A Survey Examining the Impact of Exhaust Emissions from the Cement Factory on Residents

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ABSTRACT

This study used a thorough analysis that combined descriptive statistics and inferential techniques to investigate the effects of exhaust emissions from the cement factory on the local population. Out of the 200 questionnaires that were issued, 196 were successfully retrieved and used as the foundation for the study that follows. According to the data, a significant number of inhabitants have cardiovascular and pulmonary conditions. The two most often reported diseases were asthma (52%), followed by heart disease (27%), skin cancer (12.2%), and diarrhea (8.8%). Air pollution was cited as the most prevalent type of pollution by the majority of respondents (48.9%), followed by land pollution (28.7%), water pollution (12.7%), and noise pollution (9.7%). The study's findings clearly demonstrate that emissions from the Dangote Cement factory significantly impact the health of nearby residents, particularly those living within close proximity. Effective mitigation measures, particularly the enforcement of strict environmental regulations and the adoption of cleaner technologies, are essential to reduce the adverse effects of the factory's operations on the community. Eighty percent of residents said they cope by living with the effects, while a smaller proportion chose to migrate (8.5%), complain to health authorities (7.5%), or protest (4%). Beyond that, solving the health and environmental issues the cement mill poses requires more community involvement and support for impacted residents.

Keywords: Exhaust, Cement, Pollution, Environment, Chi- square.

INTRODUCTION

The proliferation of industrial activities in urban and suburban areas brings with it a range of environmental concerns, particularly regarding air quality. Cement production involves the heating of raw materials to high temperatures, releasing various pollutants into the atmosphere, including particulate matter, sulfur dioxide (SO2), nitrogen oxides (NOx), and carbon monoxide (CO). The effects of these emissions on the environment and public health may be extensive. Of them, cement factory emissions are one of the main sources of pollution in the area. One of the biggest cement manufacturers in the world, Dangote Cement, has multiple factories spread across multiple countries, which has many people concerned about the possible impact of its emissions on neighboring towns.

The local populace is more exposed to these pollutants due to the close proximity of residential areas near cement facilities. Research has connected extended exposure to the emissions from cement plants to heart illness, lung issues, and even some types of cancer. Furthermore, there is an increased danger for vulnerable groups, including children, the elderly, and people with pre-existing medical disorders. Moreover, the effects on the environment go beyond issues with human health. The emissions from cement plants have the potential to cause acid rain, smog, soil and water contamination, and other environmental problems that could negatively impact nearby ecosystems and agricultural output. The interplay of various environmental stressors highlights how critical it is to comprehend and address the effects of Dangote Cement exhaust on local populations. The manufacture of cement has a detrimental effect on the environment, mainly because it releases greenhouse gases and uses up

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non-renewable resources [1]. The energy consumption and emissions connected to the production process make this worse [2]. Cleaner production methods and the utilization of industrial waste as supplemental materials are two possible ways to lessen these effects, but [1]. Furthermore, figuring out what causes emissions can aid in the creation of low-impact cement. The industry's role in greenhouse gas emissions is still a major concern despite these possible remedies [4]. It will need a team effort from legislators, environmental organizations, business interests, and local communities to address these issues. Implementing cutting-edge emission control technologies, regularly monitoring air quality, and encouraging community empowerment are just a few of the strategies that are necessary to achieve sustainable development and protect public health. As the demand for cement continues to rise globally, it is imperative to prioritize the health and well-being of communities living in the vicinity of cement plants. By acknowledging the effects of Dangote Cement exhaust and taking proactive measures to mitigate them, we can strive towards a more sustainable and equitable future for all.

The proximity of communities to Dangote Cement plants raises significant concerns regarding the potential adverse effects of cement plant emissions on the health and well-being of residents, as well as the broader environmental impacts. Despite the growing body of research on industrial air pollution, there remains a need for a comprehensive understanding of the specific challenges posed by Dangote Cement exhaust in these communities. Limited studies have specifically investigated the health effects of Dangote Cement emissions on nearby populations. Exhaust from motor vehicles, particularly diesel exhaust, has been shown to have a significant impact on human health. It is associated with a range of adverse health effects, including respiratory symptoms, lung function changes, and inflammation in the airways [5-7]. These effects are particularly pronounced in individuals with pre-existing conditions such as asthma, where exposure to diesel exhaust can worsen symptoms and increase airway inflammation [8]. The need for further research, particularly in real-world settings, is emphasized to better understand the specific health effects of exhaust on different populations. The prevalence of respiratory diseases, cardiovascular conditions, and other health outcomes among residents living in close proximity to the plants requires detailed examination to assess the extent of the health burden and identify vulnerable groups. The emissions from Dangote Cement plants contribute to air pollution, potentially leading to acid rain formation, soil and water contamination, and damage to local ecosystems. However, there is a lack of comprehensive research assessing the environmental impacts of these emissions and their implications for biodiversity, agricultural productivity, and ecosystem services. Socio-economic factors, including income level, access to healthcare, and housing conditions, may exacerbate the vulnerability of communities to the effects of Dangote Cement exhaust. Understanding the socio-economic determinants of exposure and vulnerability is crucial for designing targeted interventions to protect the most affected populations. The effectiveness of existing regulatory measures and industry practices in mitigating the impacts of Dangote Cement emissions on communities and the environment is unclear. There is a need to evaluate the adequacy of current regulatory frameworks, identify gaps in enforcement, and explore opportunities for enhancing environmental governance and accountability.

Meaningful engagement with affected communities is essential for addressing their concerns, building trust, and fostering collective action towards sustainable solutions. Effective communication and involvement, however, may be hampered by things like power imbalances, language obstacles, and restricted access to resources and information. Research projects involving multiple disciplines—environmental science, public health, social sciences, and policy analysis—are needed to tackle these problems. Through a methodical investigation of the effects that Dangote Cement exhaust has on local residents, this project seeks to produce evidence-based suggestions for reducing the negative effects and enhancing the health of impacted populations and ecosystems. In addition to investigating the wider environmental implications of these emissions, the study attempts to do a thorough assessment of the effects of emissions from Dangote Cement plants on the health and well-being of surrounding people. In particular, the goals are twofold: To find out if there is a relationship between the kinds of pollution that Dangote Cement factories produce and the ailments that people who live close to these plants experience, as well as to assess how these pollutants are distributed geographically. The cement business is one of the most polluting industries due to the production of numerous harmful pollutants, such as particulate matter, sulfur and nitrogen oxides, carbon monoxide gas, volatile organic compounds (VOCs), and greenhouse gases (GHGs). The Central Pollution Control Board, the Government of India, and the Ministry of Environment and Forests' evaluations served as the basis for this classification. Global environmental degradation brought about by the establishment of cement manufacturers has a substantial negative influence on human health. Studies

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show a link between cement dust exposure and detrimental consequences on respiratory health, including a higher frequency of respiratory issues.

Studies have also shown that individuals residing in proximity to cement plants experience higher rates of respiratory issues and gastrointestinal diseases [10]. Furthermore, scientific investigations have established links between cement dust exposure and chronic impairment of lung function, as well as respiratory symptoms in human populations. Cement dust can cause skin irritation upon contact and irritate mucous membranes when deposited in the respiratory tract, [11] resulting in increased pH levels and subsequent irritation. [12].

Recent research has revealed the substantial environmental repercussions stemming from Dangote Cement's operations. [13] investigation uncovered alarming levels of atmospheric dust and CO2 emissions, surpassing established safety thresholds. Expanding on this, [14] revealed elevated levels of sulfur dioxide, nitrogen oxides, and total suspended particle matter in addition to the presence of heavy metals in soil and vegetation samples. These pollutants threaten the integrity of the ecosystem in addition to endangering human health by causing allergies, respiratory problems, and maybe cancer. The results of [15] demonstrated how urgently further data collection and research projects on cement production emissions are needed, especially in developing nations like Nigeria. Moreover, [3] observations highlighted how critical it is to identify emission-causing variables and develop low-impact cement formulations in order to reduce environmental harm. evaluated the effect of a cement factory's effluent discharge on the Ngo River's water quality in Benue, Nigeria.

Certain metrics in the river water and effluent were found to be over environmental requirements, suggesting possible pollution. The report emphasizes that in order to safeguard public health and water quality, industrial effluent discharge must be monitored and regulated. Effects of the Cement Industry. The cement business may have a number of negative health effects on employees and the local populations that surround its manufacturing sites. The following are a few possible health effects of cement:

Issues with the Respiratory System: Particulate matter found in cement dust produced during manufacturing processes can cause respiratory issues like coughing, wheezing, and trouble breathing if breathed. Long-term cement dust exposure may raise the chance of acquiring bronchitis and asthma, among other chronic respiratory diseases.

Skin irritation: Chemical burns, dermatitis, and skin irritation can result from direct contact with cement or items containing cement. Because they are frequently exposed to wet cement, workers in the construction industry—especially masons and cement mixers—are at risk for skin issues. Cement dust and particles have the potential to cause irritation of the eyes, resulting in symptoms like redness, itching, tears, and pain. When handling or processing cement, workers may get eye irritation if appropriate safety precautions are not used.

Occupational Hazards: Workers in cement plants and construction sites may face various occupational hazards, including falls, slips, and injuries from handling heavy equipment and materials. Proper training, safety protocols, and personal protective equipment (PPE) are essential to mitigate these risks.

Noise pollution: The procedures used in the production of cement, such as grinding, crushing, and kiln operations, can produce a lot of noise. Workers who are exposed to high noise levels for extended periods of time may develop hearing loss and other auditory issues.

Exposure to Toxic Substances: The process of making cement requires the use of a number of chemicals and additives, including silica, gypsum, limestone, and clay, all of which have the potential to release harmful substances into the environment. Particularly silica dust is known to be carcinogenic and can lead to both progressive and irreversible lung diseases called silicosis and lung cancer.

Community Health Concerns: Particulate matter, sulfur dioxide, nitrogen oxides, and volatile organic compounds are among the air pollutants that may be released throughout the manufacturing process into the communities that surround cement factories. Residents may be more susceptible to cardiovascular problems, respiratory illnesses, and other harmful health impacts if they are exposed to these pollutants over an extended period of time.

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Regulatory bodies, industry participants, and medical professionals must work together to enforce occupational health and safety regulations, put pollution control measures into place, encourage the use of cleaner technologies, and increase public awareness of the health risks connected to the use and production of cement in order to lessen these negative effects on health. Furthermore, it is critical to safeguard the public's health to provide medical surveillance, routine health exams, and appropriate access to healthcare services for affected communities and workers.

MATERIALS AND METHODS

Located in Obajana, Kogi State, Nigeria, Dangote Cement is a well-known name in the cement sector both in Nigeria and throughout Africa. With a total land area of 80,300 square meters, Obajana is home to 2,277 people. This study's research technique mixes inferential analysis using the chi-square method with descriptive analysis that emphasizes percentages. To obtain a representative sample from the study area, cluster sampling is the sampling strategy used.

Respondents who live nearby are given questionnaires to complete in order to acquire primary data. Out of the 200 questionnaires that were issued, 196 were successfully retrieved and used as the foundation for the study that follows. The purpose of these surveys is to collect data regarding the impacts of Dangote Cement's exhaust emissions.

RESULTS AND DISCUSSION

This section includes a descriptive analysis presented in percentages and an inferential analysis conducted using the chi-square test of independence. Both analyses were performed using Stata software.

Descriptive statistics

Table 1: Descriptive statistics on the diseases caused by the exhaust from the cement factory

Diseases:	Skin cancer	Heart Disease	Asthma	Diarrhea	Total
Respondent	24	53	102	17	196
Percentage	12.2%	27%	52%	8.8%	100

Figure 1: The bar chart of different types of diseases caused by the exhaust from cement factory.

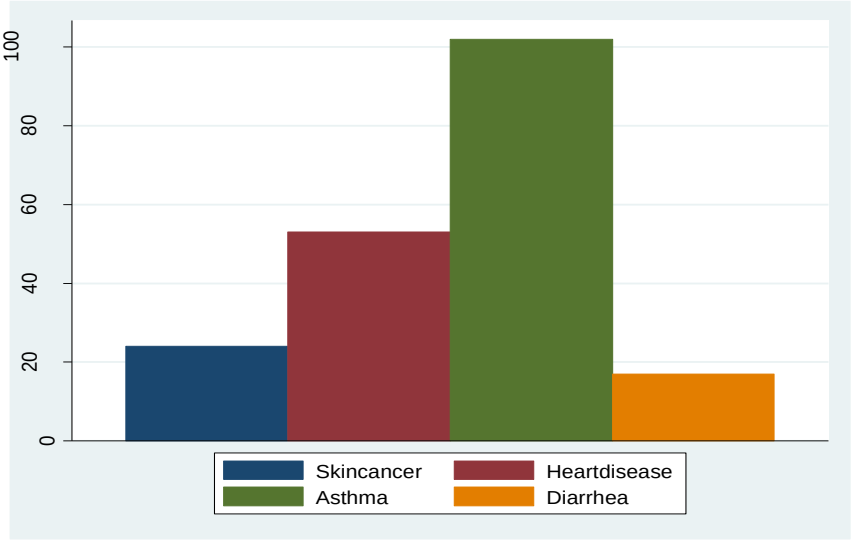

Figure1, illustrates the prevalence of diseases attributed to the exhaust from the cement factory. According to the data, 12.2% of respondents reported asthma, 27% indicated heart disease, 52% mentioned skin cancer, and 8.8% reported diarrhea.

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Table 2: Types of pollution produced by the cement factory

Pollution:	Air	Land	Water	Noise	Total
Respondent	96	56	25	19	196
Percentage	48.9%	28.7%	12.7%	9.7%	100

Figure 2: The bar chart of the common form of pollution produced by the cement factory.

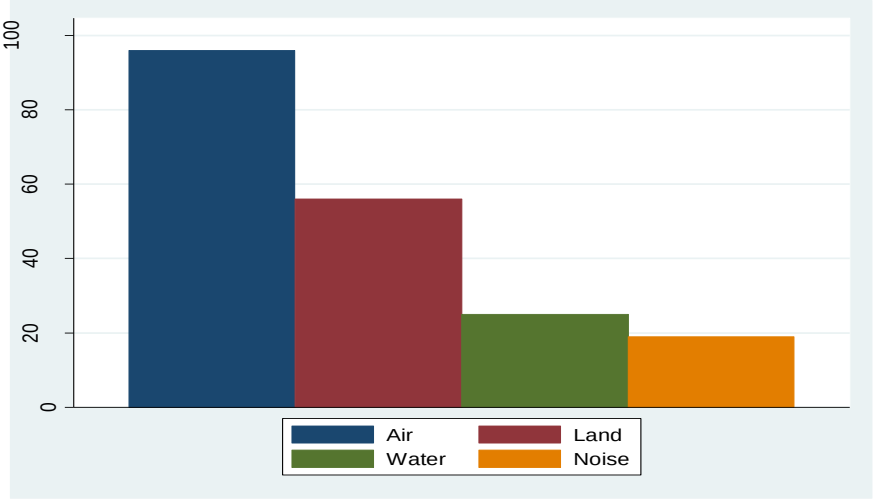

Figure 2, displayed the types of pollution generated by the cement factory. According to the data, 48.9% of respondents cited air pollution, 28.7% mentioned land pollution, 12.7% identified water pollution, and 9.7% reported noise pollution.

Table 3: Distance between individual residents and the Factory

Distance:	Less than 1km	1km-2km	2km-3km	Above 3km	Total
Respondent	102	74	14	6	196
Percentage	52%	38%	7%	3%	100

Figure 3: The bar chart of the distance between individual residents and the Factory.

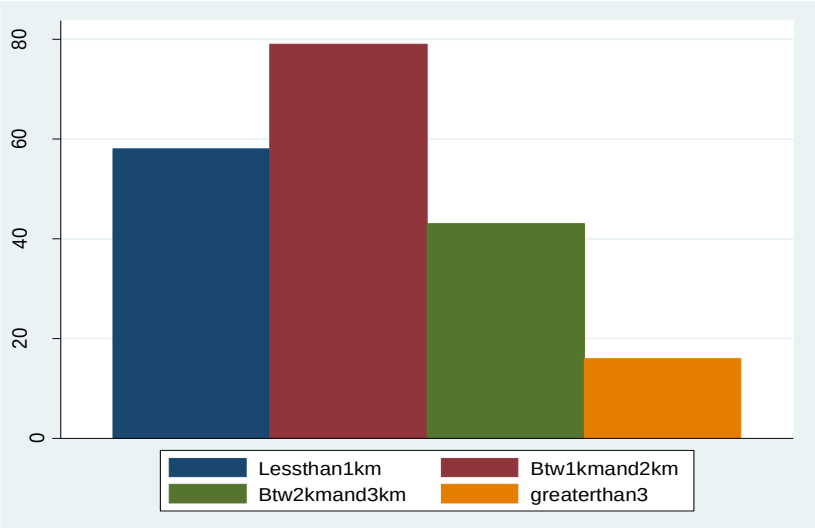

Figure 3 illustrates the proximity of individual residents to the cement factory. According to the data, 52% of respondents live less than 1km away, 38% reside within the range of 1km to 2km, 7% are situated 2km to 3km

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away, and 3% live more than 3km from the cement factory.

Table 4: How residents cope with the effect of exhaust coming from the cement factory

	Live with it	Migrate to new area	Complain to health authority	Protest	Total
Respondent	158	17	14	7	196
Percentage	80%	8.5%	7.5%	4%	100

Figure 4: The bar chart of how residents cope with the exhaust coming from the cement factory.

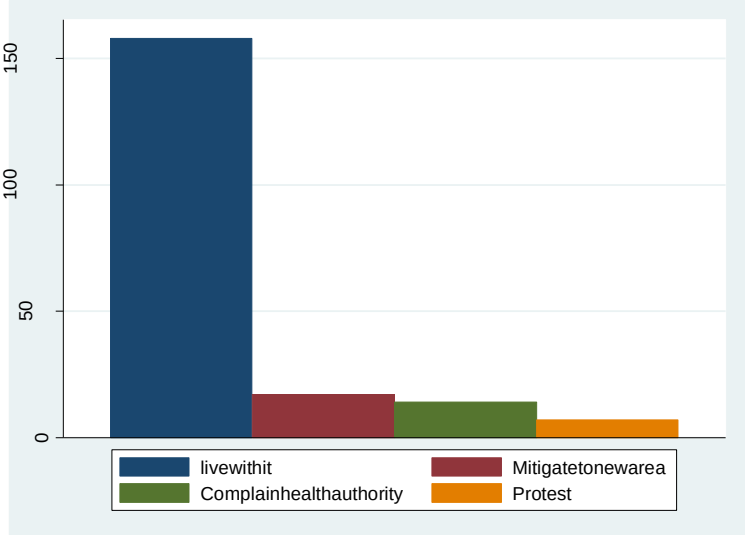

Figure 4 depicts how residents cope with the effects of the factory exhaust. According to the data, 80% of respondents reported living with the effects, 8.5% opted to mitigate by relocating to a new area, 7.5% lodged complaints with health authorities, and 4% engaged in protests.

Table 5: Mitigating measure to eradicate or reduce the effects of exhaust from the factory

Measure:	Relocation of factory	Cleaning combusting kiln fuel	Adapt stringent environmental law	Total
Respondent	10	70	120	196
Percentage	5%	35%	60%	100

Figure 5: The bar chart of the mitigating measure to eradicate or reduce the effects of exhaust from the factory

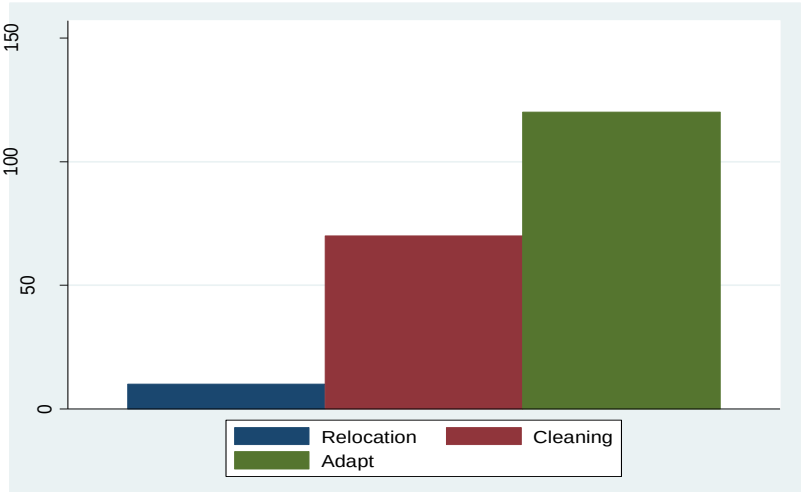

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Figure 5 illustrates the proposed strategies for mitigating or reducing the impact of the factory exhaust. According to the data, 5% of respondents suggested relocating the factory, 35% recommended cleaning the combusting fuel, and 60% advocated for the adoption of stricter environmental regulations.

Inferential Analysis

Hypothesis 1

Null Hypothesis (H0): There is no association between the health conditions experienced by individuals residing in the vicinity of the cement industry and the different types of pollution emitted by the factory.

H1: Not H0

	Disease				
Pollution	Skin cancer	Asthma	Heart Disease	Diarrhea	Total
Air	11	64	18	3	96
Land	6	22	25	3	56
Water	5	4	6	10	25
Noise	2	12	4	1	19
Total	24	102	53	17	196

Pearson chi – Square

χ^2_{cal} = 55.6699 P-value = 0.000

The results of the chi-square test indicate that the p-value (0.000) is less than the significance level of 0.05. Therefore, we reject the null hypothesis. This suggests a significant association between the types of diseases experienced and the pollution generated by the operations of the cement industry.

Hypothesis 2

Null Hypothesis (H0): There is no relationship between the health conditions experienced by individuals residing in the Cement industry area and the distance they live from the factory.

H1: Not H0

	Disease				
Pollution	Skin cancer	Asthma	Heart Disease	Diarrhea	Total
Less than 1Km	17	61	19	5	96
Btw 1km and 2Km	4	37	24	9	74
Btw 2km and 3Km	2	3	7	2	14
Greater than 3Km	1	1	3	1	6
Total	24	102	53	17	196

Pearson chi - Square

χ^2_{cal} = 21.5817 P-value = 0.010

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A p-value of 0.010, less than the predefined significance limit of 0.05, is shown by the chi-square test. As a result, the null hypothesis is rejected. This implies that people's experiences with different diseases are impacted by how far they live from the cement industry.

SUMMARY AND CONCLUSION

Situated in Obajana, Kogi State, Nigeria, Dangote Cement is a well-known entity in the cement sector both regionally and throughout Africa. There are substantial environmental and health consequences for the 2,277 persons who live in close proximity to the factory, which occupies a large area. Through a thorough analysis combining descriptive statistics and inferential approaches, the goal of this study was to investigate the impacts of exhaust pollutants from the cement mill on neighboring inhabitants. According to the data, a significant number of inhabitants have cardiovascular and pulmonary conditions. The two most often reported diseases were asthma (52%), followed by heart disease (27%), skin cancer (12.2%), and diarrhea (8.8%). These results point to a significant disease burden that may be caused by cement plant emissions.

The majority of respondents (48.9%) identified air pollution as the most common form of pollution, followed by land pollution (28.7%), water pollution (12.7%), and noise pollution (9.7%). This distribution underscores the primary concern regarding air quality and its direct impact on health. Over half of the respondents (52%) live less than 1 km from the cement factory, with a significant portion (38%) residing within 1 to 2 km. This proximity likely exacerbates exposure to harmful pollutants and correlates with the high incidence of reported health issues. The majority of residents (80%) reported that they cope by living with the adverse effects, while a smaller proportion chose to migrate (8.5%), complain to health authorities (7.5%), or protest (4%). This highlights the community's limited options and potential resilience in the face of environmental challenges.

Respondents predominantly suggested the implementation of stringent environmental laws (60%) as a mitigation measure, followed by cleaning combusting kiln fuel (35%) and relocating the factory (5%). These preferences indicate a strong desire for regulatory intervention and cleaner production processes. The chi-square test results ($\chi^2 = 55.6699$, $p = 0.000$) indicate a significant association between the types of diseases experienced by residents and the various forms of pollution emitted by the cement factory. Also, the chi-square test results ($\chi^2 = 21.5817$, $p = 0.010$) also suggest a significant relationship between the health conditions reported by individuals and their proximity to the cement factory. This implies that the closer residents live to the factory, the more likely they are to experience pollution-related diseases.

Conclusion:

The findings from this study clearly indicate that emissions from the Dangote Cement factory significantly impact the health of nearby residents, particularly those living within close proximity. The prevalence of respiratory and cardiovascular diseases is notably high, and air pollution is identified as the primary environmental concern. Effective mitigation measures, particularly the enforcement of stringent environmental regulations and the adoption of cleaner technologies, are essential to reduce the adverse effects of the factory's operations on the community's health and well-being. Additionally, increased community engagement and support for affected residents are crucial in addressing the environmental and health challenges posed by the cement plant.

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