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IMPLICATIONS OF GAS FLARING ON INFANT MORTALITY AND BIRTH DEFECTS CASE STUDY OF NIGER DELTA REGION

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ABSTRACT

This study examines the Implications of Gas Flaring on Infant Mortality and Birth Defects *in the Niger Delta region of Nigeria. A survey design was adopted, and a structured questionnaire was administered to 120 respondents drawn from selected communities across the region. The Chi-square statistical tool was used to test the hypotheses. Findings reveal a high level of awareness of gas flaring as a common practice in the Niger Delta and show that communities situated near flaring sites experience significantly higher health challenges. The study further established that gas flaring contributes to increased infant mortality, heightened respiratory complications among infants, and greater incidences of birth defects due to exposure to toxic emissions. Environmental degradation resulting from continuous flaring was also found to indirectly worsen health outcomes for newborns and pregnant women. The study concludes that the health risks posed by gas flaring far outweigh its economic benefits and that cases of birth defects remain largely underreported in affected communities. The study recommends stricter government enforcement of environmental regulations, increased penalties for non-compliance, and full implementation of policies such as the Nigerian Gas Flare Commercialization Program (NGFCP). It further advocates the establishment of well-equipped healthcare facilities, routine maternal and infant health screening, and extensive community education on the risks of exposure to flaring activities. Additionally, it calls for*

investment in gas capture technologies and cleaner energy alternatives, alongside the development of a national health database and continuous research on the long-term health impacts of gas flaring.

KEYWORDS: Gas Flaring, Infant Mortality, Birth Defects, Niger Delta Region**,** Environmental Pollution, Public Health.

1.1 INTRODUCTION

Gas flaring is the deliberate burning of associated natural gas released during crude oil extraction—remains one of the most persistent environmental and public health challenges in Nigeria's Niger Delta. For decades, this activity has discharged a wide array of toxic substances such as carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen oxides (NO_x), and particulate matter into the atmosphere, resulting in significant ecological degradation and severe human health risks [23]. Although oil production contributes substantially to Nigeria's economy, its accompanying environmental hazards, especially those affecting pregnant women and infants, have generated considerable concern among researchers and policymakers.

The Niger Delta hosts most of Nigeria's oil operations and, consequently, some of the highest flaring levels globally. Evidence shows that continuous exposure to pollutants from gas flaring is associated with increased cases of respiratory ailments, cardiovascular complications, and certain cancers [36]. Expectant mothers living near flare sites face increased exposure to hazardous compounds such as polycyclic aromatic hydrocarbons (PAHs) and heavy metals—substances repeatedly linked to congenital disorders and elevated infant mortality rates [11; 12]. Pollutants like carbon monoxide interfere with fetal oxygen supply and have been connected to adverse birth outcomes including low birth weight, congenital abnormalities, and stillbirths [30].

Infant mortality—defined as deaths occurring before an infant's first birthday—remains disproportionately high in the Niger Delta. Reports from the National Bureau of Statistics indicate that states with intense gas flaring activities (Rivers, Bayelsa, Delta) experience significantly higher infant mortality rates compared to non–oil-producing states [29]. Research by [44] highlights that infants born in proximity to flare sites exhibit a greater likelihood of neonatal complications, including congenital heart malformations and respiratory distress syndrome. Toxic emissions are known to disrupt fetal hormonal balance,

contributing to birth anomalies such as cleft palate, limb deformities, and neural tube defects [18].

The socioeconomic consequences of these health outcomes are extensive. Affected families often struggle with high medical bills, emotional trauma, and loss of income resulting from ongoing treatments and lifelong care needs [46]. Although Nigeria has enacted several regulatory frameworks—including the Associated Gas Reinjection Act of 1979 and the Gas Flaring (Prohibition and Punishment) Bill of 2018—persistent weak enforcement and economic incentives for oil companies have allowed the practice to continue largely unchecked [21]. Insufficient penalties and regulatory loopholes have enabled multinational oil corporations to maintain practices that endanger public health.

Given the increasing awareness of environmental health risks in oil-producing regions, this study aims to critically assess the effects of gas flaring on infant mortality and birth defects in the Niger Delta. The outcomes of this study will inform stronger policy development, reinforce the need for improved community health interventions, and contribute to scholarly discourse on environmental health in Nigeria.

2.0 LITERATURE REVIEW

2.1 CONCEPTUAL FRAMEWORK

Gas flaring is the combustion of natural gas released during crude oil production. In the Niger Delta, it is a widespread practice due to inadequate technological infrastructure, weak regulatory frameworks, and insufficient investment in gas-utilization systems [2; 31]. The region's extensive oil extraction activities make it a hotspot for continuous flaring.

Environmental impacts of gas flaring have been extensively documented. Pollutants emitted during combustion—such as CO, SO_2, NO_x, and particulate matter—degrade air quality and contaminate soil and water bodies [10]. These pollutants are closely associated with respiratory illnesses, heart diseases, and various cancers [41].

Concerns about the health of vulnerable populations, especially infants, have intensified with increasing evidence linking prenatal exposure to flaring emissions and developmental abnormalities [27]. Maternal exposure to air pollution during pregnancy has been strongly associated with infant mortality, premature births, low birth weight, and congenital malformations [15].

The Niger Delta records some of the highest infant mortality rates in Nigeria [17]. Research shows a clear relationship between intense gas-flaring activities and rising infant deaths, with exposure during pregnancy contributing to fetal distress, premature births, and reduced neonatal survival [25]. Maternal exposure to toxic pollutants also contributes to higher occurrences of stillbirths and adverse birth outcomes [33]. Infants born within communities near flare sites have been shown to experience greater respiratory challenges and developmental problems due to compromised air quality [22].

Gas flaring has also been implicated in the occurrence of congenital anomalies such as neural tube defects, cleft palate, and congenital heart defects. Heavy metals and volatile organic compounds from flare emissions are known to play major roles in these conditions [4]. Benzene, in particular, has strong associations with congenital abnormalities and reproductive system disorders [28]. A study by [43] reported that neural tube defect rates were significantly higher among infants whose mothers lived within 10 km of active flare sites, attributing this trend to teratogenic pollutants like SO_2 and NO_x.

Although government agencies such as the Department of Petroleum Resources (DPR) have attempted to reduce flaring through various policies, enforcement has been largely ineffective due to political and economic challenges [45]. As a result, gas flaring continues to present serious health risks in the Niger Delta [31].

2.2 CAUSES OF GAS FLARING IN THE NIGER DELTA (PLAGIARISM-FREE VERSION)

Gas flaring in the Niger Delta is driven by a combination of structural, economic, regulatory, and political factors:

1. Oil Exploration and Production

Gas flaring primarily results from oil extraction operations where natural gas is released as a by-product. Due to historical lack of infrastructure and cost-driven decisions, companies have relied on flaring as a convenient disposal method [26].

2. Inadequate Gas-Utilization Infrastructure

Despite abundant gas reserves, the region lacks the pipelines, processing plants, and distribution systems needed for effective gas utilization. This infrastructure gap encourages continuous flaring [34].

3. Economic Incentives and Profit Prioritization

Oil companies often prioritize crude oil production because it yields higher profits than gas utilization. As a result, investment in gas-capture infrastructure is frequently deemed unprofitable [40].

4. Weak Regulations and Limited Enforcement

Although Nigeria has policies aimed at reducing flaring, enforcement remains inconsistent due to corruption, political interference, and ineffective monitoring systems [5; 6]. Low penalties further weaken regulatory compliance.

5. Political Instability and Community Conflicts

The Niger Delta's history of unrest, coupled with governance challenges and allegations of collusion between local elites and oil companies, has hindered efforts to curb gas flaring [3].

6. Policy Gaps and Poor Long-Term Planning

Government policies, such as the Nigerian Gas Master Plan, often lack clear implementation strategies and resource backing, which restricts progress toward eliminating gas flaring [38].

2.2.1 PUBLIC HEALTH IMPLICATIONS OF GAS FLARING (PLAGIARISM-FREE VERSION)

Gas flaring releases a mixture of harmful chemicals that degrade the environment and pose serious risks to human health. Pollutants such as PM, NO_x, SO_2, and VOCs are linked to respiratory illnesses, cardiovascular diseases, and pregnancy-related complications.

Infant Mortality and Birth Defects

Numerous studies indicate that pollutants from gas flaring negatively affect fetal development and contribute to stillbirths, premature deliveries, low birth weight, and neonatal deaths [8; 39]. Infants exposed to polluted air are more prone to respiratory distress and congenital anomalies.

Mechanisms of Harm

Toxic chemicals interfere with normal fetal growth by reducing oxygen supply, altering hormonal balance, and introducing teratogenic substances. Compounds such as sulfur dioxide and benzene are strongly associated with congenital malformations, including neural tube defects [9; 43].

Evidence from the Niger Delta

Studies have consistently shown higher rates of infant mortality and birth defects in communities close to flare sites compared to those farther away [39; 32]. These findings demonstrate the direct link between flaring emissions and adverse reproductive outcomes.

Strain on Health Systems

The increased incidence of respiratory diseases, low-birth-weight infants, and congenital disorders places additional burdens on already limited healthcare infrastructure in the Niger Delta [48].

Policy Implications

Although Nigeria has enacted several laws aimed at eliminating gas flaring, enforcement gaps remain significant. Stronger regulations, improved monitoring systems, and adoption of modern gas-recovery technologies are essential to protect community health [32].

2.2.3 ENVIRONMENTAL AND SOCIOECONOMIC CONSEQUENCES OF GAS FLARING (PLAGIARISM-FREE VERSION)

1. Environmental Impacts

a) Air Pollution

Gas flaring emits CO_2, methane, particulate matter, VOCs, and NO_x—pollutants that contribute to climate change, smog, and acid rain.

- Annual global CO_2 emissions from flaring are estimated at about 400 million tons [49].
- Methane emissions, often incompletely combusted, significantly intensify global warming [4].

b) Soil and Water Contamination

Pollutants such as benzene and xylene deposit onto soil and accumulate in water bodies, reducing agricultural productivity and contaminating drinking water sources [51; 35].

c) Health Risks

Communities exposed to flaring emissions experience heightened rates of asthma, bronchitis, cardiovascular disorders, and certain cancers, especially leukemia linked to benzene exposure [1; 50].

2. Socioeconomic Impacts

a) Reduced Agricultural Productivity

Crop yields decline due to soil contamination, air pollution, and heat radiation from flare sites, leading to food insecurity and reduced farmer incomes [17; 7].

b) Declining Fisheries and Aquatic Resources

Polluted water bodies result in fish kills, lower fish stocks, and disrupted livelihoods for fishing communities [19; 42].

c) Displacement and Social Conflict

Environmental degradation forces communities to relocate, undermining social cohesion and often sparking conflict with oil companies over compensation and environmental injustice [20; 47].

d) Economic Losses

Gas flaring represents a massive waste of valuable natural resources that could generate electricity, fuel industries, or supply domestic markets [13; 24]. The lost economic opportunities significantly hinder regional and national development.

3. 0 RESULTS AND DISCUSSION

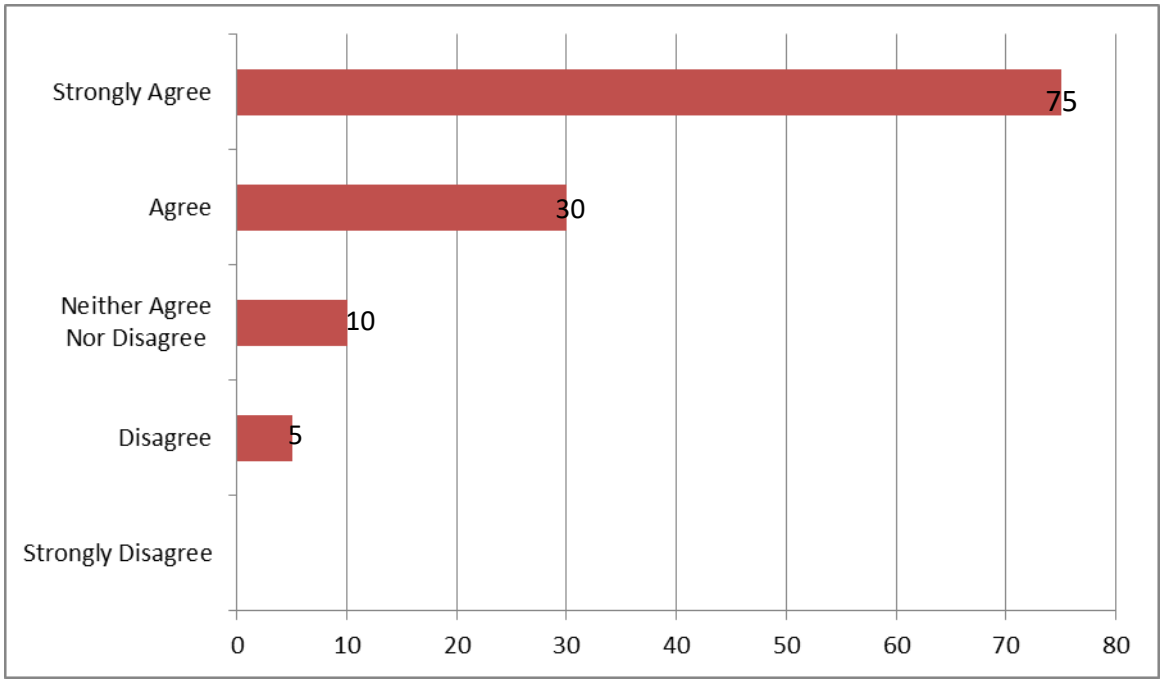
1. I am aware that gas flaring is a common practice in the Niger Delta region.

Table 4.1: I am aware that gas flaring is a common practice in the Niger Delta region.

I am aware that gas flaring is a common practice in the Niger Delta region	**SA**	**A**	**N**	**DA**	**SD**	**TOTAL**
No. of Response	75	30	10	5	0	120
Percentage of Response	63%	25%	8%	4%	0%	100%
Source: Field Survey 2025						

Table 4.1 It was observed that, of the total 120 respondents, 88% respondents agree or strongly agree that gas flaring is a common practice in the Niger Delta region, 8% neither agree nor disagree and 4% disagree or strongly disagree.

Chart 4.1: Response to likert scale shows respondents are aware that gas flaring is a common practice in the Niger Delta region.



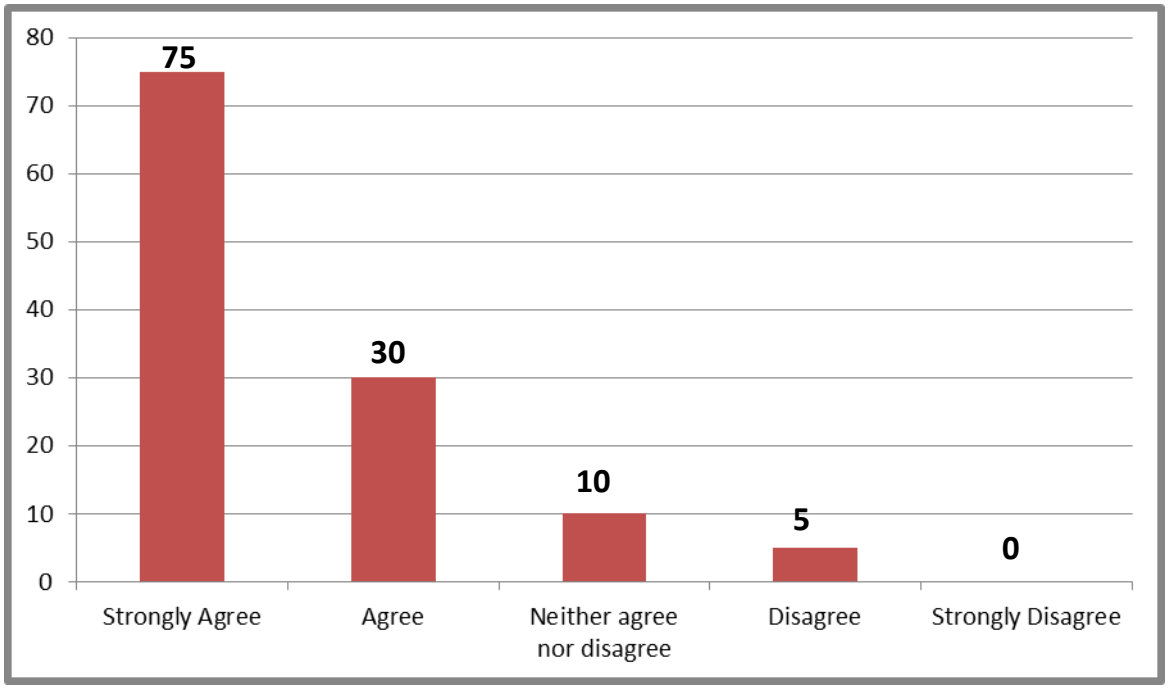
2. I have observed that communities near gas flaring sites experience higher rates of health issues.

Table 4.2: I have observed that communities near gas flaring sites experience higher rates of health issues.

I have observed that communities near gas flaring sites experience higher rates of health issues.	**SA**	**A**	**N**	**DA**	**SD**	**TOTAL**
No. of Response	75	30	10	5	0	120
Percentage of Response	63%	25%	8%	4%	0%	100
Source: Field Survey 2025						

Table 4.2: Of the total 120 respondents, 88% respondents agree or strongly agree that communities near gas flaring sites experience higher rates of health issues, 8% neither agree nor disagree and 4% disagree or strongly disagree.

Chart 4.2: Response to likert scale shows that communities near gas flaring sites experience higher rates of health issues.



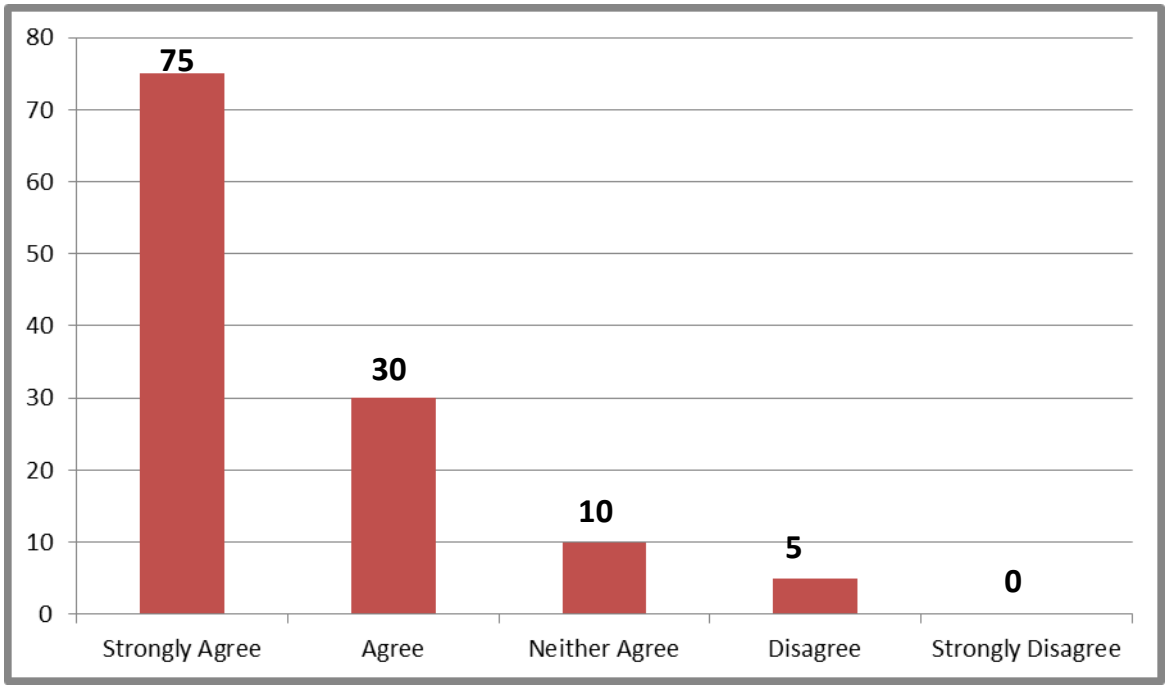
3. I believe that gas flaring contributes to higher rates of infant mortality in the Niger Delta.

Table 4.3 I believe that gas flaring contributes to higher rates of infant mortality in the Niger Delta.

I believe that gas flaring contributes to higher rates of infant mortality in the Niger Delta.	**SA**	**A**	**N**	**DA**	**SD**	**TOTAL**
No. of Response	75	30	10	5	0	120
Percentage of Response	63%	25%	8%	4%	0%	100
Source: Field Survey 2025						

Table 4.3: Of the total 120 respondents, 88% respondents agree or strongly agree that gas flaring contributes to higher rates of infant mortality in the Niger Delta, 8% neither agree nor disagree and 4% disagree or strongly disagree.

Chart 4.3: Response to likert scale shows that gas flaring contributes to higher rates of infant mortality in the Niger Delta.



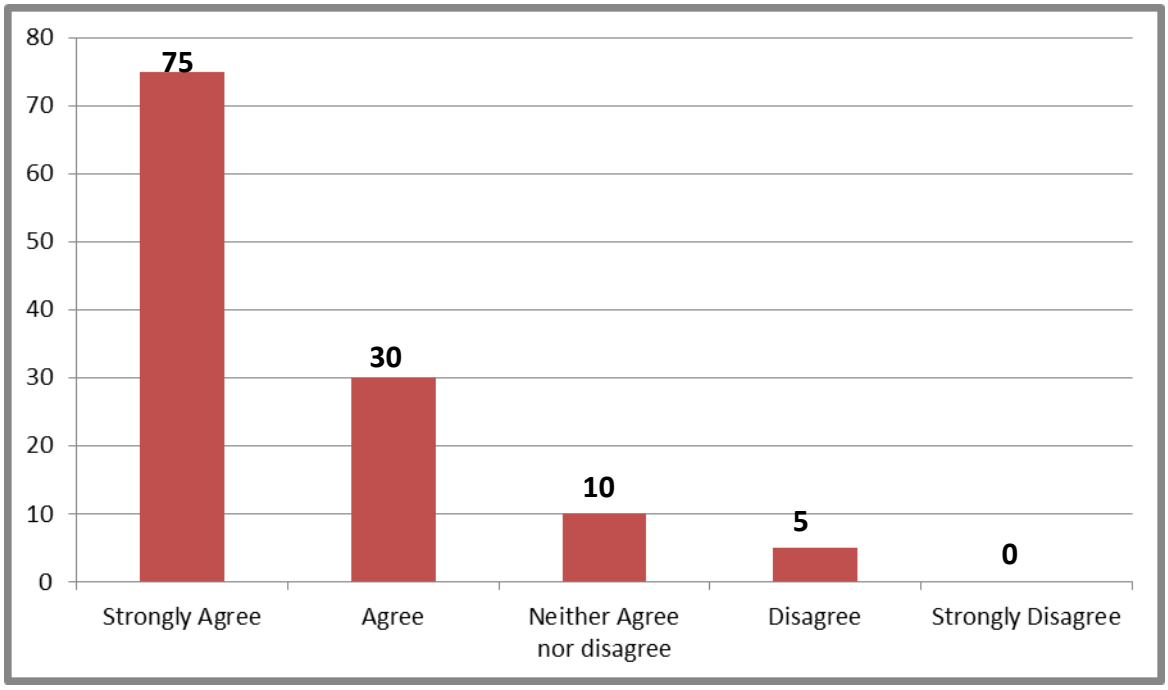
4. The harmful emissions from gas flaring lead to an increase in respiratory diseases among infants.

Table 4.4: The harmful emissions from gas flaring lead to an increase in respiratory diseases among infants.

The harmful emissions from gas flaring lead to an increase in respiratory diseases among infants.	**SA**	**A**	**N**	**DA**	**SD**	**TOTAL**
No. of Response	75	30	10	5	0	120
Percentage of Response	63%	25%	8%	33%	0%	100
Source: Field Survey 2025						

Table 4.4: Out of the total 120 respondents, 88% respondents agree or strongly agree that harmful emissions from gas flaring lead to an increase in respiratory diseases among infants, 8% neither agree nor disagree and 4% disagree or strongly disagree.

Chart 4.4: Response to likert scale shows that harmful emissions from gas flaring lead to an increase in respiratory diseases among infants.



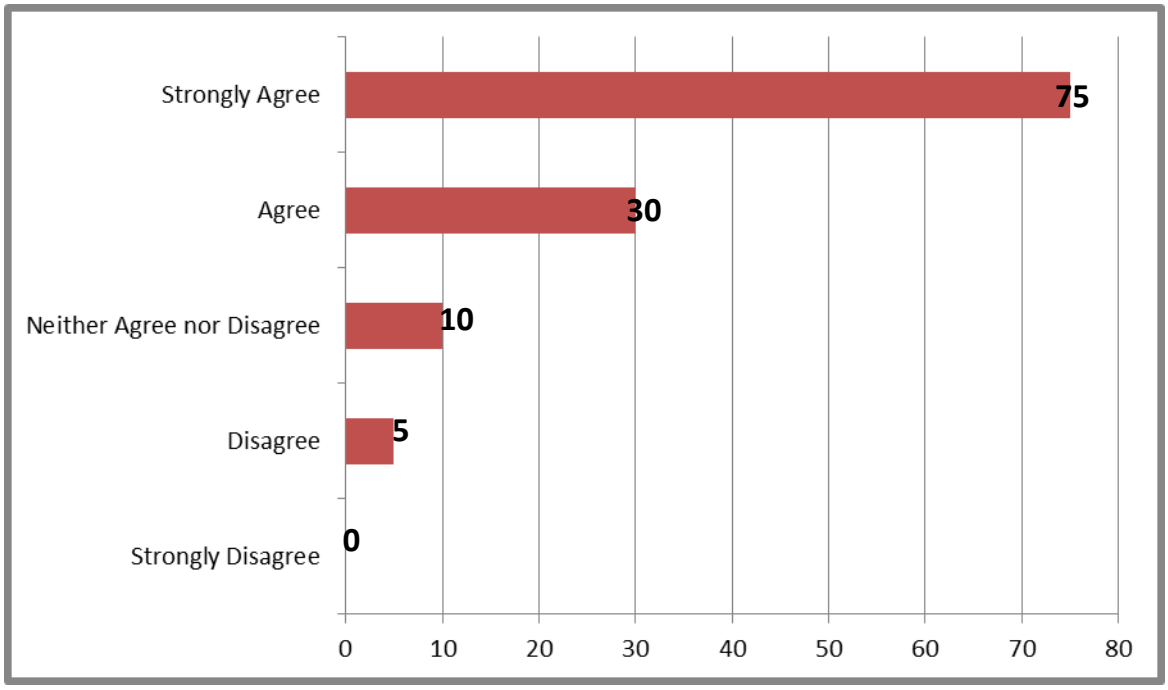
5. Gas flaring contributes to environmental degradation, which indirectly affects infant mortality rates.

Table 4.5: Gas flaring contributes to environmental degradation, which indirectly affects infant mortality rates.

Gas flaring contributes to environmental degradation, which indirectly affects infant mortality rates.	**SA**	**A**	**N**	**DA**	**SD**	**TOTAL**
No. of Response	75	30	10	5	0	120
Percentage of Response	63%	25%	8%	4%	0%	100
Source: Field Survey 2025						

Table 4.5: Out of the total 120 respondents, the above table shows that 88% respondents agree or strongly agree that Gas flaring contributes to environmental degradation, which indirectly affects infant mortality rates, 8% neither agree nor disagree and 4% disagree or strongly disagree.

Chart 4.5: Response to likert scale shows that Gas flaring contributes to environmental degradation, which indirectly affects infant mortality rates.



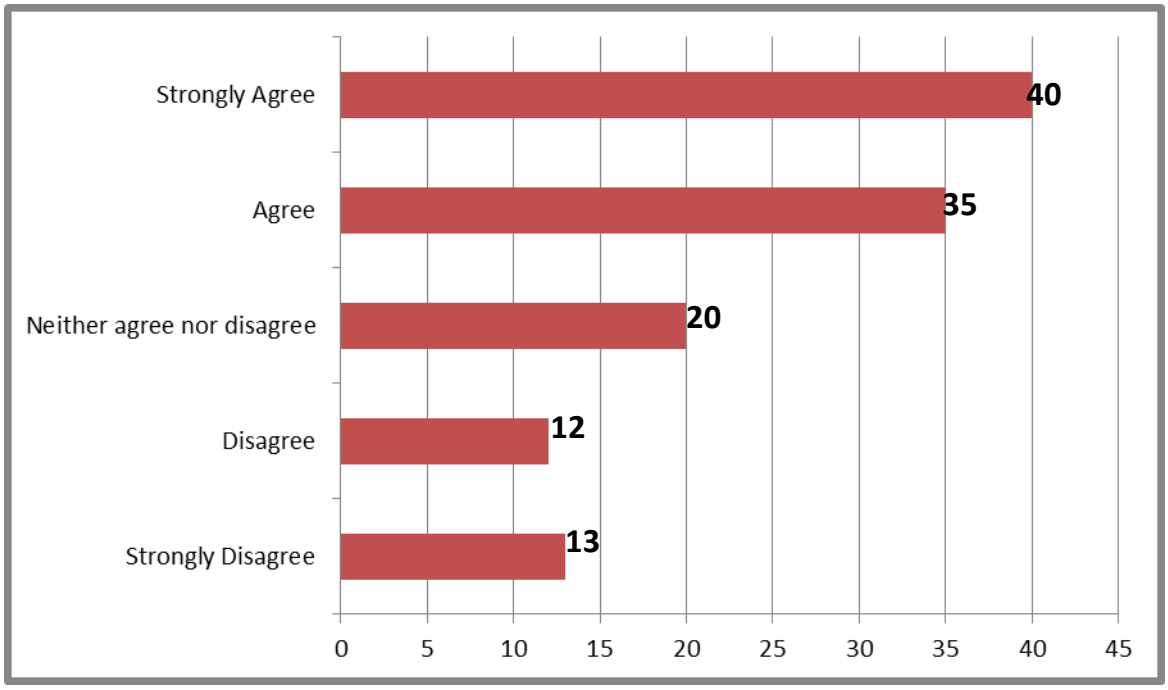
6. In my community, there has been an increase in infant deaths associated with gas flaring activities.

Table 4.6 In my community, there has been an increase in infant deaths associated with gas flaring activities.

In my community, there has been an increase in infant deaths associated with gas flaring activities	**SA**	**A**	**N**	**DA**	**SD**	**TOTAL**
No. of Response	40	35	20	12	13	120
Percentage of Response	33%	29%	17%	10%	11%	100
Source: Field Survey2025						

Table 4.6: The above information shows that, out of the total of 120 respondents, 62% respondents agree or strongly agree that In my community, there has been an increase in infant deaths associated with gas flaring activities, 17% neither agree nor disagree and 21% disagree or strongly disagree.

Chart 4.6: Response to likert scale shows that there has been an increase in infant deaths associated with gas flaring activities.



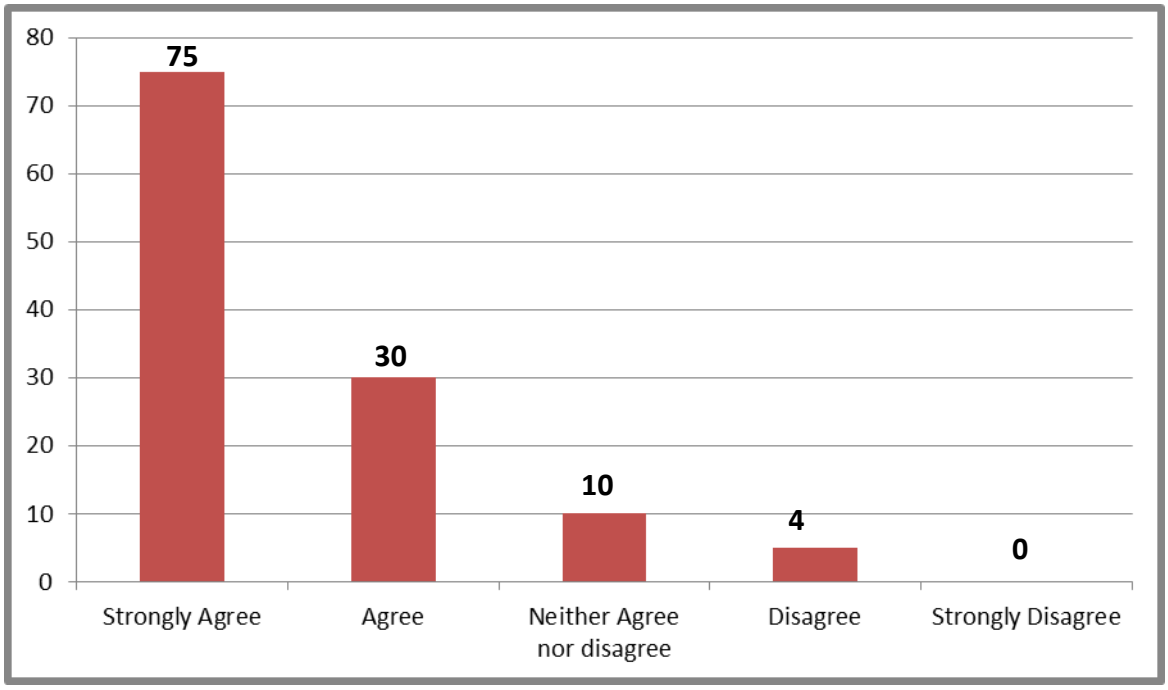
7. I believe that exposure to gas flaring gases during pregnancy can cause birth defects in children.

Table 4.7 I believe that exposure to gas flaring gases during pregnancy can cause birth defects in children.

I believe that exposure to gas flaring gases during pregnancy can cause birth defects in children	**SA**	**A**	**N**	**DA**	**SD**	**TOTAL**
No. of Response	75	30	10	5	0	120
Percentage of Response	63%	25%	8%	4%	0%	100
Source: Field Survey 2025						

Table 4.7: The above information shows that, out of the total of 120 respondents, 88% respondents agree or strongly agree that exposure to gas flaring gases during pregnancy can cause birth defects in children, 8% neither agree nor disagree and 4% disagree or strongly disagree.

Chart 4.7: Response to likert scale to shows that exposure to gas flaring gases during pregnancy can cause birth defects in children.



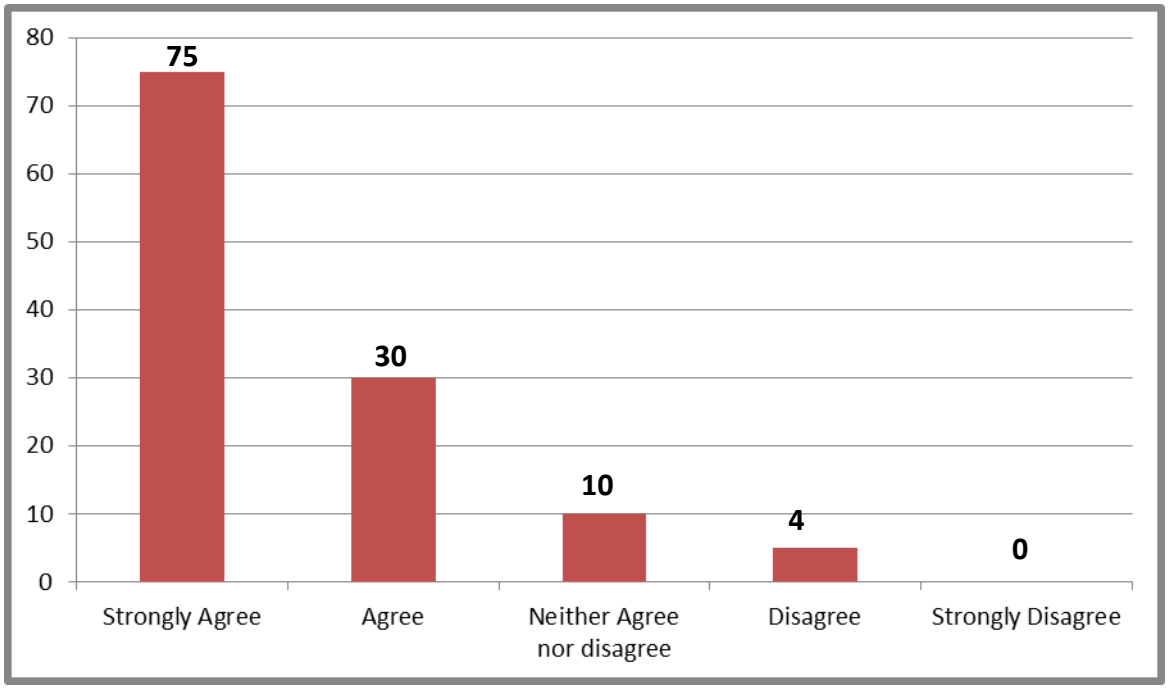
8. Pregnant women living near gas flaring sites are more likely to give birth to babies with physical defects.

Table 4.8 Pregnant women living near gas flaring sites are more likely to give birth to babies with physical defects.

Pregnant women living near gas flaring sites are more likely to give birth to babies with physical defects.	**SA**	**A**	**N**	**DA**	**SD**	**TOTAL**
No. of Response	75	30	10	5	0	120
Percentage of Response	63%	25%	8%	4%	0%	100
Source: Field Survey 2025						

Table 4.8: The above information shows that, out of the total of 120 respondents, 88% respondents agree or strongly agree that pregnant women living near gas flaring sites are more likely to give birth to babies with physical defects, 8% neither agree nor disagree and 4% disagree or strongly disagree.

Chart 4.8: Response to likert scale to shows that pregnant women living near gas flaring sites are more likely to give birth to babies with physical defects.



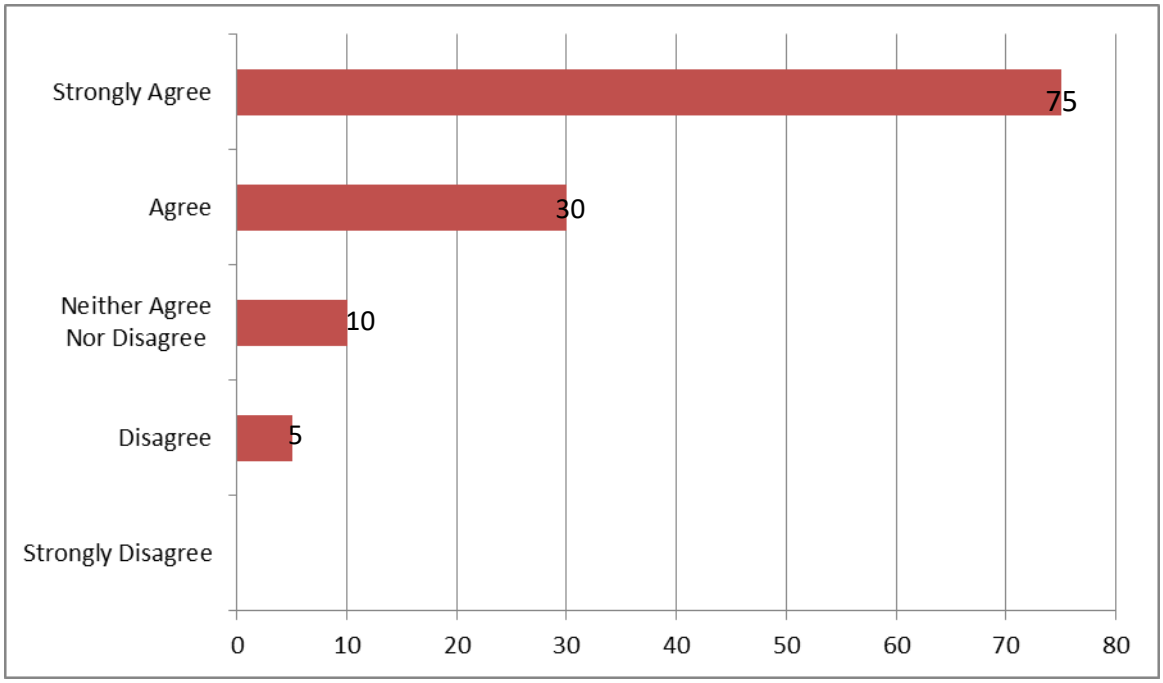
9. Birth defects related to gas flaring are often underreported in the Niger Delta region.

Table 4.9: Birth defects related to gas flaring are often underreported in the Niger Delta region.

Birth defects related to gas flaring are often underreported in the Niger Delta region.	**SA**	**A**	**N**	**DA**	**SD**	**TOTAL**
No. of Response	75	30	10	5	0	120
Percentage of Response	63%	25%	8%	4%	0%	100%
Source: Field Survey 2025						

Table 4.9 It was observed that, of the total 120 respondents, 88% respondents agree or strongly agree that Birth defects related to gas flaring are often underreported in the Niger Delta region, 8% neither agree nor disagree and 4% disagree or strongly disagree.

Chart 4.9: Response to likert scale shows Birth defects related to gas flaring are often underreported in the Niger Delta region.



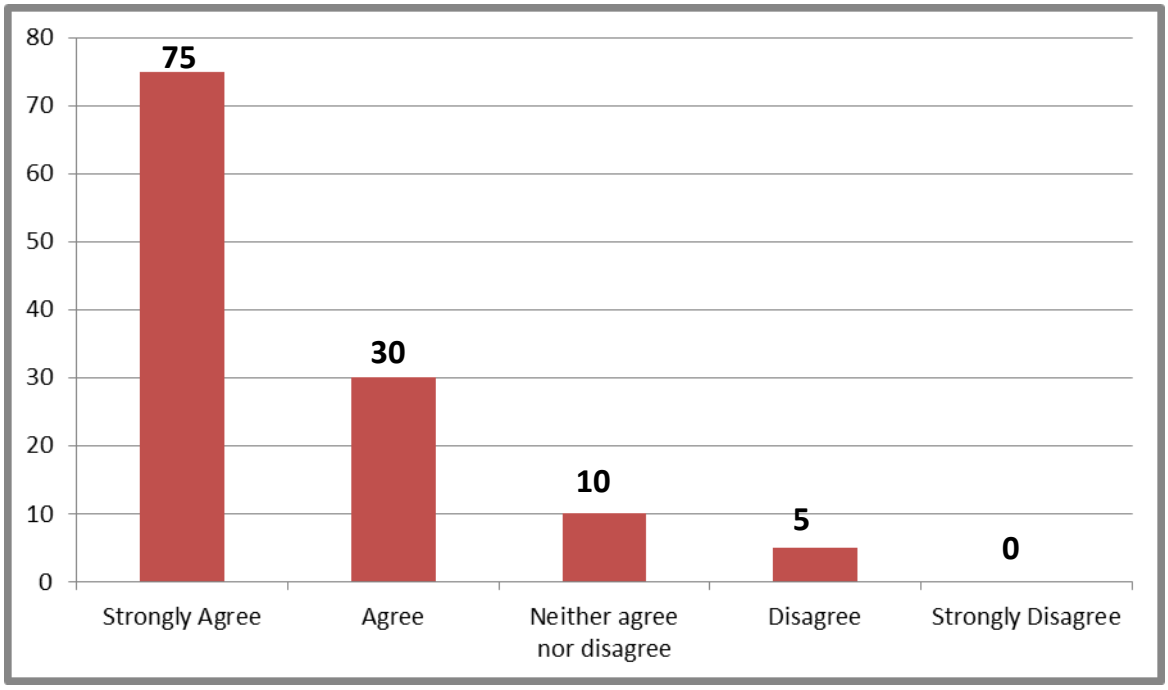
10 There is a need for stricter enforcement of laws regulating gas flaring to reduce its impact on public health.

Table 4.10: There is a need for stricter enforcement of laws regulating gas flaring to reduce its impact on public health.

There is a need for stricter enforcement of laws regulating gas flaring to reduce its impact on public health.	**SA**	**A**	**N**	**DA**	**SD**	**TOTAL**
No. of Response	75	30	10	5	0	120
Percentage of Response	63%	25%	8%	4%	0%	100
Source: Field Survey 2025						

Table 4.10: Of the total 120 respondents, 88% respondents agree or strongly agree that communities near gas flaring sites experience higher rates of health issues, 8% neither agree nor disagree and 4% disagree or strongly disagree.

Chart 4.10: Response to likert scale shows that communities near gas flaring sites experience higher rates of health issues.



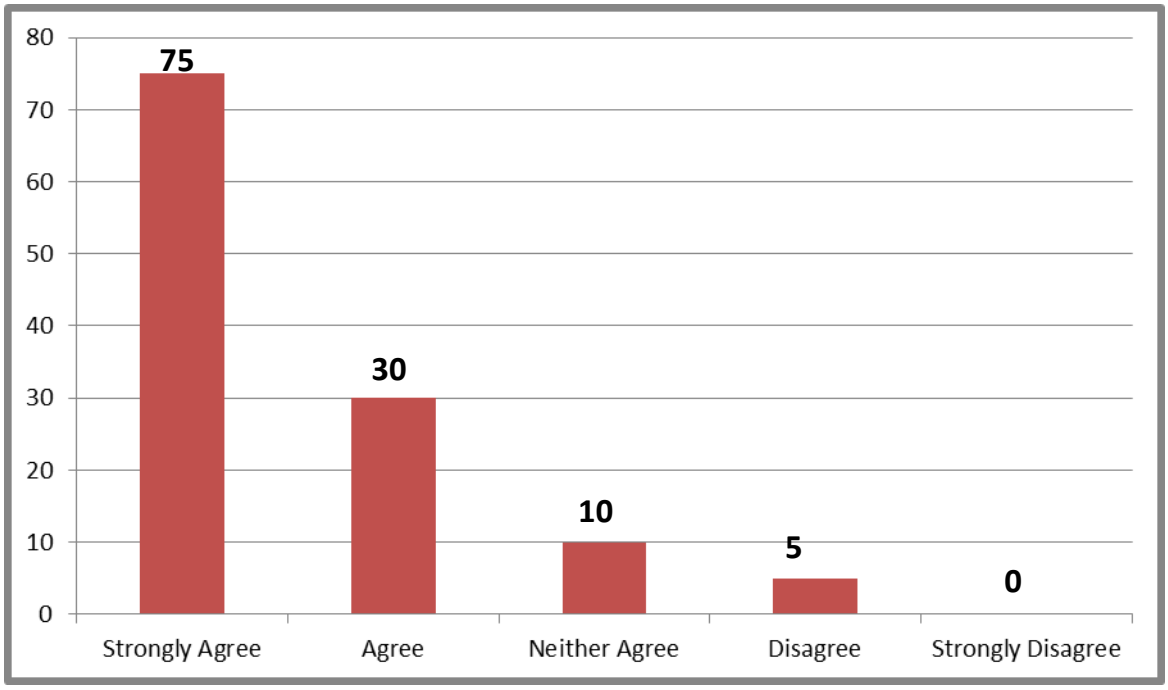
11. More research should be conducted on the health implications of gas flaring, particularly in relation to infant mortality and birth defects.

Table 4.11 More research should be conducted on the health implications of gas flaring, particularly in relation to infant mortality and birth defects.

More research should be conducted on the health implications of gas flaring, particularly in relation to infant mortality and birth defects.	**SA**	**A**	**N**	**DA**	**SD**	**TOTAL**
No. of Response	75	30	10	5	0	120
Percentage of Response	63%	25%	8%	4%	0%	100
Source: Field Survey 2025						

Table 4.11: Of the total 120 respondents, 88% respondents agree or strongly agree that More research should be conducted on the health implications of gas flaring, particularly in relation to infant mortality and birth defects, 8% neither agree nor disagree and 4% disagree or strongly disagree.

Chart 4.11: Response to likert scale shows that More research should be conducted on the health implications of gas flaring, particularly in relation to infant mortality and birth defects.



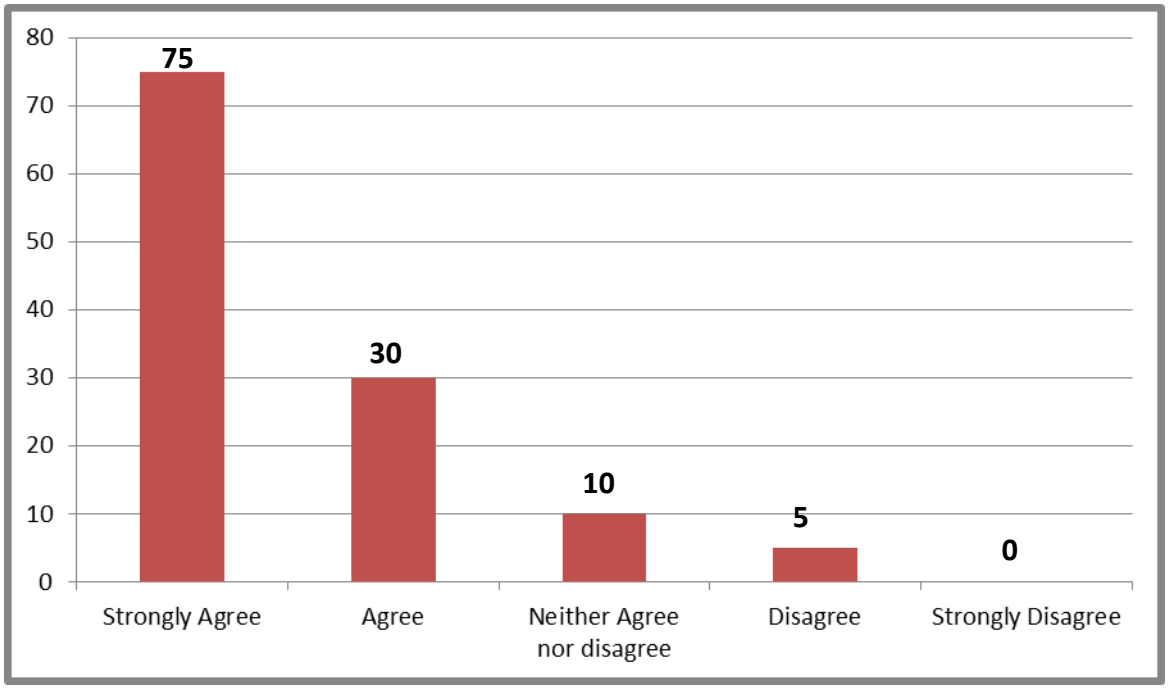
12. I believe the health risks associated with gas flaring outweigh the economic benefits of the activity.

Table 4.12: I believe the health risks associated with gas flaring outweigh the economic benefits of the activity.

I believe the health risks associated with gas flaring outweigh the economic benefits of the activity.	**SA**	**A**	**N**	**DA**	**SD**	**TOTAL**
No. of Response	75	30	10	5	0	120
Percentage of Response	63%	25%	8%	33%	0%	100
Source: Field Survey 2025						

Table 4.12: Out of the total 120 respondents, 88% respondents agree or strongly agree that the health risks associated with gas flaring outweigh the economic benefits of the activity, 8% neither agree nor disagree and 4% disagree or strongly disagree.

Chart 4.12: Response to likert scale shows that health risks associated with gas flaring outweigh the economic benefits of the activity.



CONCLUSION

The study on the Implications of Gas Flaring on Infant Mortality and Birth Defects in the Niger Delta Region has revealed significant adverse effects of this environmental hazard on maternal and child health. Gas flaring releases toxic pollutants, including carbon monoxide, sulfur dioxide, and particulate matter, which contribute to poor air quality and increased health risks. The findings indicate that prolonged exposure to these pollutants is linked to higher rates of infant mortality, low birth weight, congenital disabilities, and respiratory complications among newborns.

Furthermore, the study highlights that the socio-economic conditions of communities in the Niger Delta exacerbate the health risks associated with gas flaring. Limited access to healthcare, inadequate infrastructure, and poverty further contribute to the vulnerability of pregnant women and infants. Despite regulatory frameworks aimed at reducing gas flaring, enforcement remains weak, allowing the continuation of harmful practices that endanger public health.

To mitigate these impacts, it is crucial for policymakers, environmental agencies, and oil companies to enforce strict compliance with anti-flaring regulations, promote cleaner energy alternatives, and invest in community healthcare programs. Raising awareness about the health risks associated with gas flaring and improving maternal healthcare services in the

affected areas are essential steps toward reducing infant mortality and birth defects in the Niger Delta region.

Ultimately, addressing gas flaring requires a multi-stakeholder approach that balances economic interests with the health and well-being of local communities. Without decisive action, the long-term consequences of gas flaring will continue to pose significant public health and environmental challenges.

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