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Occupational Hazards and Chronic Health Outcomes Among Oil Drilling Workers in The Niger Delta, Nigeria

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ABSTRACT

The Niger Delta region remains one of the world's most significant oil-producing areas, yet occupational health risks associated with drilling operations remain inadequately characterised. The study adopted a quantitative research design, utilising a cross-sectional survey to obtain information on drilling operation hazards and chronic health outcomes. A total of 385 questionnaires were distributed to workers in the drilling section in oil and gas companies in the Niger Delta region. The data were collected and analysed using descriptive statistics, chi-square tests, odds ratios with 95% confidence intervals, and multiple correspondence analysis. Results revealed that 63.4% of workers reported at least one chronic health condition, with skin conditions being most prevalent (24.9%), followed by respiratory problems (11.1%) and musculoskeletal disorders (8.9%). Multiple overlapping hazards showed that employment type influences the hazards to which workers are exposed. Contract workers are exposed to more noise pollution, while permanent workers complain about stress and mental health disorders. Age demonstrated the strongest association with health outcomes, with workers aged 55+ showing substantially elevated chronic health risk (OR = 27.50, 95% CI: 4.61-164.15) compared to those under 25 years. The Chi-Squared test of independence confirmed that the association between worker age and chronic health outcomes was statistically significant ($\chi^2 = 21.420$, df = 4, $p < 0.001$). Gender was not significantly associated with health outcomes ($p = 0.246$). The urgent need for occupational health management programs should be implemented for drilling operations in the oil and gas industry in the Niger Delta region.

ARTICLE DETAILS

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1.0 INTRODUCTION

Oil drilling is the primary method for extracting crude oil from the ground, and the crude oil obtained is extremely vital to the Nigerian economy, as it provides most of its foreign exchange. However, the economic benefits of petroleum extraction have been accompanied by significant occupational health and safety challenges that remain inadequately addressed, especially in developing countries where oil is extracted (Eyayo, 2014). It is estimated that occupational accidents and work-related diseases result in more than 2.3 million deaths annually globally (Oyamienlen et al., 2023). Workers engaged in oil drilling operations face exposure to multiple occupational hazards, including physical strain, chemical exposure, noise pollution, ergonomic risks, and psychosocial stressors (Benson et al., 2021; Eyayo, 2014). The nature of these hazards creates unique challenges for occupational health management, as workers often experience simultaneous exposure to several risk factors rather than isolated hazards (Benson et al., 2021). Drilling workers are at a higher risk of work-related death than well servicing workers and operators (Witter et al., 2014). Drilling workers have a 3 times higher risk of death than well servicing operators.

Despite the critical importance of the oil sector to Nigeria's economy and the substantial workforce employed in drilling operations, very few studies have examined the relationship between occupational health and safety and the chronic health challenges workers experience (Benson et al., 2021). Identifying the occupational hazards associated with drilling operations and their health outcomes leads to a more effective way to control those hazards. Previous research has documented various health concerns among oil industry workers, including respiratory diseases, musculoskeletal disorders, dermatological conditions, and cardiovascular problems

(Esswein et al., 2013; Witter et al., 2014; Oyamienlen et al., 2023). However, studies specifically focusing on oil drilling workers in the Niger Delta are scarce.

2.0 MATERIALS AND METHODS 2.1 STUDY AREA

The study was conducted in the Niger Delta region, where most drilling operations in Nigeria occur. The study area is in the Southern region of Nigeria, as shown in Figure 1. Oil companies in the nine states in the Niger Delta region participated in the study. The region is characterised by a network of rivers, mangroves, swamps, and tributaries with a land area of about 70,000km^2. About 90% of the country's earnings come from petroleum exports produced in the region. However, extensive oil exploration has led to severe environmental challenges, including oil spills, gas flaring, and land degradation, that have adversely affected both the ecosystem and public health. The region's unique environmental and socioeconomic challenges, combined with the high prevalence of occupational health issues among oil field workers, make it an appropriate focus for investigating the chronic effects of oil drilling exposure on worker health.

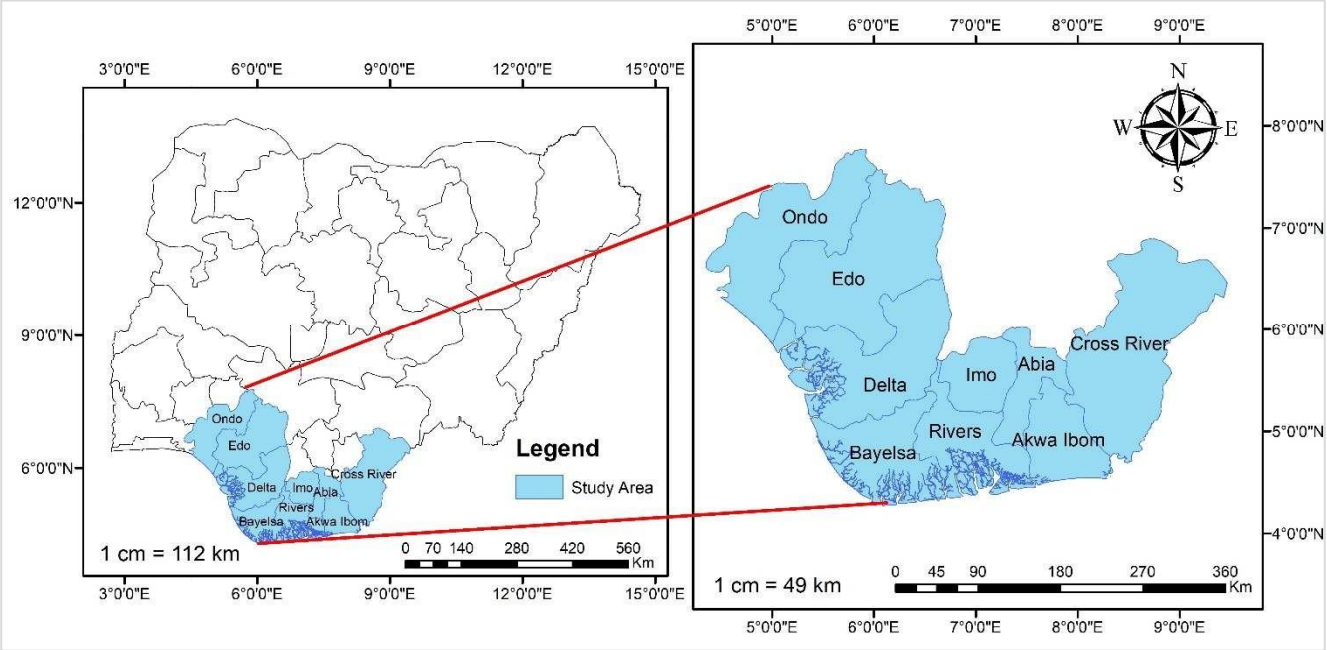


Figure 1: Map of the study area where survey sampling took place

2.2 Data Collection

This study adopted a quantitative research approach using a cross-sectional study design. It involved distributing questionnaires to workers in the drilling department of oil and gas companies on a one-time basis. A total of 385 questionnaires were distributed to oil and gas workers in drilling operations across the Niger Delta region. The sampling technique used for the study was purposive sampling. The inclusion criteria were that workers must be in a drilling operations department and have been on the job for more than 3 years. The instrument used for data collection measured occupational hazards and the health outcomes associated with them. The questionnaire sections included: (1) demographic information (age, gender, educational qualification, years of experience, and employment type); (2) occupational hazard exposure (types of hazards encountered, frequency of exposure); (3) chronic health conditions (presence, type, and onset of chronic health issues); and (4) safety practices and protective measures. The questionnaire was pre-tested among a small sample of oil workers to ensure clarity and validity before full-scale deployment.

2.3 Data Analyses

The survey data were entered into Microsoft Excel and appropriately coded. After which, descriptive statistics, such as frequency analysis and percentages, were done to characterise the sample demographics, occupational hazard exposures, and health outcome distributions. Chisquare tests of independence were conducted to examine if there is a statistically significant association between the demographic variables and the chronic health outcomes. Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated to quantify the strength of the associations. Multiple Correspondence Analysis (MCA) was employed to visualise the relationships between demographic variables and drilling-related hazards. The data analyses were conducted using Microsoft Xlstat and SPSS version 26.

3.0 RESULTS

3.1 Demographic Characteristics

Of the 385 questionnaires distributed, 350 were usable for data analysis. The survey revealed that most respondents were between 35 and 44 years old. A total of 75.4% of the respondents fell into this age group, while 12.3% of the respondents fell in the age group of 25 – 34years. Most drilling workers were male: 93.40% identified as male, while just 6.6% identified as female. Regarding work experience, most respondents had significant industry exposure. A total of 44.90% of the respondents reported having more than 10 years of work experience, while 33.40% reported having between 6 and 10 years of experience.

3.2 Occupational Hazards in Drilling Operations

The occupational hazards experienced by oil and gas workers during drilling operations are presented in Figure 2. The results showed that most respondents reported facing multiple hazards simultaneously. A total of 69.43% of respondents reported exposure to multiple hazards (including noise pollution, long hours, ergonomic strain, and chemical exposure) during their drilling operations. Aside from multiple hazards, ergonomic hazards and long working hours were the second- and third-most common hazards faced by workers. Stress and mental health issues were reported by 25 respondents, indicating that psychological strain forms an important dimension of occupational hazards in the drilling industry. Other risks identified included noise pollution and exposure to hazardous chemicals.

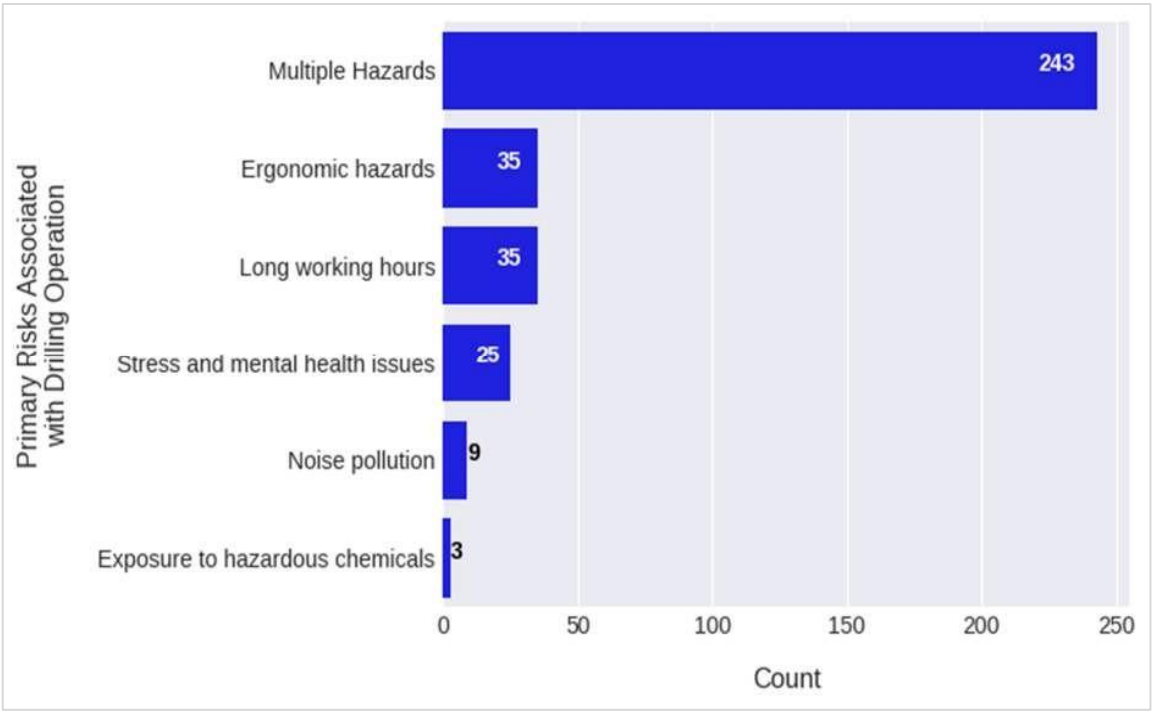


Figure 2: Distribution of hazards experienced by oil and gas workers during drilling operations (N=350).

3.2 Relationships Between Employment Type, Hazards, and Exposure Frequency

The relationships between hazards, frequency of exposure, and employment type were examined using Multiple Correspondence Analysis, and the results are presented in Figure 3. Two components retained in the MCA accounted for 80.71% of the total variance, indicating robust representation of the data structure. The Symmetry plot of the MCA showed distinct relationships among hazards, exposure frequency, and employment type. Drilling workers who were exposed to noise pollution were usually contract staff who were often or always exposed to this hazard. The symmetry plot also revealed that permanent workers usually complained about having stress and mental health issues. Also, Permanent workers were exposed to hazardous chemicals. Casual workers were sometimes exposed to multiple hazards more than other employment types, which may reflect their intermittent involvement in drilling operations.

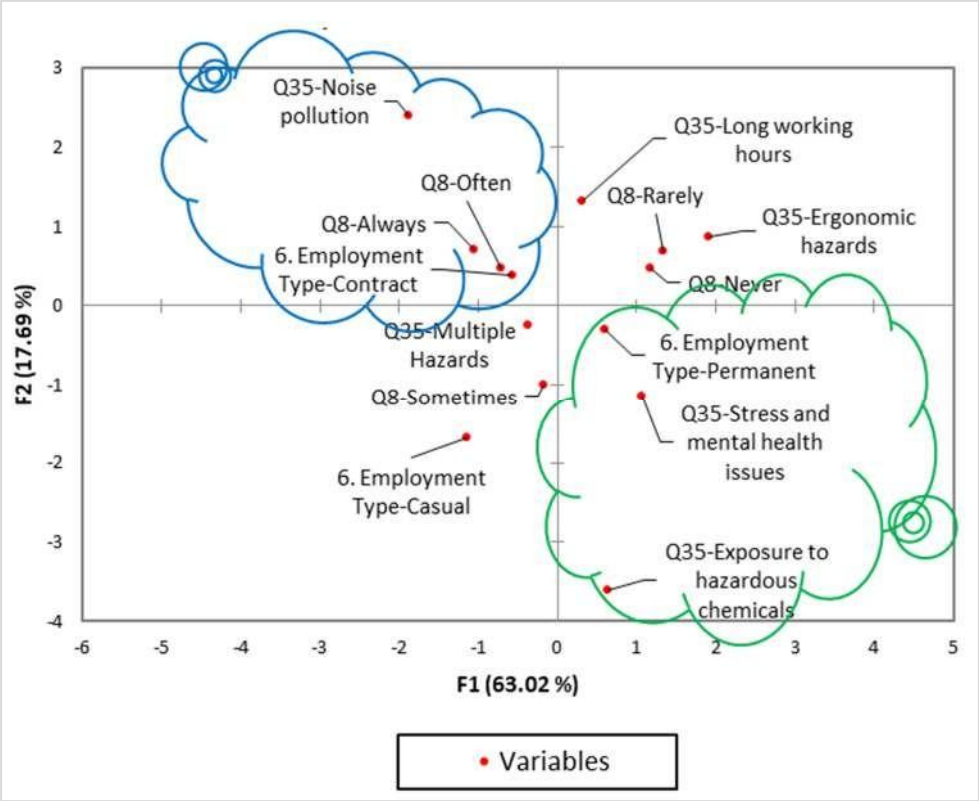


Figure 3: Relationship between the hazard faced, frequency of exposure and employment type

3.3 Prevalence of Chronic Health Outcomes

The overall distribution of chronic health issues among surveyed oil workers is presented in Figure 4. Results revealed that a substantial majority of respondents reported experiencing at least one chronic health issue attributable to their occupational exposure during drilling operations. A total of 222 out of 350 reported having suffered from one chronic health issue due to exposure to the hazard. Figure 3 showed that most respondents had skin conditions. A total of 24.9% of the total respondents reported suffering from a skin condition. However, this translated into 39.2% of respondents stating that they had suffered from one health issue, as presented in Table 1. A total of 16.9% of the total respondents reported suffering from multiple chronic health issues, which was 26.6% of the affected workers, as shown in Table 1. Respiratory problems were reported by 39 workers (11.1%), while musculoskeletal disorders affected 31 respondents (8.9%). Hearing loss and cardiovascular issues were less commonly reported, with 5 cases (1.4%) and 1 case (0.3%), respectively.

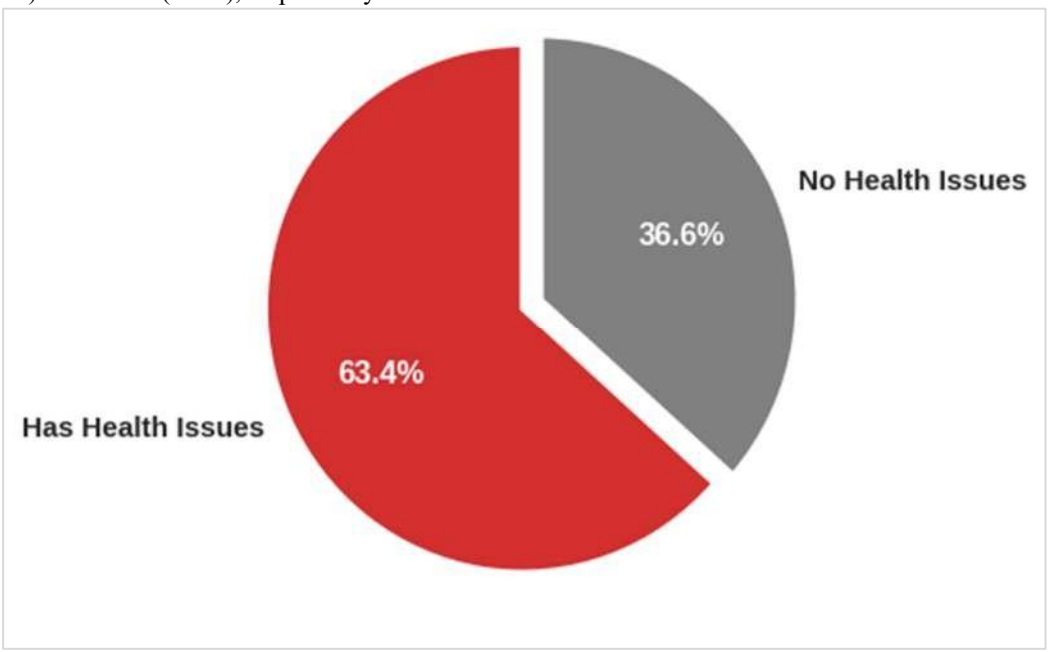


Figure 4: Percentage of oil and gas workers with at least one chronic health issue due to drilling operation hazards (N=350).

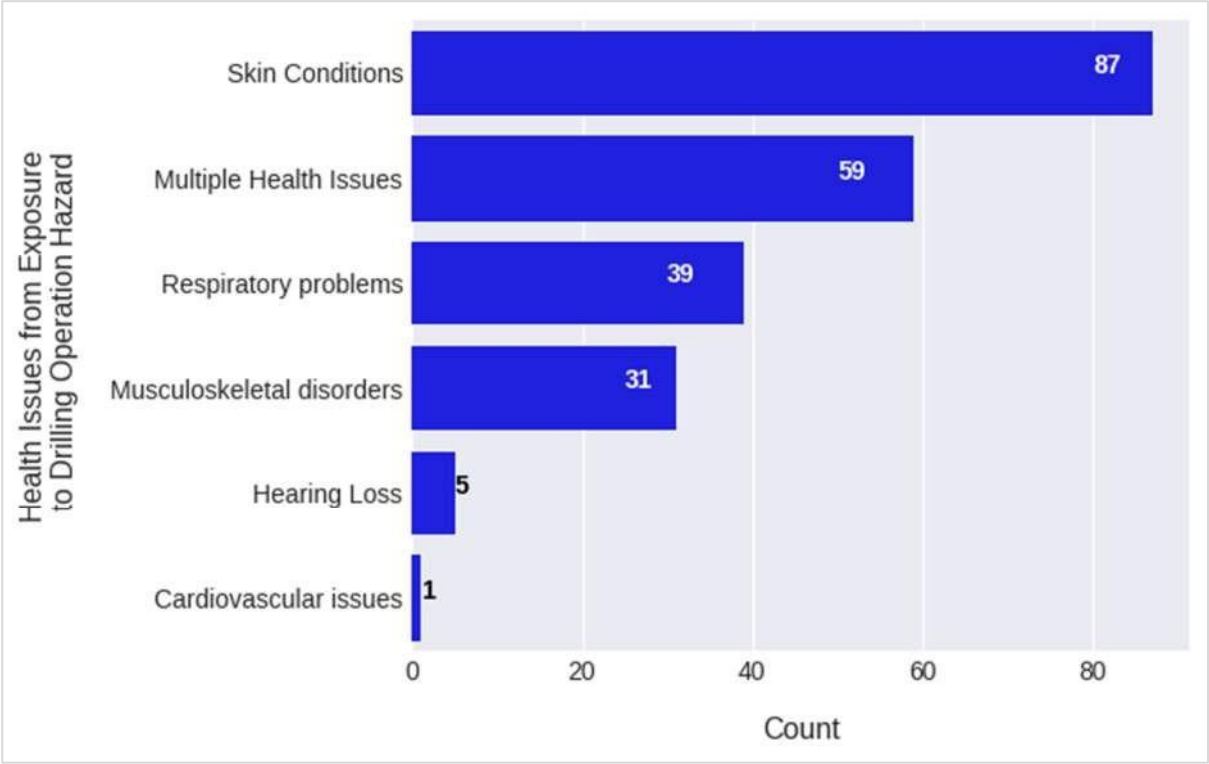


Figure 5: Distribution of specific chronic health conditions among oil and gas workers exposed to drilling operation hazards (N=222 workers with health issues).

Table 1: Distribution of Chronic Health Conditions Among Oil Drilling Workers (N=350)

Chronic health condition	n	% of total sample	% of affected workers
Skin conditions	87	24.9	39.2
Multiple health issues	59	16.9	26.6
Respiratory problems	39	11.1	17.6
Musculoskeletal disorders	31	8.9	14.0
Hearing loss	5	1.4	2.3
Cardiovascular issues	1	0.3	0.5
No chronic health issues	128	36.6	—
Total	**350**	**100.0**	—
Workers with ≥1 chronic issue	222	63.4	100.0

3.4 Associations Between Demographic Factors and Health Outcomes

To determine whether there is a relationship between the demographic variables and the chronic health outcome, cross-tabulation was used, followed by the Chi-Squared test of independence. The cross-tabulation in Table 2 shows that older workers are more likely to develop chronic health issues than younger workers. Workers between the ages of 45 and 54 all stated that they developed chronic health issues from exposure to drilling hazards. Similarly, 83.3% of worker that are above 55 years of age reported having developed chronic health issues. However, 67.4% of workers between the ages of 25 and 34 reported having developed a chronic health issue. The chi-square test of independence presented in Table 3 confirmed significant associations between workers' age and chronic health outcomes ($\chi^2 = 21.420$, df = 4, $p < 0.001$). The test provided sufficient evidence that older workers have a higher prevalence of chronic health conditions than younger workers. Table 4 presents the odds ratios for health issues by age group, with workers under 25 years as the reference category. The odds of developing chronic health issues increased progressively with age. Workers aged 25-34 years showed 11.39 times higher odds (95% CI: 2.22-58.51) compared to the youngest age group. The 35-44 years age group demonstrated 9.04 times higher odds (95% CI: 1.96-41.62), while workers aged 55 years and above showed the highest risk with OR = 27.50 (95% CI: 4.61-164.15).

Interestingly, gender showed no significant association with health outcomes ($\chi^2 = 1.344$, df = 1, p = 0.246), suggesting that male and female workers experience similar health burden when exposed to comparable occupational hazards in drilling operations. The odds ratio for males compared to females was 1.65 (95% CI: 0.70-3.84), which was not statistically significant as the confidence interval included 1.0 as shown in Figure 6.

Table 2: Cross-Tabulation of Health Issue Outcome Against Age of Workers (N=350)

Age group (years)	No health issue (n)	No health issue (%)	Developed health issue (n)	Developed health issue (%)	Total (N)	Total (%)
Under 25	11	84.6	2	15.4	13	100.0
25–34	14	32.6	29	67.4	43	100.0
35–44	98	37.8	161	62.2	259	100.0
45–54	0	0.0	5	100.0	5	100.0
55 and above	5	16.7	25	83.3	30	100.0
Total	**128**	**36.6**	**222**	**63.4**	**350**	**100.0**

Note. N = 350. Percentages represent row percentages within each age group.

Table 3: Chi-Square Tests for Association Between Age Group and Chronic Health Conditions

Test	Value	df	Asymptotic sig. (2-sided)
Pearson chi-square	21.420	4	<0.001
Likelihood ratio	23.611	4	<0.001
Linear-by-linear association	11.766	1	0.001
N of valid cases	350		

Note. N = 350. All chi-square tests indicate a statistically significant association between age group and the development of chronic health conditions.

Table 4: Odds Ratios for Chronic Health Conditions by Age Group Compared to Workers Under 25 Years

Comparison	OR	95% CI	Interpretation
25–34 vs. Under 25	11.39	[2.22, 58.51]	Significantly increased risk
35–44 vs. Under 25	9.04	[1.96, 41.62]	Significantly increased risk
55+ vs. Under 25	27.50	[4.61, 164.15]	Substantially increased risk

Note. OR = odds ratio; CI = confidence interval. The reference category is workers under 25 years. All odds ratios are statistically significant at p < .05.

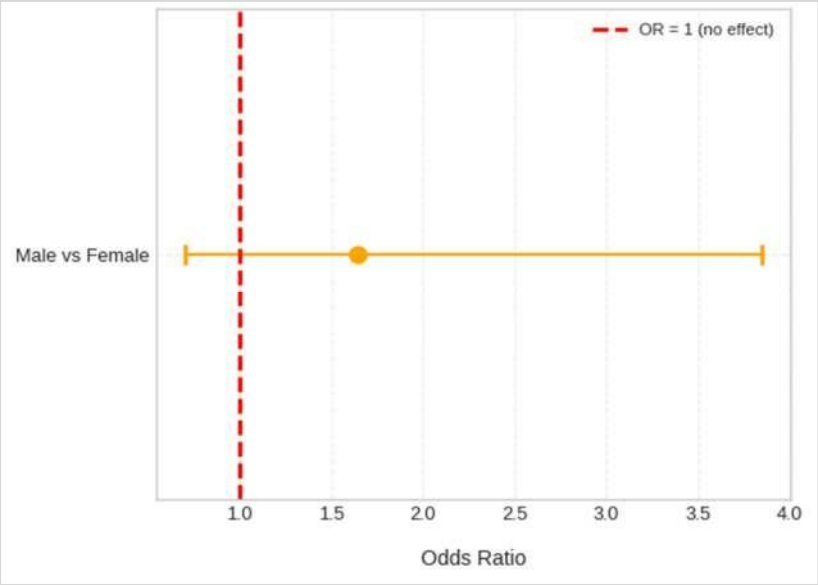


Figure 6: Odds ratio for health outcome by gender compared to female workers

4.0 DISCUSSION

The survey showed that the drilling industry was male-dominated, as is typical in the oil and gas industry. Benson et al. (2021) reported that the oil and gas industry has a male-dominant workforce. There was a substantial chronic health risk to workers associated with exposure to drilling operations hazards. The results showed that more than half of the workers engaged in drilling operations reported at least one chronic health issue. Occupational health issues are very common in the oil and gas industry, as various studies have reported that workers suffer from health problems due to exposure to hazards (Eyayo, 2014; Witter et al., 2014; Benson et al., 2021; Oyamienlen et al., 2023). The finding underscores the need for enhanced occupational health management in the drilling industry. However, the types of health issues reported in other studies differ from those observed in this study. Benson et al. (2021) reported that most oil and gas workers face ergonomic hazards, which result in musculoskeletal disorders. They opined that most workers in the operational and drilling departments are people who suffer most from musculoskeletal disorders. Oyamienlen et al. (2023) also suggested that most oil and gas workers suffer from musculoskeletal disorders due to work-related accidents. However, most workers in the drilling department in this study suggest that they are exposed to multiple hazards and suffer from chronic skin conditions. The variation might be because the present study focuses on chronic health issues rather than just normal health issues experienced. However, a good number of workers in the present study suffered from musculoskeletal disorders. Chemical agents in drilling operations, including petroleum distillates, heavy metals, and various additives, are known dermal irritants and sensitisers. These could be possible causes of the chronic skin condition experienced by the workers in the present study. Diepgen (2012) stated that occupational skin diseases are the most common work-related disorder.

The result revealed an association between demographic characteristics and the chronic health issues workers developed. Age demonstrated the strongest association with chronic health conditions, with older worker been more prone to developing chronic health issues. Worker above the aged 55 and above showed 27.50 times higher odds of developing a chronic health issue compared to those under 25. This finding reflects both cumulative exposure effects and age-related physiological changes affecting hazard susceptibility and recovery capacity (Janabayev et al., 2019). The progressive increase in health risks across age groups emphasises the importance of implementing early intervention strategies and continuous health monitoring throughout workers' careers, particularly given that chronic conditions may remain subclinical until advanced stages. There was an absence of relationship between gender and the chronic health outcome in the present study. Oyamienlen et al. (2023) also reported that gender did not play any significant role in the health issues experienced by oil and gas workers. Multiple Correspondence Analysis revealed that the employment type is associated with certain types of hazards. Contract workers were exposed to more noise pollution, while permanent workers complained about stress and mental health issues.

5.0 CONCLUSION

This study aimed to examine occupational hazards and health outcomes among oil-drilling workers in the Niger Delta, Nigeria. The chronic health outcomes associated with drilling operations include skin conditions, respiratory problems, and musculoskeletal disorders. Skin condition was the most prevalent chronic health issue among workers. Age emerged as the strongest predictor of health outcomes, with workers aged 55+ showing 27.50 times higher odds of developing chronic conditions compared to younger workers, reflecting cumulative exposure effects and the critical need for early intervention strategies. The findings underscore the

urgent need for occupational health surveillance programs incorporating regular health screening, enhanced provision and enforcement of personal protective equipment, and targeted interventions for high-risk categories, including contract workers, ageing workers, and those with prolonged exposure histories.

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