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# Perceived Health Effects of Liquefied Natural Gas (LNG) Among Nearby Residents in Batangas City

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**Abstract**

The development of liquefied natural gas (LNG) infrastructure in Batangas City has raised community concerns regarding potential environmental and health risks. This study examined residents' perceived health effects, concerns about long-term health conditions, quality of life, and assessments of regulatory responsiveness in communities near LNG facilities. The research was described as employing a community survey within an explanatory sequential mixed-methods design involving structured questionnaires and follow-up interviews; the findings available for this article consist principally of descriptive survey results. Findings indicated that 65% of respondents expressed concern about long-term health outcomes, while 73% perceived an increased likelihood of developing chronic health conditions. Furthermore, 75% believed that respiratory and cardiovascular problems were more prevalent in their communities, and more than 60% attributed perceived health deterioration to LNG-related emissions. Regarding quality of life, 60% perceived their circumstances as less favorable than those of residents living away from LNG facilities, while 72% believed LNG emissions substantially affected their overall well-being. Additionally, 69% considered regulatory and industry responses to community health concerns inadequate. These findings indicate substantial perceived health risks and concerns regarding environmental governance among residents near LNG infrastructure. The reported perceptions do not establish direct pollutant exposure, disease incidence, or causal health effects. The study underscores the importance of transparent environmental monitoring, participatory risk communication, community engagement, and further epidemiological investigation.

**Keywords:** *liquefied natural gas; health risk perception; community health; quality of life; regulatory responsiveness; Batangas City*

## 1. Introduction

The growing demand for reliable and diversified energy sources has accelerated the development of liquefied natural gas (LNG) infrastructure in many countries, including the Philippines. LNG has become an important component of energy transition strategies because of its potential to support electricity generation, industrial production, and energy security. In the Philippine context, natural gas has attracted increasing interest as an alternative energy source for industrial and commercial applications, with its adoption influenced by economic considerations, infrastructure availability, and energy policies (Ravago et al., 2021). Nevertheless, the expansion of LNG infrastructure raises environmental and public health concerns, particularly among communities situated near processing, storage, and transportation facilities.

Although natural gas is frequently presented as a comparatively cleaner-burning alternative to certain other fossil fuels, its environmental implications extend beyond combustion. LNG infrastructure involves transportation, storage, regasification, and associated industrial activities, each presenting distinct environmental and safety considerations. Cordero (2024) emphasized the importance of examining the environmental and public health implications of LNG development in the Philippines, particularly appropriate regulatory interventions, environmental safeguards, and community engagement. These considerations highlight the importance of examining not only the technical dimensions of energy infrastructure but also the experiences and concerns of populations residing near such facilities.

Batangas City is an important setting for examining these concerns because of its concentration of energy-related and industrial infrastructure, including LNG facilities and associated operations. Communities near such developments may experience uncertainty about environmental conditions, potential health consequences, and the adequacy of protective measures. That uncertainty can influence how residents interpret physical well-being, evaluate

living environments, and assess the responsiveness of public institutions. Perceptions of environmental health risks therefore constitute an important dimension of community well-being, even where a direct relationship between exposure and specific health conditions has not been clinically established.

From a behavioral and social science perspective, perceived environmental risks are relevant because they reflect how individuals interpret potential hazards and form judgments about their surroundings. Concerns about respiratory illnesses, cardiovascular conditions, and long-term health outcomes may influence residents' sense of security, perceived quality of life, and expectations of government and industry accountability. Similarly, assessments of regulatory responsiveness may shape residents' confidence in monitoring, public information, and institutional safeguards. These perceptions offer insight into the social dimensions of industrial development and the importance of transparent environmental governance.

Existing literature has examined natural gas development, environmental sustainability, and public health considerations (Cordero, 2024; Ravago et al., 2021). However, the literature reviewed here provides limited direct evidence regarding how residents of LNG-adjacent communities in Batangas City perceive potential health consequences, evaluate their quality of life, and assess the adequacy of institutional responses. This context-specific empirical gap matters because community assessments may identify concerns warranting further investigation, improved public communication, and participatory environmental management.

The present study addresses this gap by examining residents' reported health concerns and evaluations of community well-being in selected barangays of Batangas City. Rather than establishing epidemiological causation, the analysis focuses on residents' reported experiences, beliefs, and judgments regarding potential health risks and regulatory responsiveness. Perceived health deterioration and perceived disease prevalence do not independently establish pollutant exposure, medically confirmed illness, or direct attribution to LNG operations. Nevertheless, such perceptions constitute meaningful behavioral and social evidence for public health communication, community engagement, and environmental governance.

### *Objectives of the Study*

This study aimed to examine the perceived health effects of LNG operations among residents living near LNG infrastructure in Batangas City, with particular emphasis on health risk perception, community well-being, and perceived regulatory responsiveness. Specifically, it sought to: (1) determine residents' awareness of and concerns regarding potential long-term health implications; (2) describe perceived health changes and assessments of respiratory and cardiovascular conditions; (3) examine perceptions of how LNG-related environmental concerns affect quality of life and well-being; (4) assess perceived adequacy of regulatory and industry responses; and (5) identify community-level concerns and possible improvements in environmental monitoring, risk communication, regulatory responsiveness, and public health protection.

## 2. Review of Related Literature

### *2.1 LNG Development, Environmental Emissions, and Community Health*

Liquefied natural gas has become important in energy diversification strategies, particularly in countries seeking greater energy security. In the Philippines, the potential adoption of natural gas among manufacturing firms has been associated with considerations of fuel competitiveness, operational requirements, and infrastructure availability (Ravago et al., 2021). Expansion of LNG infrastructure, however, also raises questions about environmental sustainability, industrial emissions, and nearby communities.

Cordero (2024) emphasized environmental and public health concerns associated with LNG development in the Philippines, particularly monitoring, accountability, and precautionary interventions. Al-Yafei et al. (2021) examined air emissions and potential human health impacts across stages of the LNG supply chain, demonstrating the importance of evaluating environmental consequences across interconnected activities rather than considering combustion alone.

More recent investigations provide specific evidence about emissions associated with LNG infrastructure. Wu et al. (2026) modeled nitrogen dioxide concentrations surrounding four LNG export terminals in the United States and estimated associated potential health burdens. Their analysis identified spatial variations in modeled concentrations and potential exposure-related inequalities. Minet et al. (2025) investigated flaring at 48 LNG export facilities worldwide and identified variations associated with facility operations and development stages. Research on related natural gas infrastructure also demonstrates the value of monitoring: Davis et al. (2023) reviewed emissions and

community health considerations associated with pipeline compressor stations, emphasizing regulatory oversight and community engagement.

Together, these investigations show that LNG and associated gas infrastructure can generate environmental concerns requiring assessment. Nevertheless, emission profiles differ across liquefaction, regasification, transport, and other processes. Findings from export terminals and compressor stations cannot automatically establish the environmental exposure conditions experienced by residents in Batangas City.

### *2.2 Industrial Proximity and Environmental Health Risk Perception*

Environmental health risk perception concerns individuals' assessments of the likelihood, severity, and potential consequences of environmental hazards. Residential proximity to industry is an important contextual factor because neighboring communities may have greater awareness of industrial operations, environmental changes, and potential exposure pathways.

Balžekienė et al. (2025), in a systematic review, found substantial evidence that geographical distance influences perceptions of environmental and technological hazards, although effects vary with the hazard, community circumstances, and social context. Thus, proximity alone does not fully explain how residents interpret industrial risks. Karki et al. (2023) examined perceptions among residents near industrial facilities in Nepal and documented concerns regarding environmental pollution and self-reported health effects. Burcham et al. (2025), studying communities affected by environmental contamination, identified associations between residential circumstances and subjective well-being.

Interpretations of industrial risks may also depend on familiarity with industrial activities, environmental knowledge, perceived vulnerability, and confidence in responsible institutions. Communities with longstanding industry may recognize potential hazards while also perceiving economic or social benefits. Accordingly, perceptions cannot be assumed uniform merely because residents occupy similar geographical locations.

In LNG-adjacent communities, residents may develop concerns about respiratory illness, cardiovascular conditions, and long-term health outcomes. These concerns are meaningful social and behavioral responses to perceived environmental hazards, but they must be distinguished from verified exposure, clinically established disease, and epidemiological evidence of causation.

### *2.3 Perceived Environmental Quality, Health Concerns, and Community Well-Being*

Perceived environmental quality is important for understanding subjective well-being and health-related concerns in industrial communities. Evaluations of air quality, pollution, safety, and neighborhood conditions may affect residents' satisfaction with their surroundings and assessments of personal health.

Zhao et al. (2024) found that perceived air pollution was negatively associated with life satisfaction in China, highlighting the role of subjective environmental assessments and their possible distinction from objective pollution indicators. Zhu and Lu (2023) examined pollution perception and residents' health and identified relationships between perceived environmental conditions and self-rated health outcomes.

Phan et al. (2021), in research among residents near a solid waste management facility in Vietnam, identified associations involving environmental dissatisfaction, health, facility acceptance, and quality of life. Li et al. (2024) used structural equation modeling to examine air pollution risk perception and subjective well-being; perceived risk consequences were negatively related to well-being, whereas controllability, trust, and acceptability were positively associated with well-being. Industrial pollution concerns may also involve reported physical symptoms and psychological discomfort. Guadalupe-Fernandez et al. (2021), in a systematic review and meta-analysis, identified associations between industrial odor pollution and selected health complaints while acknowledging limitations in the available evidence. In a Philippine urban setting, Marcos et al. (2026) similarly used residents' self-reported household environmental conditions and reported illness occurrence across selected barangays, illustrating how community survey data can describe local environmental health concerns.

Collectively, these studies indicate that perceived conditions and health risks are relevant to community well-being. However, subjective deterioration in health or quality of life is not proof of direct industrial exposure or causally established disease. This distinction is particularly important when findings depend on self-reported survey responses.

### *2.4 Regulatory Responsiveness, Institutional Trust, Risk Communication, and Community Participation*

Community assessments of environmental safety are influenced by perceived physical hazards and by evaluations of the institutions responsible for environmental protection. Regulatory responsiveness, trust, accessible information, and meaningful participation represent important dimensions of environmental governance.

Stretesky et al. (2023) examined trust and hydraulic-fracturing risk perception in the United Kingdom and found that associations depended on the institution evaluated. Trust in the oil and gas industry was associated with lower perceived risks, whereas relationships involving government and regulators were less consistent. Institutional trust should therefore not be treated as a single uniform construct.

Risk communication affects how communities understand and respond to hazards. Lindsey et al. (2022) emphasized environmental health literacy and the need for understandable and accessible communication that recognizes residents' concerns. Sansom et al. (2021), examining emergency communication following an industrial incident, found associations between information channels and willingness to follow recommended protective actions. In flood-prone Philippine barangays, Temporada et al. (2025) observed generally high disease-risk awareness alongside specific knowledge gaps and recommended targeted campaigns and community engagement to strengthen prevention.

Community participation provides another mechanism for addressing environmental concerns. Symanski et al. (2023) showed how community-based participatory research can support the identification of pollution concerns and development of corresponding health responses. Miguel et al. (2026) examined participation, institutional trust, and distributive justice in renewable-energy projects and found that meaningful engagement and perceptions of institutional credibility were more closely associated with favorable fairness evaluations than awareness of formal procedures alone.

These studies support the importance of responsive institutions, transparent risk communication, and participatory environmental decision-making. Nonetheless, satisfaction with regulatory responses, institutional trust, and perceived procedural fairness remain conceptually distinct; conclusions must correspond to the constructs actually measured.

### *2.5 Synthesis of Literature and Research Gaps*

The literature identifies interconnected considerations relevant to communities near LNG and related industrial infrastructure. Environmental investigations support monitoring of emissions and assessment of potential health implications (Al-Yafei et al., 2021; Davis et al., 2023; Minet et al., 2025; Wu et al., 2026). Studies of industrial communities indicate that proximity and perceived environmental conditions can influence assessments of risk (Balžekienė et al., 2025; Karki et al., 2023). Evidence also associates pollution perception and environmental dissatisfaction with subjective well-being (Li et al., 2024; Phan et al., 2021; Zhao et al., 2024; Zhu & Lu, 2023). Research on governance highlights the relevance of regulatory responsiveness, institutional credibility, communication, and participation (Lindsey et al., 2022; Miguel et al., 2026; Stretesky et al., 2023; Symanski et al., 2023).

Nevertheless, much of the evidence concerns modeled pollution, epidemiological outcomes, or industrial facilities outside the Philippines. Perception studies often address sites whose characteristics are not directly equivalent to LNG infrastructure. The reviewed literature provides limited integrated evidence about perceived health risks, quality of life, and assessments of institutional responses among residents near LNG facilities in Batangas City. The present study addresses this context-specific gap through descriptive evidence of reported concerns, while recognizing that perceived risks alone cannot establish exposure or causal health outcomes.

## 3. Methodology

### *3.1 Research Design*

The source study was described as adopting an explanatory sequential mixed-methods design to examine perceived health effects, environmental risk concerns, quality of life, and regulatory responsiveness among residents near LNG infrastructure in Batangas City. Its first component consisted of a community survey; follow-up interviews were described as the means of contextualizing survey findings. However, the material available for this article contains descriptive survey outcomes without a documented qualitative results section or joint quantitative–qualitative analysis. Consequently, the reported research design is distinguished here from the evidence that can presently be interpreted.

### *3.2 Participants and Study Setting*

The study was conducted in selected barangays of Batangas City, Philippines, with attention to communities near LNG-related infrastructure. Eligible survey respondents were adults aged 18–65 years who had resided in the city for at least three years. The source manuscript reports conflicting totals for the survey sample and geographical coverage: its abstract identifies 1,730 residents from 13 barangays, whereas the participants section describes a plan for 1,260 residents from 12 barangays. The final achieved sample size and coverage therefore remain unverified in the supplied documentation.

### *3.3 Sampling Technique*

The original methodology described stratified random sampling, treating selected barangays as strata. The stated allocation was 105 respondents in each of 12 barangays, corresponding to a planned total of 1,260. However, neither the final sampling frame nor the achieved allocation and random-selection procedure can be reconstructed from the supplied results. The original report also describes 60 qualitative interview participants while elsewhere referring to interviewing every third survey participant, an inconsistent selection rule requiring documentary clarification.

### *3.4 Research Instruments*

The research used a researcher-developed structured questionnaire and an interview guide. The questionnaire addressed awareness of LNG-related health concerns, perceived health outcomes near infrastructure, perceived respiratory and cardiovascular conditions, and perceived changes in health status. It contained English and Tagalog statements and was described as using a five-point Likert-type response format. The interview guide was designed to explore residents' experiences and their views of environmental protection and institutional responses.

The source manuscript states that the questionnaire underwent pilot testing for validity and reliability, but the cited appendix, pilot-test details, numerical reliability coefficients, and validation evidence were not supplied. The instrument's psychometric properties therefore cannot be independently reported.

### *3.5 Data Gathering Procedure*

Data were gathered through face-to-face administration of structured questionnaires among eligible residents of selected barangays. The survey was supplemented by face-to-face interviews lasting approximately 20–25 minutes, with participants' consent obtained for recording and subsequent transcription. These procedures were intended to capture community perceptions and experiences concerning environmental exposure, associated health risks, and perceived institutional responses.

The study also incorporated consideration of regulatory frameworks and mitigation strategies relevant to the research objectives. However, specific regulatory documents and corresponding analytical findings are not reported. Consequently, the presentation of findings focuses on the documented survey results.

### *3.6 Data Analysis*

The quantitative component employed a descriptive analytical framework incorporating frequencies, percentages, weighted means, and rankings. The reported findings primarily consist of descriptive percentages reflecting respondents' perceptions of long-term health risks, chronic health conditions, community health discussions, perceived deterioration of health, respiratory and cardiovascular conditions, quality of life, and regulatory responsiveness.

The quantitative interpretation was limited to the reported descriptive percentages because item-level response counts, denominators, weighted mean values, and ranking summaries were not available for presentation. Accordingly, the findings were interpreted descriptively, without inferential statistical comparisons or causal attribution.

For the qualitative component, Colaizzi's phenomenological method was identified as the analytical approach for examining interview responses. This approach has also been applied in phenomenological health research conducted in Batangas City (Macatangay & Magnaye, 2026). However, because the qualitative findings are not accompanied by identifiable themes, supporting interview excerpts, or integrated qualitative–quantitative analyses, the interpretation is confined to the documented descriptive results. No additional qualitative themes or participant narratives are inferred.

### *3.7 Ethical Considerations*

The study's ethical protocol emphasized voluntary participation, informed consent, confidentiality, and protection of participants' privacy. Specific provisions addressed consent for interview recording and the responsible handling of information collected during the research process.

The Lyceum of the Philippines University–Batangas Research Ethics Review Committee was identified as the institutional body responsible for ethical review. However, an ethics approval reference number, approval date, and confirmation of completed ethical clearance are not reported. Accordingly, formal committee approval is not asserted without supporting documentation.

## 4. Results and Discussion

### *4.1 Perceived Long-Term Environmental Health Risks*

The reported findings indicate substantial concern about health implications among surveyed residents. Approximately 65% expressed concern about long-term health outcomes associated with LNG facilities, and 73% perceived a greater likelihood of developing chronic health conditions. Further, 69% reportedly discussed potential health implications of LNG-related emissions within their communities. These findings indicate that perceived environmental risks were salient in individual and community assessments. They do not measure actual long-term illness or objective exposures.

### *4.2 Perceived Health Conditions and Environmental Exposure Concerns*

More than 60% of respondents believed that their health had deteriorated because of LNG-related emissions. In addition, 75% perceived a higher prevalence of respiratory and cardiovascular conditions in their communities. These responses indicate that residents associated aspects of their perceived health and local illness patterns with nearby industry, but the available material contains no clinical diagnoses, facility-based health records, exposure measurements, or separately sampled comparison community. The findings should therefore be interpreted as reports of perceived risks and health conditions rather than verified disease incidence or causally attributable health effects. Table 1 consolidates the reported descriptive indicators.

**Table 1**. *Summary of Residents' Reported Perceptions Concerning LNG Operations*

| Domain | Reported indicator | Percentage |
|---|---|---|
| Long-term health concern | Concerned about long-term health outcomes associated with LNG facilities | 65% |
| Chronic health risks | Perceive a greater likelihood of developing chronic health conditions | 73% |
| Community discussion | Discuss health implications of LNG-related emissions | 69% |
| Perceived health deterioration | Believe personal health has declined because of LNG-related emissions | Over 60% |
| Perceived disease prevalence | Perceive greater prevalence of respiratory and cardiovascular conditions | 75% |
| Comparative quality of life | Believe quality of life is lower than in areas without LNG facilities | 60% |
| Overall well-being | Believe LNG emissions substantially affect overall quality of life | 72% |
| Regulatory responsiveness | Consider regulatory and industry responses to health concerns inadequate | 69% |

*Note.* Percentages are reproduced from the source manuscript. The achieved sample size, item-level denominators, and response-category aggregations have not been verified. Findings concern reported perceptions, not clinically established disease, measured exposure, or independently verified regulatory deficiencies. "Substantially" refers to perceived magnitude rather than statistical significance.

### *4.3 Perceived Quality of Life and Community Well-Being*

Approximately 60% of respondents considered their quality of life lower than that of individuals in communities without LNG facilities, and 72% believed LNG emissions substantially affected their well-being. These findings indicate that concerns extended beyond specific health conditions to evaluations of the residential environment, community satisfaction, and future well-being. However, the comparison with areas without LNG facilities reflects residents' judgments; the study did not include an independently sampled comparison population or an objective measure of quality-of-life differences.

### *4.4 Perceived Regulatory and Industry Responsiveness*

Approximately 69% of respondents perceived that regulatory authorities and industry stakeholders had not adequately addressed LNG-related health concerns. This indicates reported dissatisfaction with perceived institutional accountability and protective responses. It does not independently establish environmental noncompliance, failures to implement legally required safeguards, or shortcomings in the technical effectiveness of existing regulations. The finding concerns perceived adequacy of response, not a validated measure of generalized institutional trust.

### *4.5 Discussion*

The findings contribute descriptive evidence about environmental health risk perception and community well-being surrounding industrial energy infrastructure in Batangas City. Respondents reported substantial concerns about long-term health outcomes, perceived disease prevalence, quality of life, and institutional responsiveness. These results are socially relevant because they show how communities interpret potential hazards and assess the institutional environment in which industrial development occurs.

**Industrial proximity and perceived risk.** The high proportions expressing concern are compatible with literature identifying proximity as one contextual factor in environmental risk perception. Balžekienė et al. (2025) found that geographical proximity frequently relates to perceived hazards, but that relationships vary by facility type and social circumstances. Karki et al. (2023) likewise documented risk concerns among people living near industry. These studies help contextualize perceptions in Batangas without implying that this study demonstrated an association between residential distance and survey responses: no proximity-band comparisons were supplied. Thus, the findings describe perceived hazards within selected communities rather than a measured geographical risk gradient.

**Health concerns and environmental uncertainty.** The reported beliefs about deteriorating health and greater respiratory or cardiovascular prevalence indicate that residents associate industrial operations with potential adverse effects. Environmental investigations provide context for why industrial emissions may be regarded as hazardous. Al-Yafei et al. (2021) examined emissions and potential human health impacts across the LNG supply chain; Wu et al. (2026) modeled near-source concentrations and potential burdens around LNG export terminals; and Minet et al. (2025) examined flaring activity. These studies do not establish the pollution levels or exposure pathways in Batangas City. Without site-specific monitoring, clinical outcomes, or comparison groups, residents' perceptions cannot be reclassified as verified disease incidence or exposure–response relationships.

**Environmental risk and subjective well-being.** The 60% comparative quality-of-life finding and 72% overall well-being finding are consistent with research connecting environmental perceptions to subjective well-being. Zhao et al. (2024) associated perceived air pollution with lower life satisfaction, while Zhu and Lu (2023) examined distinctions between perceived and objective pollution in relation to health. Phan et al. (2021) found associations among environmental dissatisfaction, health, and quality of life near a solid waste facility. Li et al. (2024) further showed that risk consequences, controllability, trust, and acceptability may relate differently to subjective well-being. Yet the present study supplied only separate percentages and no correlations or multivariate models. It cannot establish that perceived health risks statistically predict lower quality of life.

**Regulatory responsiveness and institutional confidence.** The 69% reporting inadequate regulatory and industry responses demonstrates perceived dissatisfaction, not independently proven noncompliance. Stretesky et al. (2023) found that relationships between trust and industrial risk differ by institutional actor, making it inappropriate to equate perceived inadequate response with a general measure of distrust. In the Philippine context, Dela Cruz and Atento (2026) argued that public distrust of government institutions is better understood in relation to perceived institutional performance and governance conditions than as a fixed cultural disposition. Lindsey et al. (2022) stressed the value of accessible environmental health literacy, while Sansom et al. (2021) demonstrated the relevance of communication channels to emergency protective responses. Participatory research by Symanski et al. (2023) and findings on meaningful engagement by Miguel et al. (2026) provide a rationale for including communities in

environmental information and governance. The present data support examining those practices, not asserting that particular interventions would necessarily reduce concern or raise trust.

**Contribution and limitations.** Three descriptive observations emerge: many respondents perceived long-term health risks, concerns about health coexisted with reported quality-of-life concerns, and many evaluated regulatory responses unfavorably. The study documents behavioral and social dimensions of industrial development that may not be captured in technical environmental assessments alone. Nonetheless, self-reported perceptions may reflect recall and reporting biases, environmental awareness, and other personal or contextual influences. Multiple industrial activities in Batangas City further complicate attributing perceived health concerns to LNG specifically. Perceived cardiovascular conditions may also reflect common lifestyle-related risk factors; a community screening in Manila documented hypertension, exposure to cigarette smoke, dietary risks, physical inactivity, and elevated glucose among selected respondents (Cabanban et al., 2026). Absence of measured exposure, validated clinical outcomes, independently sampled comparisons, item-level statistics, and reported qualitative themes limits generalizability and interpretation. The conflicting reported sample totals additionally prevent accurate identification of denominators and response rates. These limitations do not erase the value of describing community concerns; they define the claims that can responsibly be made from the available evidence.

## 5. Conclusions, Recommendations, and Implications

### *5.1 Conclusions*

The study examined perceived health effects, environmental concerns, quality of life, and regulatory responsiveness among residents near LNG infrastructure in Batangas City. The findings provide descriptive evidence that residents' interpretations of potential hazards are relevant to the social dimensions of energy development.

First, 65% expressed concern about long-term health outcomes, 73% perceived a greater likelihood of chronic illness, and 69% reportedly discussed LNG-related health concerns within their communities. These results demonstrate considerable awareness and concern about possible long-term implications.

Second, more than 60% believed their health had declined because of LNG-related emissions, and 75% perceived greater respiratory and cardiovascular prevalence nearby. These are residents' assessments, not independently established disease incidence or clinically verified LNG-related effects.

Third, 60% believed their quality of life was lower than in areas without LNG facilities, and 72% perceived substantial effects on well-being. These responses suggest that concerns encompass broader assessments of residential conditions, but they do not establish objective between-community differences.

Fourth, 69% considered regulatory and industry responses inadequate. This highlights perceptions of institutional responsiveness without establishing regulatory noncompliance or inadequacy of particular legal safeguards.

Overall, the findings support the value of incorporating community perceptions into environmental risk communication, engagement, and further investigation. Stronger exposure and health evidence is necessary before making causal claims about LNG operations.

### *5.2 Recommendations*

**Strengthen environmental and community health monitoring.** The Department of Environment and Natural Resources–Environmental Management Bureau (DENR-EMB), Department of Health (DOH), local government units, and relevant operators should consider strengthening monitoring around LNG infrastructure. Where technically appropriate, monitoring can address particulate matter, nitrogen oxides, sulfur dioxide, volatile organic compounds, and other operation-specific indicators. Appropriate health surveillance can document respiratory and cardiovascular complaints without presuming that LNG operations caused them.

**Improve public information and risk communication.** Batangas City authorities and relevant agencies should promote accessible information about LNG operations, monitoring, potential hazards, and emergency measures. Materials should use clear language, including Filipino or Tagalog as appropriate, and established barangay and digital communication channels. Messages should distinguish confirmed environmental findings from potential risks and unverified health claims. Philippine hazard scholarship has similarly argued for publicly communicated, evidence-grounded warning systems that separate verified hazards from popular narratives (Atento et al., 2026).

**Strengthen participation and institutional responsiveness.** Government and industry stakeholders should maintain accessible channels through which residents can report concerns, request information, and receive documented responses. Community consultations and clear reporting processes can support responsiveness without presuming existing regulatory failures.

**Support community-based environmental health education.** Local health offices, barangay health workers, educational institutions, and community organizations may implement environmental health literacy initiatives covering industrial emissions, potential exposure pathways, preventive practices, and incident response. Household surveys in CALABARZON have reported near-universal awareness of and high trust in community health workers, supporting their role in community-level health engagement (Morcilla & Quinto, 2026). Community participation can help tailor activities to actual information needs, particularly because knowledge does not necessarily translate into practice; a barangay-level study in Marikina City found that preventive practices were less consistent than residents' generally high knowledge (Quinto et al., 2026).

**Prioritize vulnerable populations in future assessments.** Future investigations should consider children, older adults, pregnant women, and people with pre-existing conditions. Because the stated survey eligibility was ages 18–65 years, this manuscript does not establish the experiences or disease incidence of other age groups.

**Conduct stronger epidemiological and exposure research.** Subsequent studies should integrate objective environmental measurements, documented clinical outcomes, appropriate comparison populations, residential distance and duration, and relevant sociodemographic characteristics. Investigators should account for other industrial sources in Batangas City before assigning potential effects specifically to LNG operations.

**Use evidence-based approaches to environmental governance.** Institutions should periodically consider monitoring records, community feedback, health evidence, and applicable regulatory requirements when evaluating safeguards. Any additional environmental or health impact assessment requirements should be proposed and examined within the existing legal and regulatory framework rather than treated as established obligations.

### *5.3 Implications of the Study*

**Behavioral and social research.** The findings highlight environmental risk perception as a meaningful dimension of residents' assessments of health, safety, quality of life, and institutional protection. The study contributes context-specific descriptive evidence; future investigations could test relationships among perceived exposure, health concerns, risk communication, institutional trust, and responses using validated measures and appropriate models.

**Community health and institutions.** The dissatisfaction reported by many respondents indicates a reason to examine the accessibility of environmental information and the visibility of responses to community concerns. Public institutions and operators may use the results to guide communication and engagement initiatives, while recognizing that this study does not independently assess regulatory compliance.

**Environmental policy and future inquiry.** Community perceptions should complement, not replace, technical environmental assessments, exposure monitoring, and epidemiological evidence. The study identifies concerns that may inform subsequent inquiry, including research integrating community survey responses with site-specific environmental and clinical measures. Its contribution lies in documenting residents' perspectives while clearly separating perceptions from established exposure and health outcomes.

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