The effect of Demographic factors on work-related Injuries in the Oil and Gas Industry in The Niger Delta Region in Nigeria

Abstract

This study aimed to find out the effect of Demographic factors on work-related Injuries in the Oil and Gas Industry in The Niger Delta Region in Nigeria. The research method that was used for this study was a correlation design to test the demographic variables and how related they were to work-related injuries The instrument used for this study was a well-structured questionnaire sent to e-mails of oil and gas workers in Akwa Ibom state and the Rivers state of Nigeria for the collection of data to provide answers to the questions. The reliability of the instrument was assessed using Cronbach's alpha, Different statistical test methods were used. The findings revealed that gender does not play any significant role in work-related injuries, Education plays a role in certain types of injuries, and musculoskeletal disorders were the common types of injuries experienced by staff. Fractures and Amputations were experienced by workers who have spent above 16 years working offshore.

Keywords: Demographic factors, Work-related injury, Oil and gas

1. Introductions

Occupational or work-related injuries became more common after the industrial revolution. Over time, in response to the great demand for better working conditions, the first occupational laws were enacted in the 19th century in England. Occupational injuries are associated with lots of suffering and loss at individual, community, societal and organizational levels (Mekkodathil, El-Menyar, & Al-Thani 2016). Occupational accidents and ill health can significantly hurt the profitability of the business and, it can lead a production platform out of business because WRAs and diseases cost money. When an accident occurs there will be direct costs that arise directly from the incident itself and indirect costs which arise indirectly as a consequence of the more significant incidents (National General Certificate Unit, 2015). Occupational accidents and work-

related diseases result in more than 2.3 million fatalities globally every year, of which over 350,000 results from occupational accidents and around 2 million results from work-related diseases. Statistics show that every 15 seconds, one worker dies from a work-related incident, and 153 workers have a work accident. Additionally, 6,300 people pass away daily as a result of work-related incidents or work-related ill-health (El Bouti & Allouch, 2018).

The majority of the oil and gas resources are domiciled in offshore fields. Past studies (Ferreira and Suslick, 2001) indicate that there are over 7270 offshore oil and gas installations in place globally with distribution in more than fifty-three countries. Consequently, Oil and gas are the cornerstones of growth and production across the nations since it is omnipresent in all sectors, which makes them indispensable (Department of Homeland Security, 2015; Higgins & Vernadsky, 2013). Offshore oil and gas operations are highly associated with life-threatening risk factors for rig workers. Every year, hundreds of people die and thousands of them are injured while performing their tasks in oil and gas drilling and production industries (DOSH, 2014). (Leigh *et al*, *2004*, Mekkodathil, et al 2016) ranks oil and gas industries as one of the industries that spend high costs on occupational injuries. Even in high-income economies, occupational injury figures remain remarkably high (Rommel, Varnaccia, Lehmann, Kottner, Kroll 2016). This argument is hinged on the nature of these projects which are characterized by having extreme locations, harsh environmental conditions, and a large number of participants from diverse orientations, etc. Furthermore, the offshore oil and gas industry also presents a typical example of a safety-critical sector because of the interplay of inherent technological, environmental, and human challenges According to the International Labor Organization (ILO, 2014), Due to the unpredictable and hazardous nature of the operation, several chemical, safety,

environmental and ergonomic hazards have been reported from decades in all over the world in the sector (Nolan, 2014; Asad *et al*., 2018.

Work-related accidents (WRAs) constitute a social phenomenon and one of the major problems all over the world (El Bouti & Allouch, 2018). Despite all the implemented safety control measures in any organization and the improvements in work-related safety which have been known in the last decades, things can still go wrong, and accidents and incidents still do happen. Ignoring the health and safety of workers cannot be the stepping stone to a good corporate sustainability strategy. The incident rates have increased alongside the industrial revolution and the rapid globalization of the world. This article reviews the literature on the association between demographic variables (e.g., gender, Education, work experience, and types of staff) with work-related injuries. Researchers have also found disparities in injury risk by race/ethnicity, gender, age, geographic region, and education (Xiuwen, Xuanwen & Julie 2015).

Study Hypothesis;

The following Hypothesis was postulated and tested at a 5% significance level

H_o- There is no significant relationship between work-related injuries and Gender

H_1- There is no significant relationship between work-related injuries and Education

H_2- There is no significant relationship between work-related injuries and types of Staff

H_3- There is no significant relationship between work-related injuries and years of Experience

2.1 Methods

The research method that was used for this study was a correlation design to test the demographic variables and how related they were to work-related injuries. A stratified sampling technique was used for this study which involves dividing the entire population into smaller groups or strata (according to their Department). The researcher stratifies the population before proportionally selecting a sample at random. The instrument used for this study was a well-structured questionnaire sent to e-mails of oil and gas workers in Akwa Ibom state and the Rivers state of Nigeria for the collection of data to provide answers to the questions.

The questionnaire contains six sections consisting of questions on demographics, hazards likely to occur in an offshore environment, injury types experienced by offshore workers, injured body parts prevalent among offshore workers, types of accidents in the offshore environment and consequences of accidents in the offshore environment were used in the data collection phase of the study. The study was performed using a population of personnel that work offshores in selected oil and gas industries in Akwa Ibom and Rivers state respectively. The population of this study covers Maintenance personnel, Marine Engineers, Mooring masters, Operations personnel, Engineers, Asset owners, Emergency Responders, and Medics in selected oil and gas offshore facilities of the company operating in Rivers and Akwa Ibom state irrespective of the level of education, sex, job specialty, ethnicity, etc.

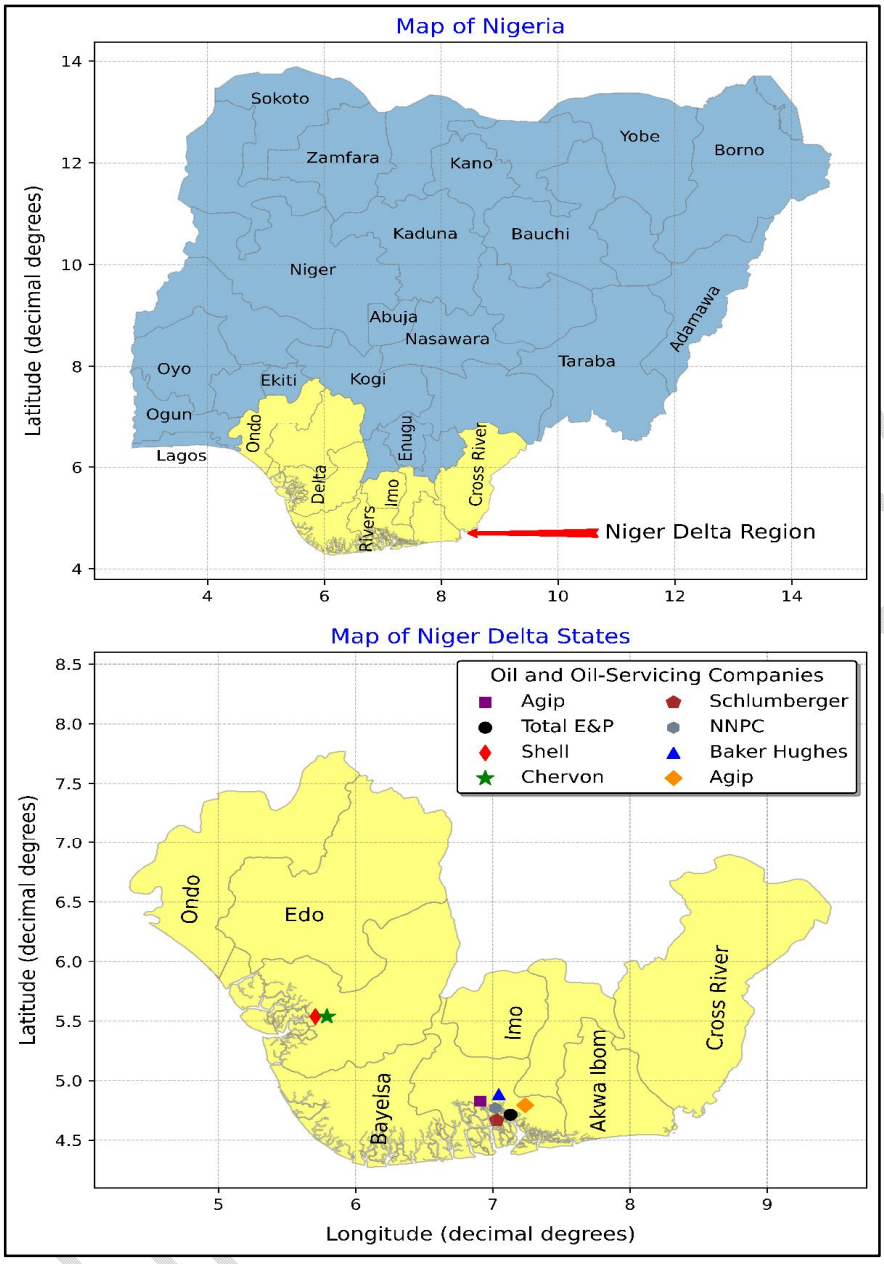

Figure 1: Map of Nigeria showing Niger Delta Area, the Oil & Oil servicing companies in the region. Source: https://www.sec.gov/Archives/

2.2 Instruments:

The research instrument adopted was the questionnaire method. A variety of four-point Likert scales ranging from 1 (strongly disagree) to 4 (strongly agree) was used. The constructs for the work-related injuries and some demographic criteria were obtained from well-Structured Health and Safety questionnaires (HSE, 2005). The questionnaire was adopted to fit with the practices in the offshore installations.

Hazards Likely to Occur in Offshore Environment: this measures their perception of factors that can cause hazards in the offshore environment. 15 questions were asked to elucidate their response as adopted from the offshore industry safety questionnaire (HSE, 2005). An example of such a question was; how likely is wind/strong current to occur in an offshore environment?

Injury Types Experienced by Offshore Workers: This measures their opinion on the common injuries experienced in an offshore environment. 10 investigative variables were used to find out their response as embraced from the offshore safety questionnaire (HSE, 2005). A sample of the question was; if laceration was probable to appear offshores. “Others” were used in the questionnaire to represent Musculoskeletal Disorders.

Injured Body Parts Prevalent among Offshore Workers: This measures their Opinion on the most affected Body parts when an Injury Occurs Offshores. 15 body parts were identified from the offshore safety questionnaire (HSE, 2005). Questions on if the hand was a prevalent body part to get injured offshores were asked.

Types of Accidents in Offshore Environment: Respondents were asked to carefully choose accidents prevalent in an offshore environment. 8 investigative variables were used to find out

their response as embraced from the offshore safety questionnaire (HSE, 2005). Industrial chemical accident was asked to know their perception of the likelihood of such accident to occur.

Consequences of Accidents in Offshore Environment; Interviewees were asked about their perception on the effect of accidents offshores. . 8 investigative variables were used to find out their response as embraced from the offshore safety questionnaire (HSE, 2005). Effect on the personnel was one of the questions asked by the researcher to find out the response on the likelihood of the consequence to happen.

2.3 Data analysis and procedures

The responses from the participants were analyzed using SPSS version 26 and the coding was done according to the Likert scale used for the questionnaire. Composite scores were computed for each of the constructs and reliability was carried out using Cronbach alpha. Descriptive statistics were done on the composite score to understand the general view of the participants on each of the work-related injuries. Transformations were carried out to meet assumptions for Parametric Statistics and compare values between Parametric and non-parametric tests to see if there would be any significant difference. Mann-Whitney Test and Z test were carried out to establish any significant difference in work-related injuries for different genders. Kruskal Wallis Test and ANOVA test were carried out to establish any significant difference in work-related injuries and educational qualification. Mann-Whitney and Z- Test were carried out to establish any Significant differences in the work-related injuries and type of staff. Kruskal Wallis Test and ANOVA test were carried out to establish any significant difference in work-related injuries and years of working experience.

3. Results

A total of 450 questionnaires were distributed among workers that work in the oil and gas sector in the Niger Delta region using an online questionnaire survey method. From the 450 questionnaires distributed, a total of 70 questionnaires were not returned which accounted for about 15.55% of the total questionnaires. A total of 54 questionnaires were not properly filled which accounted for about 12% of the total questionnaires distributed and 326 questionnaires were deemed ok to be used which accounted for about 72.44% of the total questionnaires.

Table 1: Distribution of demographic variables

Demographic Criteria	Gender	Frequency	Percentage (%)	Cumulative Percentage (%)
Gender	Male	225	69.2	69.2
	Female	100	30.8	100
Educational Qualification	Primary	36	11.1	11.1
	Secondary	39	12.0	23.1
	Tertiary	250	76.9	100
Marital Status	Single	156	48.0	48.0
	Married	162	49.8	97.8
	Divorced	7	2.2	100
Work Experience (Years)	0 - 5	101	31.1	31.1
	6 - 10	79	24.3	55.4
	11 - 15	86	26.5	81.8
	16 - 20	50	15.4	97.2
	21 and Above	9	2.8	100.0
Type of Staff	Contract	98	30.2	30.2
	Permanent	227	69.8	100

Table 1 shows the distribution of demographic variables for Gender, Educational Qualification, work experience and types of Staff.

Table 2: Mann-Whitney and Z-Test for Significant difference in the work-related injuries and different gender

Variable\Test	Mann-Whitney	Z-test
Amputation	0.338	0.331
Contusion	0.323	0.262
Burn	0.463	0.411
Laceration	0.369	0.457
Fracture	0.777	0.990
Dislocation	0.750	0.755
Strains and Sprains	0.472	0.447
Bruises	0.787	0.863
Cut	0.938	0.906
Others	0.185	0.206

Table 2 shows the Test for Significant differences in work-related injuries for gender using the Mann-Whitney test and Z test after transformation. The significance test on injuries using the Mann-Whitney test for Significance and Z-test had values greater than P –value greater than 0.05.

Table 3: Kruskal Wallis and ANOVA Test for Significant difference in the work-related injuries and educational qualification

Variable\Test	Kruskal-Wallis	ANOVA
Amputation	0.435	0.401
Contusion	**0.013**	**0.015**
Burn	0.130	0.118
Laceration	0.176	0.144
Fracture	0.838	0.783
Dislocation	0.439	0.315
Strains and Sprains	0.365	0.324
Bruises	0.761	0.654
Cuts	0.125	0.078
Others	**0.046**	0.068

Kruskal Wallis Test and ANOVA test for Significant differences in the work-related injuries for educational qualification using Kruskal- Wallis non-Parametric Statistics and transformation was done so that Parametric Statistics can be used for analysis as shown in Table 3. Contusion was significant using both Kruskal-Wallis and ANOVA and "Others" which represents musculoskeletal disorder was significant using nonparametric statistics and not Significant using Parametric Statistics. Which implies that Education has a role to play in musculoskeletal injuries using the Kruskal-Wallis test of Significance.

Table 4: Dunn multiple comparison test for contusion injuries

Sample	Frequency	Mean of ranks	Groups	
I2 | Tertiary	250	155.010	A	
I2 | Primary	36	185.583	A	B
I2 | Secondary	39	193.372		B

Category	LS means	Groups	
Secondary	2.846	A	
Primary	2.778	A	B
Tertiary	2.448		B

From Table 4, Dunn's test is used for testing two or more experimental groups. Dunn's multiple comparison tests for contusion injuries using the mean of ranks showed that Tertiary degrees had a mean ranking of 155.010 which shows workers with Tertiary Education experience fewer injuries than Primary and secondary school holders which had a mean ranking of 185.583 and 193.372 respectively.

Table 5: Dunn multiple comparison test for “other” injuries

Sample	Frequency	Mean of ranks	Groups	
I10 | Tertiary	250	157.180	A	
I10 | Secondary	39	170.654	A	B
I10 | Primary	36	195.125		B

From Table 5: Dunn multiple comparison tests for “other” injuries. (“Others” refers to musculoskeletal Diseases. Musculoskeletal disorders (MSDs) are conditions that can affect your muscles, bones, and joints. MSDs include tendinitis, carpal tunnel syndrome, osteoarthritis, rheumatoid arthritis (RA), and fibromyalgia). Tertiary degrees had a mean ranking of 157.108 which shows workers with Tertiary Education experience fewer injuries than Secondary and primary school holders which had a mean ranking of 170.654 and 195.125 respectively.

Table 6: Mann-Whitney and Z-Test for Significant difference in the work-related injuries and type of staff

Variable\Test	Mann-Whitney	Z-test
Amputation	0.080	0.070
Contusion	0.276	0.265
Burn	0.947	0.891
Laceration	0.798	0.842
Fracture	0.568	0.518
Dislocation	0.059	0.057
Strains and Sprains	0.435	0.482
Bruises	0.243	0.268
Cut	0.338	0.364
Others	**0. 005**	**0.006**

Table 6: shows Mann-Whitney and Z-Test for Significant differences in the work-related injuries for the type of staff. Mann-Whitney, non-Parametric Statistics and transformation were done so that Z-test can be used for analysis. The significance test on work-related injuries for the type of Staff using the Mann-Whitney test for Significance and Z-test for significance had values equal to P –the value of 0.05.

Table 7: Kruskal-Wallis and ANOVA Test for Significant difference in the work-related injuries and year of working experience

Variable\Test	Kruskal-Wallis	ANOVA
Amputation	**0.031**	**0.035**
Contusion	0.125	0.128
Burn	0.433	0.437
Laceration	0.696	0.606
Fracture	**0.020**	**0.022**
Dislocation	0.663	0.495
Strains and Sprains	0.803	0.806
Bruises	0.237	0.160
Cut	0.416	0.265
Others	0.659	0.738

Table 7 shows Kruskal Wallis and ANOVA Test for Significant differences in work-related injuries for years of working experience. Amputation and Fracture were statistically significant having a P-value of less than 0.05.

Table 8 shows the Dunn multiple comparison tests for amputation injuries using the mean of ranks. Greater than 20-year work experience had a mean rank of 100.444, and 11 to 15 years of work experience had a mean rank of 151.988.personnel with 6 to 10 years of working experience had a mean rank of 167.178. Personnel with 0 to 5 years of working experience had a mean ranking of 168.178 and personnel with 16-20years of work experience had the highest mean rank of 176.300.

Table 8: Dunn multiple comparison test for amputation injuries

Sample	Frequency	Mean of ranks	Groups	
I2 | >20 years	9	100.444	A	
I2 | 11-15 years	86	151.988	A	B
I2 | 6-10 years	79	167.076		B
I2 | 0-5 years	101	168.178		B
I2 | 16-20 years	50	176.300		B

Table 9 shows the Dunn multiple comparison test for Fracture injuries using the mean of ranks. Greater than 20-year work experience had a mean rank of 196.944, and personnel with 11 to 15 years of work experience had a mean rank of 196.944. Personnel with 6 to 10 years of working experience had a mean rank of 151.234. Personnel with 0 to 5 years of work experience had a mean ranking of 158.886 and personnel with 16-20 years of work experience had a mean rank of 1144.200.

Table 9: Dunn multiple comparison test for fracture injuries

Sample	Frequency	Mean of ranks	Groups	
I5 | 16-20 years	50	144.700	A	
I5 | 6-10 years	79	151.234	A	
I5 | 0-5 years	101	158.886	A	
I5 | 11-15 years	86	185.727		B
I5 | >20 years	9	196.944		B

4. Discussion

The result shows that certain demographic criteria influence work-related accidents and certain kinds of intervention should be introduced to ensure that all working on offshore platforms are safe. For this study, most Parametric statistics were as significant as non-parametric statistic

Ho- There is no significant relationship between work-related injuries and Gender. From our findings, gender does not play any significant role in work-related injury experienced offshores, this is in tandem with the findings of (Shipp et al., 1970) who agreed on occupational injuries among students were not gender-based, hence we accept the null hypothesis and reject the alternative hypothesis.

H_1- There is no significant relationship between work-related injuries and Education, from the study, education has a significant role to play in contusion and Musculoskeletal Disorders and work-related injuries. Dunn's multiple comparison tests have shown that Musculoskeletal Disorders' work-related injuries decrease with an increase in Educational qualification findings (Lombardi et al. & Alkhaldi *et al*., 2017) also agreed with these findings that Education has a role to play in the cause of injuries. However, Contusion Injuries were more on workers with Secondary school education, this is so because these are the class of personnel that interface with the machinery. Hence, we reject the null hypothesis in favor of the alternative hypothesis.

H_2- There is no significant relationship between work-related injuries and types of Staff. Musculoskeletal Disorders were a significant type of injury experienced by staff. This happens as a result of awkward positions that workers have to position themselves in while carrying out their job. Hence, we reject the null hypothesis in favor of the alternative hypothesis

H_3- There is no significant relationship between work-related injuries and years of Experience. From the work, years of Experience were significant for Amputation and Fracture. (Bena et al.) believes that years of experience have a role to play, however, their study attributes work-related injury to lower levels of years of experience between 0-5 years. Dunn's Test of Multiple comparisons has shown that Amputation was common amongst workers that have worked for 16-20 years and this could largely be associated with complacency. While workers who have spent more than 20 years on the job experienced more fractures which are closely associated with the age of the personnel, hence, reject the null hypothesis in favor of the alternate hypothesis.

Conclusion,

In Summary, work-related Injuries about demographic factors were examined. Gender does not play any significant role in work-related injuries, but Education plays a role in certain types of injuries, musculoskeletal disorders were the common types of injuries experienced by staff, and fracture and Amputations were experienced by workers who have spent above 16 years working offshore.

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