to environmental hazards. Houston is an appropriate focal point for this type of research because Houston is the only major US city lacking zoning laws, and thus has one of the greatest degrees of exposure disparity in the United States (Chamberlain, 2017).

Instruments

My instruments consist of existing school and facility demographic data found in institutional databases. These sources contain statistical data for me to augment in the form of a table and graph. Parameters within this data include the racial composition of schools, the location of schools, the location of facilities, and exposure indexes. Valid statistical analysis methods are utilized to interpret this data. I also utilized an online survey platform and digital recording device to create a transcript of the interviews for me to analyze in my paper. The data I collect allows me to confirm

the statistical correlation between childhood exposure and racial composition - thus allowing my paper to fill in the gap of environmental racism toward Houston's children. Through the subsequent use of a qualitative cluster sample to validate my quantitative data, my statistical research's originality and applicability increased.

Procedure

The procedure for my research mirrors a triangulated study design in which there is a correlational meta-analysis, qualitative interviews, and a data analysis. First, I broadly identified common demographic characteristics of environmentally hazardous areas in Houston. Then, I collected sources with quantitative data on racial composition and facility placement. After augmenting the data together in the form of a table and graph, I drew various statistical measures to analyze the data. As for the qualitative portion of my research, I surveyed an appropriate cluster sample - Cesar Chavez High School students and staff - to validate the quantitative findings. After analyzing the common themes among the responses given by interviewees, I interpreted the statistical data using content from my survey responses and Literature Review.

Findings

To interpret the collected data accurately, the findings have been categorized into a quantitative analysis and a qualitative analysis.

Quantitative Data

An original proximity analysis was completed by plotting 38 Houston Independent School District high schools on a map and computing the number of energy production facilities within their ZIP code. Refer to Appendix A for the data sets used for this proximity analysis. Table 1 displays the proximity calculations for African American plurality and majority schools. Using the data from Table 1, Figure 2 displays a linear regression between the percentage of the student population of a school being African American and the proximity index of the school. Table 2 displays the proximity calculations for Hispanic plurality and majority schools. Using the data from Table 2, Figure 3 displays a linear regression between the percentage of the student population of a school being Hispanic and the proximity index of the school. However, only non-zero values were used for the regression. Table 3 displays the proximity calculations for White plurality and majority schools. No regression was done for this data because of its small size.

Table 1. Proximity for African American Plurality and Majority Schools

School	African American (%)	Facilities in ZIP
Kashmere	59.3	0
North Forest	56.8	2
Wheatley	50.3	0
Worthing	71.1	0
Yates	87.6	0

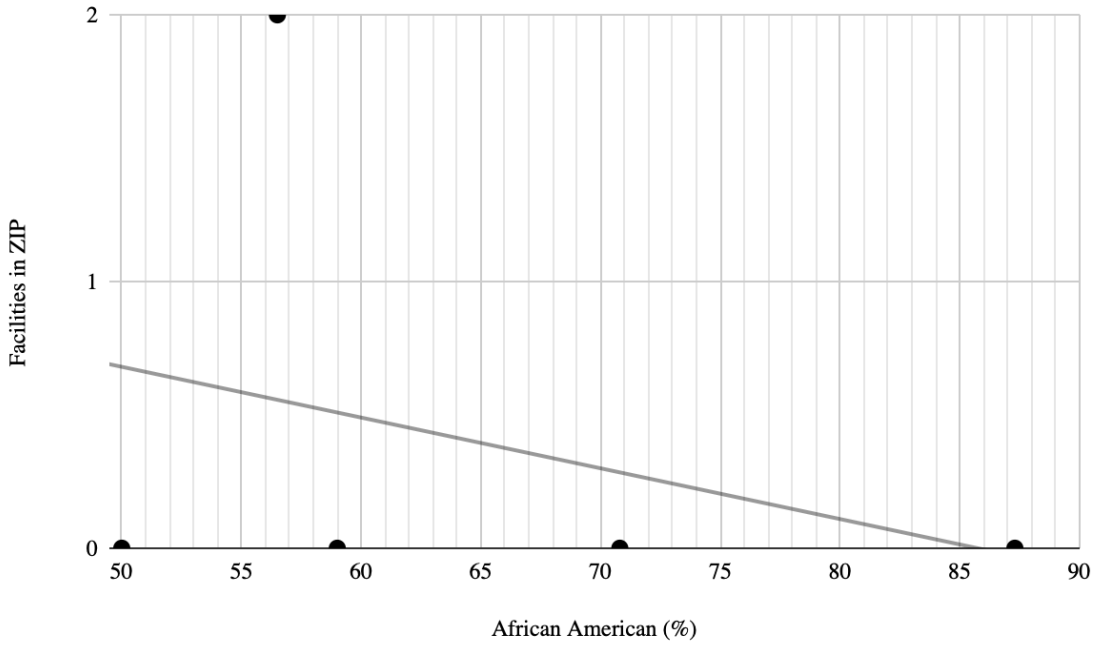

Figure 2. Proximity vs African American Composition Graph

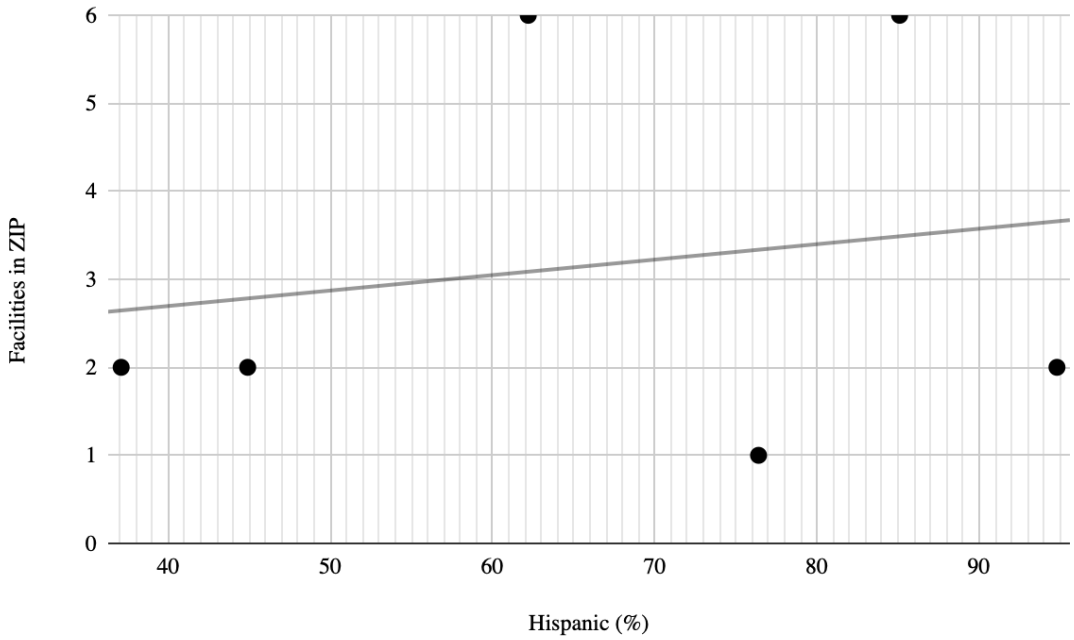

Figure 3. Proximity vs Hispanic Composition Graph

Table 2. Proximity for Hispanic Plurality and Majority Schools

School	Hispanic (%)	Facilities in ZIP
Austin	90.9	0
Bellaire	41.1	0
Carnegie	32.9	0
Challenge	71.6	0
Chavez	85.1	6
DeBakey	37.1	2
East	93.7	0
Eastwood	94.1	0
Energized	95.4	0
Energy	47.5	0
Furr	79.5	0
HAIS	51.9	0
HCC Life Skills	50.6	0
Heights	75.1	0
MSTC	90.7	0
HSLJ	71.1	0
Jones	59.6	0
Lamar	38.9	0
Madison	62.2	6
Fraga	95.1	0
Gulfton	80.5	0
Milby	94.8	2
N Houston	88.5	0
Northside	84.1	0
Scarborough	77.4	0
Sharpstown	76.1	0
South	48.9	0
Sterling	49.9	0
Waltrip	79.5	0
Washington	51.2	0
Westbury	63.9	0
Westside	44.9	2
Wisdom	76.4	1

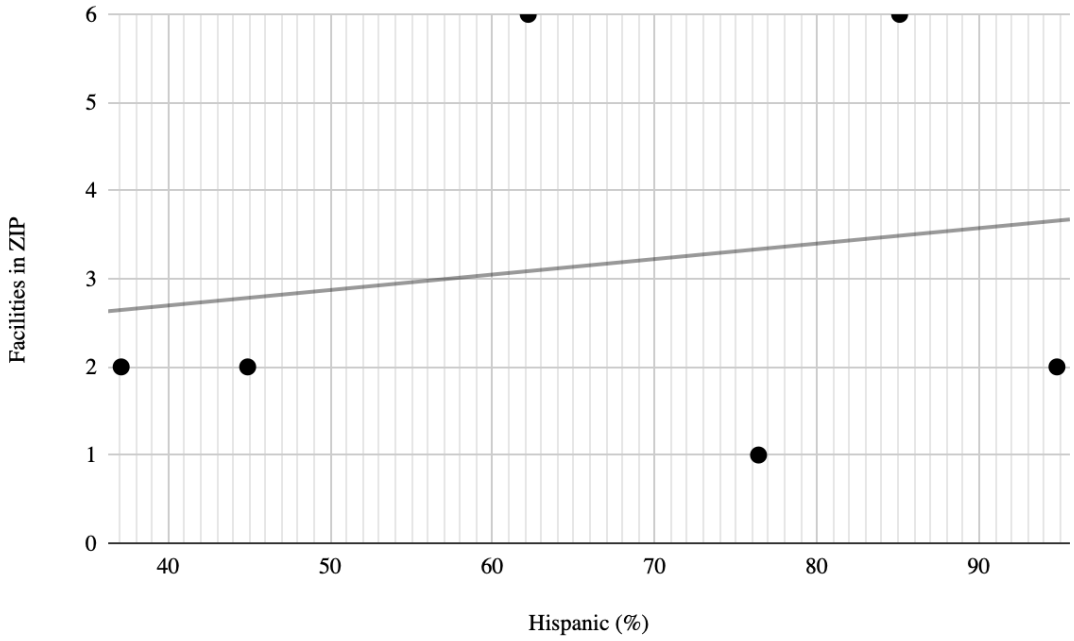

Figure 3. Proximity vs Hispanic Composition Graph

Table 3. Proximity for White Plurality and Majority Schools

School	White (%)	Facilities in ZIP
HSPVA	40.8	0

Qualitative Data

Qualitative data were collected from 11 participants in the form of interviews and a personalized survey sent to a limited number of individuals, both of which featured the same questions. The data gathered has allowed me to rationalize and further understand the experiences with petrochemical plant pollution among my participants. While conducting my research, I began to notice a correlation between the stories and descriptions of multiple community members who completed my questionnaire. Having such consistency in a large sample allows for the collected data to be authentic and accurate. The figures below categorize common questionnaire responses by frequency. Certain figures may have more total indexes than there are respondents due to category overlaps by respondents. Other figures may contain fewer indexes due to incomplete responses. Additionally, responses that did not fit into specific categories were excluded from the figures. Refer to Appendix B for respondent consent forms and Appendix C for the questionnaire used.

Table 4. Classification of Responses - Q1 (Timing)

Time Frame	Frequency	Percent (of 11 respondents)
Once a week	0	0
Twice a week	3	27.27
Thrice a week	5	45.45
Daily	3	27.27

Table 5. Classification of Responses - Q2 and Q3 (Concerns)

Concern	Frequency	Percent (of 11 respondents)
Asthma / Breathing Difficulty	6	54.54
Carcinogens / Cancer	4	36.36
Skin Irritation	2	18.18

Table 6. Classification of Responses - Q4a (Stakeholders)

Stakeholder	Frequency	Percent (of 11 respondents)
Legislators (Local)	4	36.36
Legislators (State)	2	18.18
Legislators (Education)	5	45.45
Petrochemical Industry	7	63.63
Specific Companies	3	27.27

Table 7. Classification of Responses - Q4b (Actions)

Action	Frequency	Percent (of 11 respondents)
Profit Motive	3	27.27
Racism	5	45.45
Non-accountability	1	9.09

Table 8. Classification of Responses - Q4c (Alleviation)

Action	Frequency	Percent (of 11 respondents)
Legislation (Local)	6	54.54
Legislation (State)	2	18.18
Community Action	4	36.36

Table 9. Classification of Responses - Q5a (Racial Status)

Response	Frequency	Percent (of 11 respondents)
Yes	9	81.81
No	2	18.18

Table 10. Classification of Responses - Q5b (Economic Status)

Response	Frequency	Percent (of 11 respondents)
Yes	10	90.90
No	1	9.09

Table 11. Classification of Responses - Q6 (Effects on Students)

Effect	Frequency	Percent (of 11 respondents)
Asthma / Breathing Difficulty	6	54.54
Carcinogens / Cancer	4	36.36
Psychological Distress	4	36.36
Limited Outdoor Interaction	5	45.45
School-Day Modifications	3	27.27
Enrollment Decline	2	18.18
Academic Decline	2	18.18

Analysis

As established in the Literature Review, existing research methods have utilized Census tracts for their proximity analyses. However, such methods do not account for contiguous communities since they often dilute minority neighborhoods into larger, white communities, and can thus skew the data to present a different picture of hazard proximity. However, Tables 1 through 3, which were a meta-analysis of energy facilities and majority-minority schools, utilized ZIP codes, which increased the validity of the data (Bullard, 1996). Within the quantitative data, the selection of a majority-Hispanic cluster sample experiencing environmental racism demonstrates the differing experiences of racial groups evidenced by the meta-analysis.

Quantitative Data

Table 1 displays the proximity indexes for African American plurality and majority schools, of which HISD has five. The data, when graphed in Figure 2, does not demonstrate any association, meaning that it is unlikely that African American children are at a heightened risk of toxin exposure from the facilities in the metadata. This finding is in line with existing literature which claims that Houston's African American community is at risk of toxin exposure from landfills and waste processing facilities, as opposed to energy facilities (Bullard, 1996). However, as evidenced in Figure 3, a moderately strong positive correlation was found between a school's Hispanic composition, or the percentage of students identified as Hispanic attending the school, and its proximity index to an energy facility. To achieve this, the data had to be standardized by removing zero values. Thus, the collected data represents a proximity trend among Hispanic-majority schools with a non-zero number of facilities rather than among all Hispanic-majority schools. It is also important to note that the highest number of facilities in the data was six, which was present among two schools, including Chavez High School, suggesting that the environmental disaster at Chavez High School may be replicated at other schools. These findings are significant due to Table 3 demonstrating that HISD's single plurality-white high school does not have an energy facility within its ZIP code, which establishes that a racial inequality exists.

These findings are significant due to the effect of such facilities on the children of color living in the area. Existing correlational studies indicate that Hispanic and black individuals are 1.5 times more likely to live in low air quality regions than white individuals (Ahlers, 2016). Given this, even low amounts of airborne particles can affect an individual's immune system, making them 8% more likely to die when ill with an airborne respiratory illness (Ahlers, 2016). As evidenced in the Literature Review, this revelation has lasting effects on the psychological and physiological health of the minor children living in the area who are at a heightened risk of airborne toxin exposure from environmentally hazardous facilities being placed proximate to areas they frequent.

Qualitative Data

Moreover, many of these symptoms have surfaced in the qualitative data collected from associates of an environmentally disadvantaged high school in southeast Houston. As evidenced in the Literature Review, the likely cause for the correlation between minority concentrations and energy facility proximity is due to white-flight and discriminatory development policies (Pulido, 2000). However, as per Table 8, respondents to the survey noted, in tandem with research identified in the Literature Review, that intervention from governmental agencies can force companies to take accountability and action. However, due to a lack of diversity in planning and zoning commissions, the concept of local control is difficult to accomplish (Bullard, 1993). This was seen in the sample data, with many respondents noting that Chavez High School was built near the petrochemical facilities after those facilities had already begun operations, and opposition from the community was often ignored by the school board.

Table 4 asked respondents about the time and frequency of the smoke plumes near the school. Responses to this question varied, signaling that the respondents may see the plumes as "a daily reality" that "does not get measured

by people in our community". Table 5 collected data on the symptoms and concerns faced by individuals due to the smoke plumes. The most common concern listed was asthma and breathing difficulties, which the Literature Review validates as a symptom of toxin exposure. Table 6 surveyed respondents on who they believe to be the stakeholders of the crisis and responses were generally mixed with a peak for "Petrochemical Industry" and an even distribution of Local or Education Legislators. However, interviews demonstrated that individuals with an awareness of legal avenues often had more critical opinions of the stakeholders. Respondents also indicated that they often feel as if their community's issues have been "swept under the rug" by those in power, with Table 9 and Table 10 demonstrating that a majority of respondents believe their race and economic status are factors in the non-action of combatting the crisis. Across the responses to all questions, there appeared to be growing awareness and discontentment with environmental pollution since a majority of respondents did believe that their race is a factor in their experiences.

A county attorney, who agreed to be interviewed on the condition of anonymity and is a community member of the area, noted that previous pollution mitigation efforts by legislative bodies have seen success. The respondent noted that Texas Petrochemicals, one of the three petrochemical facilities adjacent to the school, signed a butadiene-reduction agreement in 2005. The agreement was successful with butadiene emissions reduced by 58 percent the following year. Moreover, the respondent explained that the state of Texas has the authority to deny air permits to a petrochemical facility built within 3,000 feet of a school. However, no regulation prevents the reverse. The information presented by this respondent validates the potential for success of the other respondents' expressed desire for governmental regulation and mitigation efforts. Thus, this research presents a new understanding that environmental regulations are not only supported by those within marginalized communities but are also successful when implemented.

Conclusions

The data I have gathered addresses the gap identified in my Literature Review: how environmental racism has impacted the experiences of children of color in Houston. My Literature Review identified how environmental racism initiatives in local governments and non-governmental organizations have failed to support a key subpopulation: children. My research has helped fill in this gap by demonstrating through qualitative data how accountability and awareness have made impacts within marginalized communities by giving individuals a voice to raise concerns within their local governments. The current body of knowledge in the field is also very much statistics-based with little account for the actual experiences of the citizens living in environmentally disadvantaged areas. My research, however, centers on a case study of a sample community in southeast Houston. By utilizing this set of interviews, my research adds to the current body of work by documenting the experiences of these communities.

Limitations

Various limitations do exist within the data gathered. As for the meta-analysis, Houston ISD's school-of-choice program means that, within the meta-analysis data set, many schools with Hispanic pluralities serve majority-White residential populations. However, this realization strengthens the claim that minority children are at a heightened risk of toxin exposure since low-exposure schools would be theoretically majority-white. Furthermore, qualitative data may be incomplete due to limitations on what employees from Chavez High School were allowed to discuss. Moreover, it is important to note that survey data may not provide an accurate representation of the broader population's views since sample trends are not always indicative of population trends. Response bias is also a potential issue, as responses were observed to be polarized - either strongly in favor or strongly against the hypothesis - with few responses in the middle. It is likely that only those with a strong inclination towards a particular side participated. As such, the survey may not reflect the community's views fully.

New Understanding

This research presents a new understanding that Houston's Hispanic children have higher exposure levels to toxin-releasing energy facilities than white children. However, policy measures to reduce the environmental burden faced by minority communities were found to have high rates of support within the communities themselves. Moreover, community members from Chavez High School listed health concerns which align with existing literature on toxin exposure.

In my preliminary research, I encountered challenges in integrating the economic perspective into my study of environmental inequality factors. While economic factors have undoubtedly played a significant role in the development of oil facilities in majority-minority communities, they have been primarily enabled by political actions. Moreover, research on how companies have chosen specific areas purely for economic motives has been inconclusive and challenging to obtain. Instead, the blame for this situation has been mostly attributed to non-restrictive zoning laws, or in Houston's case, a lack of zoning, which are political decisions. Additionally, researchers often bring up the issue of racism when arguing that businesses have chosen to discriminate in their placement of industrial sites. However, I would categorize racism as falling under the social perspective rather than the economic perspective. Consequently, my research underscored how political and social factors are the predominant factors shaping the economic perspective, making it difficult to treat it as a standalone perspective.

Implications

These findings hold significant implications for the body of knowledge on the well-being of children of color living near environmentally hazardous facilities. Existing correlational studies have demonstrated that Hispanic and Black individuals are 1.5 times more likely to reside in regions with poor air quality. Even low levels of the airborne particles these individuals face can make them 8% more likely to die when suffering from a pre-existing respiratory illness, (Ahlers, 2016). As outlined in the Literature Review, there are long-term consequences to the psychological and physiological health of children who are exposed to airborne toxins from environmentally hazardous facilities in areas they frequent.

Furthermore, qualitative data obtained from associates of an environmentally disadvantaged high school in southeast Houston corroborates the presence of many of these symptoms. As per the Literature Review, the correlation between proximity to energy facilities and minority concentrations is attributed to discriminatory development policies and white flight, (Pulido, 2000). Nonetheless, survey respondents in conjunction with Literature Review research, suggest that government intervention can hold companies accountable and trigger remedial action. However, achieving local control in this regard is challenging due to the lack of diversity in planning and zoning commissions, (Bullard, 1993).

Future Directions

A question that has emerged from my research is how the government and policy aspect of this crisis has been shaped by the various stakeholders. Although my paper does consider existing literature on how a lack of equitable zoning laws and economic motives by companies have exploited vulnerable communities and led to these experiences, it does not focus or centralize upon this gap. My Literature Review, along with many survey respondents (including a county attorney), noted how environmental standards are often not adhered to in energy facilities that are placed in majority-minority communities due to a lack of enforcement and a lack of legal resources within the communities. Thus, a future direction for this research is examining how environmental regulations and their unequal and inadequate enforcement between different areas have played a role in the issue of environmental justice. Through my experience, I would advise future researchers to select their respondent pool on the basis of qualifications rather than experience.

My research had ordinary citizens as well as professionals in legal, environmental, and educational fields. However, I believe I could have taken my research further if I had focused exclusively on the people at the top. Thus, if someone was to research this question, they should try to sample energy executives and regulatory bodies.

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