

Risk and Safety Vulnerability of Maritime Transport Operators in Riverine Settlements within Niger Delta Region, Nigeria

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Abstract

The maritime transport operators in riverine settlements of Niger Delta, Nigeria are faced with multiple occupational risks, which threatens their safety and daily operations. This study looked at the risk exposure among 300 operators in Delta, Bayelsa, Rivers, Cross River and Akwa Ibom states, using the cross-sectional survey design tool. Data collected was through questionnaires, key informant interviews and focus group discussions covering demographics, occupational hazards, exposure levels, safety practices and psychological effects. Findings indicated high exposure to biological hazards at 82 per cent, chemical hazards (74 per cent), physical hazards (70 per cent), ergonomic risks (66 per cent), psychological stress (80 per cent) and criminal activities, including piracy and robbery at 66 per cent. Major sources of risk included water-borne pathogens (50 per cent), manual lifting and ergonomic strain (44 per cent) and psychological stressors at 54 per cent. Safety practices were generally poor with life jacket use indicated by 28 per cent, personal protective equipment (34 per cent) and participation in safety training at 30 per cent. Psychological impacts were substantial as stress affected 64 per cent of operators, emotional exhaustion (60 per cent), while fear of criminal attacks was indicated by 66 per cent. Only 16 per cent of the respondents indicated psychological counselling. A Chi square analysis revealed a significant relationship between safety training and work-related stress was less than 0.05.

Keywords: Maritime safety, Occupational hazards, Niger Delta, Psychosocial stress, Riverine transport

Introduction

Maritime transportation in riverine and coastal environments is very important for economic interactions, socialization, as well as provision of essential social services (Hidayat, et al., 2025). In the Niger Delta region of Nigeria, riverine communities depend largely on waterways for transportation to work, as well as fishing (Ogboeli, et al., 2024). Nevertheless, this activity is linked to various dangers such as mechanical hazards in the boat construction and operations environment, hazards in the river environment, work-related hazards, and more specifically in recent times, hazards linked to crimes committed against these riverine transportation means (Durlik, et al., 2024). Maritime transportation operators are thus constantly exposed to dangers that affect both safety and economic life, thereby making riverine transportation a high-risk activity for these individuals (Baig, et al., 2025).

The world has engaged in trade through the waterways, locally and transnational (Iornumbe, et al., 2025). However, despite the knowledge that the maritime transport mode has for long remained prone to some criminal activities like piracy, robbery, cargo stealing in areas such as Southeast Asia, the Gulf of Aden, as well as the Caribbean (Amao, et al., 2024). Those who operate in such regions not only experience occupational risks but are prone to attacks from armed groups, kidnappings, as well as extortion and other health risks (Omwenke, et al., 2026). Research indicates that this puts additional strain to stress, fatigue, as well as injuries, especially in the informal waterways that lack monitoring regarding the enforcement of safety measures (Rahman, & Suryawan, 2025). The users who travel through the maritime road are prone to different risks associated with the waterways, which has for long discouraged transnational trade, thus the decline in the socio-economic activities for the traders who are based in the riverine communities.

Lately, the problem of maritime crime is actual in the West Coast of West Africa, where pirates and armed groups attack fishing boats and transporters, kidnapping sailors for money and stealing cargo (Balogun, 2022). The maritime community in the Niger Delta region is prone to assault, harassment, and robbery (Edem, et al., 2025). The problem is compounded in that it is experienced in hazardous conditions. Studies conducted in Ghana, Cameroon, and Nigeria show that the risk is combined with improper boat maintenance, overcrowding, poor maritime route mapping suitability, as well as the existence of drowsiness (Njoku, et al., 2022; Ida Ngo, 2019; Gogogwute, et al., 2025).

In Nigeria, the Niger Delta zone has been known for regular maritime crime, especially in riverine communities known as Obonoma, Abonnema, Yenagoa, Bonny, and Burutu areas (Eke, et al., 2023). Stories of kidnappings, robbery at gunpoint, intimidation, and stealing of canoes and speed boats are rife, with high-profile cases including the 2020 kidnappings of fishermen on Brass River and attacks on oil service boats in Bonny and Port Harcourt communities (Umoette, 2025; Essien, et al., 2025). Such maritime crime not only poses health risks of harm and death but also psychological distress and damage to the local economies sustained by river transportation through increased fuel and operating costs due to maritime crime in the Niger Delta zone of Nigeria. The Niger Delta zone is also faced with job-related hazards. Biologically related hazards result from handling polluted water and products; chemical-related hazards result from pollution by oil spillage and industrial waste; while ergonomic hazards correlate with handling and maneuvering boats under dangerous conditions (Ugwueze, & Asua, 2021). Hazards that are physically related such as slipping, falling, and boat collisions are made worse by piracy attacks, during which operators might make quick turns or maneuver into dangerous areas. Increasingly, there are reported cases of mental health problems, specifically stress, trauma and fear of crime being experienced.

Riverine workers are frequently exposed to series of risk due to the dangers they are exposed to, be it occupational or criminal in nature. The regular cases of traumatic occurrences such as near-drowning experiences during attempted escape from armed attacks, physical assault by robbers as well as observing violence against fellow workers, improves and increases the chances of accidents due to stress, fatigue, and poor judgment (Moreno, 2023). The absence or ineffectiveness of regulatory enforcement and policing in the Niger Delta creates and deepens the opportunities for criminal elements to act with impunity (Barigbon, 2023).

The socio-economic implications of these combined risks are extensive. They often result in loss of earnings to the operator because of vessel damage or kidnap-for-ransom attacks. In the regions that are reliant on maritime trade activities, the crime translates to market disruption. Regions that border rivers within Bayelsa, Rivers, Delta, Akwa Ibom, and Cross River States are the hardest hit by the regular cases of piracy and robbery.

Methodology

Study Area

The research work was carried out in selected riverine settlements spread across the Niger Delta region in Nigeria, including Bayelsa, Rivers, Delta, Akwa Ibom, and Cross River States. These states were purposively selected because they all highly depend on maritime transport and have been documented to be prone to maritime crimes, such as piracy, armed robbery, and extortion, as identified by Asua, and Nwangwu, (2025). The riverine settlements that are targets include Obonoma, Abonnema, Yenagoa, Bonny, Brass, Burutu, Escravos, and Calabar riverine communities; settlements that are a mix of densely populated and remote riverine settlements with busy waterways, considering the high traffic flow and adverse exposure to criminal events, to ensure inclusivity and variety on the operational challenges faced by riverine maritime transporters.

Research Design

A cross-sectional technique was used to investigate the risk and safety vulnerability among maritime transport operators. The design permits the gathering of quantitative as well as qualitative information on occupational risk, crime occurrence, operational methods, and mental health outcomes. Information on the operators' sociodemographic information, operational hazard frequency and types, ship conditions, and crime exposure was sought quantitatively. Qualitative information on the experiences, strategies, and perceptions on the safety vulnerability among the operators was sought through Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs) conducted among the operators, officials at the harbours, and the security personnel.

Types and Sources of Data

Data was gathered using structured questionnaires and interview guides among maritime transport providers, harbor authorities, and law enforcement agents. Also, secondary data sources include records on maritime incidents and crime statistics from the Nigerian Maritime Administration and Safety Agency and Nigeria Police Force. These sources are expected to provide information on piracy attacks and crime trends.

Sample Size and Sampling Technique

A total of 300 maritime transport operators were selected for sampling in the eight riverine settlements identified for study. These included a combination of operators of canoes, boat operators, and ferry operators. These were chosen using a stratified-purposive sampling method. In addition to the above, 24 key informants were chosen using a purposive technique for in-depth interviews. This is in addition to 4 focus group discussions comprising 6-8 operators each. The size of the study population was chosen to create a balance between practicality and the need for generalizability.

Data Collection Methods and Instruments

The quantitative data was gathered using structured interview questionnaires on socio-demographic details, occupational hazards, rate of crime occurrence, safety practices, and psychological-social outcomes. Observation schedules were used to collect data on the condition of vessels, safety devices, as well as safety practices followed. The qualitative data was gathered using KIIs and FGDs with semi-structured guidelines for the research discussion on operational experiences, experiences with pirate attacks, methods of coping, as well as experiences with institutional support. The research assistants were trained on the use of the research instruments in addition to emphasizing research ethics.

Data Analysis

The quantitative data were coded and analyzed using SPSS version 28. Descriptive statistics were used to summarize the socio demographic characteristics of maritime transport operators, patterns of occupational hazard exposure, frequency of risk encounters, and the level of safety practices among maritime transport operators. Inferential analysis, specifically the Chi square test of independence, was applied to examine the relationship between selected occupational and safety variables, such as safety training and work-related stress, in order to determine significant associations linked to risk exposure and safety vulnerability. Qualitative data obtained through key informant interviews and focus group discussions were transcribed verbatim and analyzed. This qualitative analysis helped to provide context and deeper explanations for the quantitative findings by highlighting lived experiences, perceived risks, and safety challenges faced by operators in riverine transport. The quantitative and qualitative results gave evidences that aided in identifying patterns of prolonged exposure to occupational hazards, psychosocial stress, and gaps in operational safety within the riverine settlements of the Niger Delta.

Result and discussion

The maritime labor force in the Niger Delta, as indicated in Table 1, is mainly comprised of adults who are actually at work. Approximately 42% are aged 30-39 years, while 20% are aged 40-49 years, indicating that the majority of the personnel are likely in their highest paid years, an age bracket in which cumulative exposure to risks associated with their employment is common. The sector is male dominated with 88%, which is not a surprise owing to the physical demanding nature associated with riverine maritime operations, as well as the gender dynamics in the sector that matches previous study observations in the aquatic transport sector (Zampeta & Chondrokoukis, 2022; Sagaro et al., 2021). Observations show that 40% of the operators have worked for a period of 5–10 years, while 34% have worked for over 10 years; this indicates long exposure to risks such as chemical agents used for fueling and lubricants, ergonomic hazards such as work strain, and safety hazards such as piracy and robbery attacks. These risks are evident in key interview findings provided by respondents such as T.A. (Port Harcourt, Motorboat Operator) and F.O. (Bayelsa, Canoe Operator). Vessel type-wise, 40% pertain to motorboats, 36% to canoes, and 24% to ferries. Here, there is a clear demarcation in risk levels. Canoe captains are generally more susceptible to physical risks, whereas ferry captains are more Vulnerable to Psychosocial risks because of their liability regarding the commuters in their care and the broadside threat of attack.

Table 1: Socio-Demographic Characteristics of Maritime Transport Operators

Variable	Category	Frequency	Percentage (per cent)
Age (years)	18–29	84	28.0
	30–39	126	42.0
	40–49	60	20.0
	≥50	30	10.0
Sex	Male	264	88.0
	Female	36	12.0
Years of Experience	<5	78	26.0
	5–10	120	40.0
	>10	102	34.0
Vessel Type	Canoe	108	36.0
	Motorboat	120	40.0
	Ferry	72	24.0

Source: Authors fieldwork, 2025

Figure 1 below shows the categories of risk to maritime transport operators identified to exist within the Niger Delta. While considering biological risks such as contaminated waterborne infections and injuries from the contact or contaminated water handling, 82.0% were affected, indicating perpetual contact and exposure to contaminated water and improper handling. Chemical risk, including exposure to fuel, oils, or cleaning agents, affected 74.0%, suggesting the risks inherent in engine maintenance or cleaning activities. Physical hazards like slips, falls, or the danger of collision affected 70.0%, reinforcing the idea that riverine transport remains hazardous. Ergonomic risks affected 66.0%, driven mostly by heavy lifting activities throughout the working day as well as extensive amounts of time paddling the canoe or ferry, combined with prolonged exposure to incorrect postures most of these assault the musculoskeletal system. When considering psychosocial hazards like stress, trauma, or the fear of attack from robbers or armed kidnappers/extortioners, 80.0% were affected, obviously indicating the mental or emotional strain exerted on these operators who still choose to risk the hazards inherent within the riverine communities. Using the phrase "criminal-related risks," considering those who fall under piracy attacks, kidnapping, robbery, or extortion activities along the Niger Delta waterways, 66.0% were affected, obviously indicating the perpetual menace or threat to these riverine communities. This menace or threat is supported or reemphasized through statements obtained or collected during the Key Informants Interview among respondents like J.O. (Delta State, Ferry Transport Operator), who showed high frequency experience through robberies or extortion conducted within the waterways during the peak period, or from Focused Group Discussion.

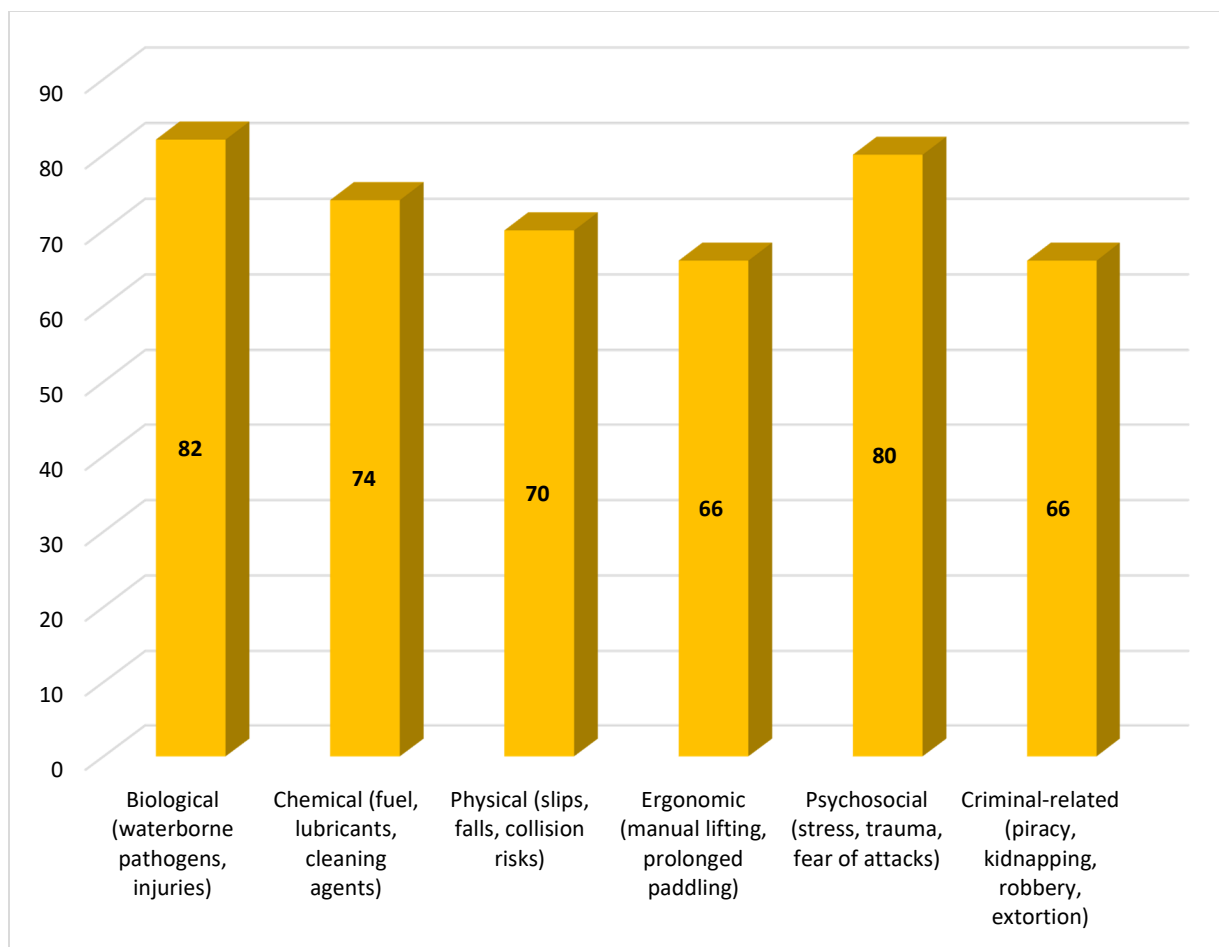


FIG. 1: Exposure to Occupational Hazards

Source: Authors fieldwork, 2025

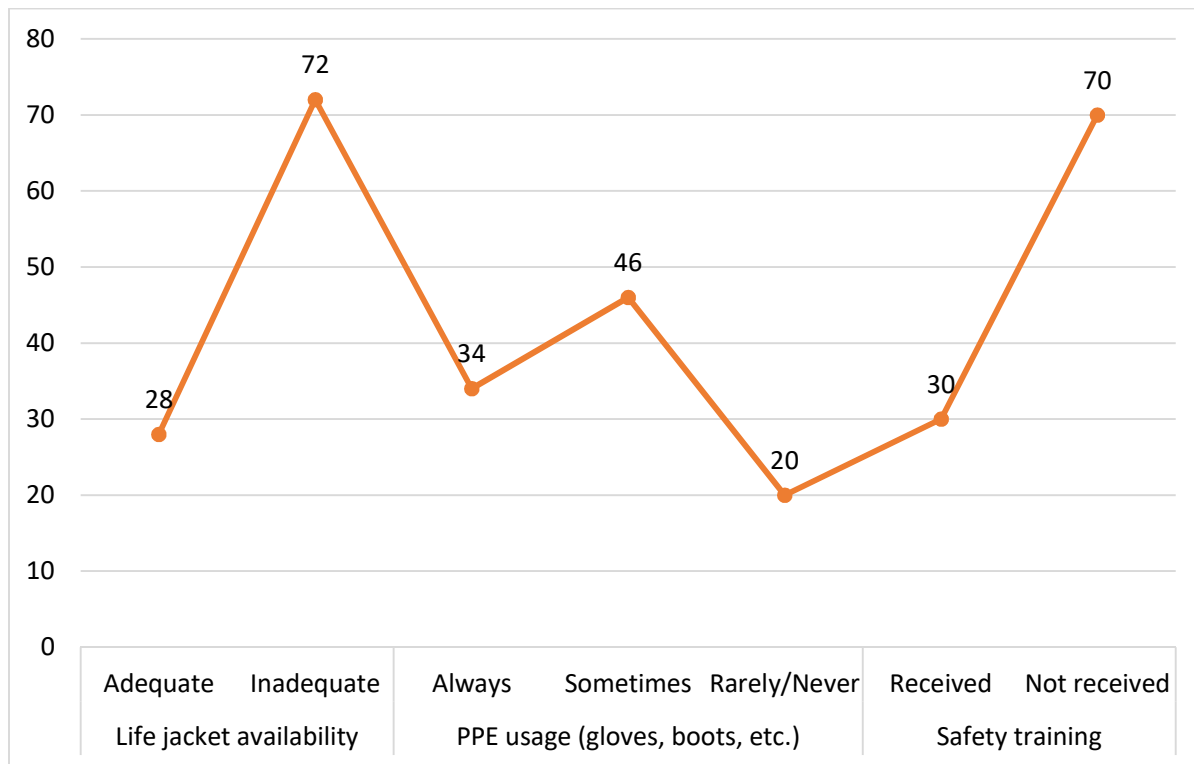
Table 2 shows the frequency of exposure to major occupational hazards happening among maritime transport workers in the Niger Delta. Daily exposure stood the highest for psychosocial stress at 54per cent, closely followed by contact with waterborne pathogens (50per cent) and manual lifting/ergonomic strain at 44per cent. Handling of chemicals and physical incidents was reported daily by 40 per cent and 36 per cent of respondents respectively. Exposure to criminal acts was less frequent on a daily basis at 32 per cent but had a notable occasional occurrence at 40 per cent. Weekly exposures ranged from 28 per cent to 36 per cent across hazard types, while occasional exposure was generally lower, except for criminal-related incidents. These patterns presents that most hazards are encountered regularly rather than sporadically, reflecting the persistent risks in riverine maritime operations.

Table 2: Frequency of Exposure to Major Hazards

Hazard Type	Daily	Weekly	Occasionally
Contact with waterborne pathogens	150 (50per cent)	90 (30per cent)	60 (20per cent)
Handling chemicals	120 (40per cent)	108 (36per cent)	72 (24per cent)
Physical incidents (falls/collisions)	108 (36per cent)	102 (34per cent)	90 (30per cent)
Manual lifting / ergonomic strain	132 (44per cent)	96 (32per cent)	72 (24per cent)
Exposure to criminal acts	96 (32per cent)	84 (28per cent)	120 (40per cent)
Psychosocial stress	162 (54per cent)	96 (32per cent)	42 (14per cent)

Source: Authors fieldwork, 2025

Figure 2 illustrates safety practices and equipment accessibility for maritime transportation operators in the Niger Delta. Just about 28 per cent of maritime transportation operators indicated adequate access to life jackets, while 72 per cent had insufficient access. Use of personal protective equipment is indicated at 34 per cent for operators who always use gloves, boots, and other protective equipment, while 46 per cent use them from time to time, and 20 per cent either rarely or never use them. Safety training is another aspect of safety lacking in maritime transportation operators, since only 30 per cent of them were involved in safety training, implying that 70 per cent of maritime transportation operators lack safety training.

**FIG. 2: Safety Practices and Equipment**

Source: Authors fieldwork, 2025

Table 3 reveals the dramatic burden of mind on the shoulders of maritime operators in the Niger Delta region. Still more ominous is the 64 per cent experiencing high occupational pressure and the 60 per cent showing symptoms of emotional exhaustion to clearly indicate that long-term occupational risk-taking has made its presence felt on the psychological front. The threat of attack and piracy occupies two-thirds of the group (66%), pointing to the menace of robbery, kidnap, and hijacking attacks identified by researchers in the region (Nwokedi et al., 2022; Umoette, 2025). There are social and personal pressures on more than half (54%) of the group to clearly indicate that occupational burden has not been confined to the professional. There is limited mental aid; only 16% access mental aid. There are formal safety measures that are not seriously enforced on only one-third (34%) of the maritime operators.

Table 3: Psychosocial and Safety Vulnerability

Indicator	Category	Frequency	Percentage (per cent)
High work-related stress	Yes	192	64.0
Emotional exhaustion	Yes	180	60.0
Fear of attacks / piracy	High	198	66.0
Social pressure / family concern	Yes	162	54.0
Access to counselling / support	Yes	48	16.0
Safety measures enforced by authority	Yes	102	34.0

Source: Authors fieldwork, 2025

Test of hypothesis

H₀: There is no significant relationship between safety training received by maritime transport operators and the occurrence of high work-related stress among operators in the riverine settlements of the Niger Delta.

Statistical tool: The Chi square test of independence was used to examine the relationship between safety training and psychosocial stress, using a five percent level of significance. This test is appropriate because both variables are categorical and measured from the same group of respondents.

The null hypothesis for this analysis assumed that safety training has no meaningful connection with the level of work-related stress experienced by maritime transport operators in the riverine settlements of the Niger Delta. To test this assumption, the Chi square test of independence was applied because both safety training and work-related stress are categorical variables drawn from the same group of respondents. The crosstabulation results show a clear pattern. Among the marine operators who had previously received safety training, a few of them reported high work-related stress as compared to those who had not received any form training. Differently, a large portion of operators without safety trainings reported that they experience high levels of stress which suggests that the absence of formal training does leave many operators unprepared and vulnerable in their daily work environment.

The Chi square statistics again confirmed that this observed pattern do not just happen. The Chi square value is statistically significant with a p- value well below the five percent threshold which indicates a strong relationship between safety training and work-related stress. This means that the null hypothesis is rejected. The findings did suggest that lack of safety training is related to higher psychosocial stress among maritime transport operators. Adding that due to lack of proper training, operators are likely to feel anxious,

overwhelmed and exposed to risks which adds to their emotional burden and influences their safety vulnerability in the challenging riverine conditions of the Niger Delta.

Table 4: Crosstabulation of safety training and high work-related stress

Safety training	High work-related stress Yes	High work-related stress No	Total
Received training	36	54	90
Not received training	156	54	210
Total	192	108	300

Table 5: Chi square test of independence

Test	Value	df	Asymp. Sig. (two tailed)
Chi Square	32.14	1	0.000
Continuity Correction	30.62	1	0.000
Likelihood Ratio	33.87	1	0.000
N of Valid Cases	300		

Summary and Conclusion

The study shows the various ways in which workers in the riverine maritime sector of Niger Delta are exposed to all sorts of common hazards. A high proportion are at risk from biological hazards at 82 per cent, chemical hazards at 74 per cent, physical hazards (70%), ergonomic stressors at 66 per cent, psychosocial threats at 80 per cent, and crime-related hazards at 66 per cent. The most commonplace incidents occurring regularly, almost on a daily basis, include waterborne pathogens at 50 per cent, ergonomic load at 44 per cent, and psychosocial pressure at 54 per cent. Safe practices remain low: only 28 per cent possess sufficient life jackets, 34 per cent put on PPE during the performance of their duties, and 30 per cent have enjoyed safety training. Psychosocial strains are at a high level: 64 per cent experience intense work-related stress, 60% declare emotional exhaustion, and 66 per cent fear piracy or criminal attack. Access to counseling is limited at 16 per cent, and formal enforcement of their safety is equally weak at 34 per cent.

Results have shown that operational activities in the Niger Delta are inherently high-risk, with continued exposure to physical, chemical, and ergonomic, psychosocial, and criminal hazards making their mark on safety and mental health. Inadequate protective gear, weak safety training, and limited oversight, together with widespread criminal threats, raise vulnerability and increase the likelihood of injury, stress-related illness, and operational inefficiency. The study has called for the integration of occupational health and safety interventions that address both physical hazards and psychosocial stressors within these communities.

Recommendations

The following recommendation were made, based on the study findings;

- i. Enhance the use and availability of personal protective equipment: Life jackets, gloves and boots for all individuals.
- ii. Launch safety training campaigns for all maritime transport operators.

- iii. Establish mental health support and counseling structures to aid the operators in dealing with psychosocial stress.
- iv. obey river operations safety guidelines. Moreover, ensure the necessary maritime authorities are closely monitoring.
- v. Develop a community-based reporting and response mechanism against piracy, robbery and criminal intimidation.
- vi. Promote the development of ergonomic solutions and the use of mechanical devices to minimize physical effort.
- vii. Conduct regular health checks and job risk assessments to identify dangers early and take corrective measures.

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