

Effects of Cleaning Chemicals on Cleaners in Oil and Gas Companies in Rivers State, Nigeria

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Abstract

The aim of this study is to determine the effect of cleaning chemicals on the health of cleaners in selected gas companies in the Bonny Island, Rivers State, Nigeria. This is a cross-sectional research study. A well-structured questionnaire was used to collect data from 240 randomly selected cleaners across six purposively selected oil and gas companies in Bonny Island, Rivers State, Nigeria. The questionnaire contained open and closed ended questions which measured five variables including socio-demographic variables, exposure of cleaners to training on occupational health safety and hazards, level of knowledge of cleaners on occupational health safety and hazards, level of compliance with occupational health safety and hazards, and the health history of the cleaners. The results of the study showed that the cleaners have a mean value and standard deviation which is taken as a moderate level of exposure to occupational health safety and hazards training (2.23 ± 0.88), moderate level of knowledge (2.27 ± 0.81), as well as a moderate level of compliance with occupational health safety and hazards guidelines (2.00 ± 0.77). The respiratory diseases mean value of 55% and allergic reactions 55% are the most frequent health effects reported among the cleaners. Other effects such as skin diseases (36.67%), chemical burns (32.92%) and poisoning (5.42%) were also reported among the cleaners. The study concluded that cleaners in oil and gas companies get exposed to various health hazards due to prolonged exposure to certain chemicals which they work with. Their exposure to these health hazards is aggravated by their low level of knowledge and compliance with occupational health safety and hazards.

Keywords

Health Effects, Toxic Chemicals, Exposure Assessment, Respiratory Diseases

1. Introduction

Cleaning is an action that is done to keep an area healthy, safe, and visually pleasant. It is the elimination of dirt from items and surfaces, which is usually done manually or mechanically with water and detergents or enzymatic treatment. It is a type of decontamination that removes organic debris, salts, and apparent soil from the surface, all of which impede with disinfection.

Cleaning supplies have become an essential component of our everyday life. They are utilised every day in almost all workplaces and residences. Cleaning agents are complicated chemical mixtures that are typically liquids, powders, sprays, or granules that are used to remove dirt, stains, foul odours, and grime from surfaces. Some cleaning chemicals are disinfectants that kill disease-causing agents while also cleaning. They can also reduce the occurrence of illness. Many of these cleaning products contain multiple chemicals (for example, perfume and other sensitizers) [1].

Cleaning was traditionally not considered a dignified job, and until recently, it was performed by members of the lower social echelons with their bare hands or the basic broom and brush [2]. Cleaning chemicals can be used in a variety of ways. These methods include everything from hand application with trigger spray bottles to more technologically advanced approaches including big mechanical sprayers, electrostatic sprayers, and foggers [1]. Many sectors in Nigeria still rely on traditional manual cleaning methods, with mechanised cleaning, despite its obvious benefits, still in its early stages of development and application. Overall, the concept of cleaning appears to have shifted from a labor-led sector to a technology-led industry. Many elements influence the cleaning approach utilised, including the type of location, target surfaces, intended purpose, size of room or number of surfaces to be treated, and presence of other occupants.

Several companies now produce a wide range of cleaning products for use in domestic and commercial cleaning. Disinfectant product manufacturers are obligated to offer clear usage and safety instructions in order to maximise disinfection efficiency while minimising risk to users and occupants [1]. Several firms that manufacture cleaning chemicals claim to use cutting-edge technology, with an emphasis on minimal toxicity and the use of eco-friendly and biodegradable raw materials, in addition to overall quality and effectiveness [2]. However, evidence abounds linking cleaning products to negative health impacts. Several commercial cleaning solutions contain hazardous chemicals that have been related to cancer, reproductive issues, asthma and other respiratory problems, as well as skin and major organ damage. Cleaning solutions can potentially provide occupational risks. Cleaning has recently been identified as an occupational concern due to an increase in the occurrence of asthma and asthma-like symptoms among cleaning employees [3] [4] [5] [6]. According to Sabharwal [2], an average of 25% of cleaning chemicals used by janitors are toxic agents that cause major burns to the eyes or skin, as well as respiratory ailments caused by chemi-

cal fume inhalation. Occupational exposure to cleaning chemicals is not restricted to cleaners, because harmful exposures in the workplace are possible where aerosols are utilised. An occupational exposure research of disinfection products discovered some indication of a link between spray cleaning chemical exposure and asthma symptoms in both professional and non-professional users, while a causal relationship was not demonstrated [7]. Other indoor contaminants that can cause asthma and other respiratory problems for cleaners include volatile organic compounds from furniture, carpets, and paint, as well as tobacco smoke, mould, dust, and other allergens and airborne particulates that they are exposed to while cleaning.

Several factors could increase the risk of cleaning chemical exposure in the workplace, including unsafe cleaning solution preparation, a lack of use of personal protective equipment while using cleaning chemicals, unsafe cleaning product storage, and misuse of cleaning chemicals, which begins with improper cleaning solution preparation, exposing users to an excessive concentration of the chemical, or dangerous by-products, as a result of chemicals. Another issue is abuse of cleaning chemicals, which includes using cleaning chemicals more frequently than required, which can lead to overexposure and immediate unpleasant effects, as well as long-term health consequences [1]. However, occupational exposure cannot be avoided no matter how cautiously a substance that is fundamentally dangerous is used. As a result, the first step in assuring cleaner safety is to ensure that whatever cleaning chemical is selected for use is not only effective as a cleaning agent but also safe for persons and the environment.

According to Kathare *et al.* [8], occupational diseases grew many-fold in 2020 but injuries declined, which could be attributed to COVID-19 [9] modifying workplace cleaning and disinfection chemical use patterns. Since then, there has been an increase in the use of cleaning chemicals, as there has been a greater awareness of the public risk of contagions. Although epidemiological studies support the hypothesis that exposure to cleaning products is associated with the development and/or exacerbation of health symptoms, including respiratory and skin problems, as has been reported in many industries, there is a lack of systematic occupational hygiene analyses and workplace exposure data for Nigeria's oil and gas industry. As a result, there is a need in this business for rigorous examination of cleaning product ingredients and their impact on cleaners. The purpose of this research is to find out how cleaning chemicals affect cleaners in chosen oil and gas firms in Bonny Island, Rivers State, Nigeria.

2. Study Area

The study area is Bonny Island in Rivers State, Nigeria (**Figure 1**). Bonny Island is roughly 215 square kilometres and is surrounded by a network of creeks and waterways. The southern margins have the most readily available landmass, with dense mangrove forest and some of West Africa's most fertile farmlands. The surge of industries has accelerated the construction of urban fabrics and fundamental infrastructure.

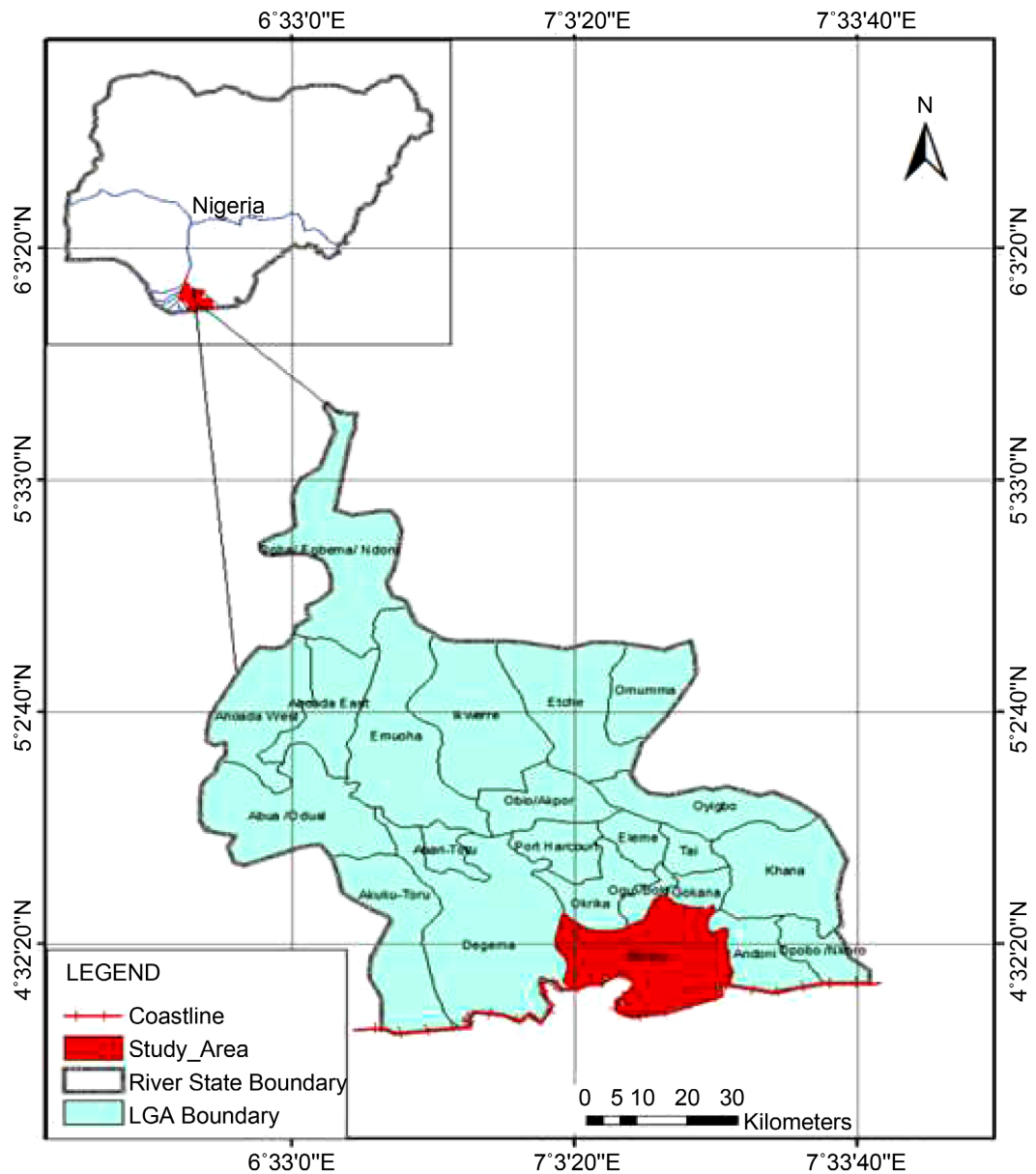


Figure 1. Map of the study area.

The Bonny Kingdom in Nigeria is located on the southernmost tip of West Africa, close to the city of Port Harcourt. As a result, it is ideal for commercial ships and vessels from both international and inland seas. The Kingdom is one of Nigeria's most industrialized communities, with the country's largest oil and gas sectors.

Bonny Kingdom has drawn traders since the 15th century, when it was the primary commercial post of the Eastern Delta. Its coasts were even frequented by slave traders. Bonny became the wealthiest and most powerful kingdom in the Eastern Niger Delta through trade, trading palm oil, ivory, and lumber after the slave trade was prohibited. Bonny Island is home to several oil and gas enterprises. There is a crude oil terminal and a liquefied natural gas plant operated

by the Nigerian National Petroleum Corporation (NNPC). In addition to the Nigerian Liquefied Natural Gas (NLNG) Company and all of the NNPC JV partners, there are several oil and gas servicing companies.

3. Methodology

3.1. Research Design

This study adopted a descriptive study design. The study documented the experience of cleaners in oil and gas companies in Rivers State, Nigeria concerning occupational health safety and hazards. Six of the oil and gas industries located in Bonny Island, Rivers State were selected for the study. These companies were contacted and intimated about the aims of the study as well as the procedures of data collection. After getting approval from the managements of these companies, cleaners were recruited from each of the companies and then the data collection process was initiated by the researcher.

A total of 287 individuals were identified as cleaners in six medium size organizations rendering cleaning services in the study area. Each of the organization has less than 100 cleaners. The cleaner distribution in the organizations is as follows: organization A has a total of 53 cleaners, B has 45 cleaners, C has 47, D has 43, E has 47 and F has 52, respectively. Altogether, these organizations have 287 cleaners. Using the online sample size calculator [10], a minimum of 165 respondents is the sample size representative enough for the group. However, 240 study participants were recruited to reduce population bias.

A well-structured questionnaire was used as the study instrument for this study. The questionnaire was divided into five different sections. The first section documents the socio-demographic information of the study participants. The second section contained closed ended questions about the participants' exposure to formal trainings on occupational safety and hazard. The third segment contained open ended questions to assess how knowledgeable the study participants are about occupational safety and hazards. The fourth segment of the questionnaire contained closed ended question concerning the participants' level of compliance with occupational safety and hazard guidelines. The fifth section of the questionnaire has open ended questions where the study participants can discuss the types of health issues they have suffered as a result of their cleaning duties.

3.2. Data Collection and Analysis

All the data collected from the questionnaire were documented in Microsoft excel as quantitative variables. Socio-demographic variables were treated as categorical variables, while all the other variables were treated as continuous variables. Descriptive statistics such as frequency, percentages, mean and standard deviation were used to present the responses to the questionnaire. Inferential statistics such as Pearson Correlation was used to establish the relationship between continuous variables.

4. Results and Discussion

4.1. Results

4.1.1. Socio-Demographic Profile

This section describes the socio-demographic profile of the cleaners recruited for the study. As shown in **Table 1**, a total of 40 cleaners were each recruited for organizations A, B, C, D, E and F. Of all these study participants, 73.75% of them were female, while the remaining 26.25% were male. Most of the cleaners (46.25%) were within the ages of 36 - 45, another 31.67% of them were above 45 years of age while the remaining 23.08% were within the ages of 25 - 35. With regards to the number of working years, 40.83% of these cleaners have worked between 5 - 10 years at their present organization, 32.08% have worked for less than five years, while the remaining 27.08% have worked for more than 10 years. With respect to the highest qualification of the cleaners, none of them has a PhD or Master's degree. Only 19.6% of them hold a bachelor's degree, while most of them (80.4%) have their Secondary School Certificate.

Table 1. Socio-demographic profile of the cleaners.

Gender	Frequency	Percentage
Male	63	26.25%
Female	177	73.75%
Age		
25 - 35	53	22.08%
36 - 45	111	46.25%
>45	76	31.67%
Number of working years		
<5 years	77	32.08%
5 - 10 years	98	40.83%
>10 years	65	27.08%
Highest Degree		
SSCE	193	80.4%
BSc	47	19.6%
MSc	0	0%
Ph.D.	0	0%
Organization		
A	40	16.67%
B	40	16.67%
C	40	16.67%
D	40	16.67%
E	40	16.67%

4.1.2. Exposure to Formal Trainings on Occupational Health and Hazards

This section shows the rate of exposure to formal trainings and knowledge about occupational health and hazards. **Table 2** shows the response distribution on questionnaire parameters of cleaners with respect to their exposure to formal trainings on hazards associated with their job. Cleaners who agree to each of the questions are scored 3, those that agree to neutral are scored 2, while those that disagreed are scored 1. The mean values show the level of knowledge. A total of 82.92% of the cleaners agreed that they have taken one or more formal training on the health hazards associated with cleaning at some point in their lives. About 15% of them disagree with this stance while only 5% of the respondents were neutral. A mean value of 2.68 suggests that majority of the cleaners have taken one or more formal training on health hazards. A total of 43.33% of the cleaners agreed that they took a formal occupational hazard training right before taking the job. A total of 42.5% disagreed with this stance while 14.17% were neutral. A mean value of 2.01 suggests that just about half of the participants took a formal occupational hazards training right before taking the job. Also, 41.67% of the cleaners agreed that they have undergone at least one occupational hazard training since they started their job, while 41.25% of them disagreed. About 17.8% of the respondents were neutral about this stance. A total of 46.25% of the cleaners were confident that they recognize all the hazards associated with the cleaning job. About 25% of them disagree with the stance that they recognize all the hazards associated with their job roles, while the remaining 28.75% were neutral. A mean value of 2.21 suggests that more than half of the cleaners are confident that that they recognize the hazards associated with their job responsibilities. Also, 50.42% of the cleaners agreed that they can protect themselves from the occupational hazards associated with cleaning. Another 24.6% disagreed that they can protect themselves against the occupational hazards associated with cleaning, while the remaining 25% were neutral about this stance. A

Table 2. Descriptive statistical outcome on cleaners exposure to occupational health and hazards training.

Questionnaire Parameters	Agree	Neutral	Disagree	Mean \pm SD
I took professional courses on occupational health and hazards	199 (82.92%)	5 (2.08%)	36 (15%)	2.68 \pm 0.72
I took an official occupational health and hazard training before taking this job	104 (43.33%)	34 (14.17%)	102 (42.5%)	2.01 \pm 0.93
I have taken an occupational health and hazard training while on this job	100 (41.67%)	41 (17.08%)	99 (41.25%)	2.00 \pm 0.91
I am aware of all the occupational hazards associated with my job	111 (46.25%)	69 (28.75%)	60 (25%)	2.21 \pm 0.82
I know how to protect myself from work hazards	121 (50.42%)	60 (25%)	59 (24.6%)	2.26 \pm 0.83

mean value of 2.26 shows that more than half of the cleaners can protect themselves against the hazards associated with cleaning.

4.1.3. Level of Knowledge about Occupational Health Hazards and Safety

This section shows the level of knowledge about occupational health safety and hazards among the cleaners. A total of five questions were asked and the cleaners were allowed to provide their answers in writing. The results were categorized as high level, mid-level and low level (**Table 3**). A score of 3 was assigned to high level, a score of 2 was assigned to mid-level while a score of 1 was assigned to low level. A mean value was used to calculate the overall score for each the questions and each respondent. About 51.25% of the respondents were able to define occupational hazard to a high and satisfactory level, another 30% were only able to define it at a mid-level, while 18.75% had a poor grasp of the definition. A mean value of 2.33 suggests that the level of knowledge concerning this question is between mid and high. About 42.08% of respondents were able to satisfactorily list the occupational hazards associated with cleaning. Another 45.42% were able to list it fairly, while the remaining 12.50% were unable to answer the question satisfactorily. A mean value of 2.30 suggests that the overall knowledge concerning this question was between mid and high level. Only 40.42% of the respondents were able to satisfactorily make a list of the chemicals used in cleaning that could harm them. Most of the respondents (51.67%) were only able to answer this question to a fairly satisfactory level, while another 7.92% provided poor answers. A mean value of 2.33 suggests that the level of knowledge concerning this question is between mid and high. Also, only 36.25% of the study participants were able to provide a satisfactory explanation as to how they can protect themselves against harmful chemicals at work. Most of the respondents (55.42%) were only able to provide a fairly satisfactory answer to this question, while the remaining 8.33% provided unsatisfactory explanations. Most of the respondents (45.38%) were only able to list the cleaning safety guidelines to a fairly satisfactory level. Only 33.3% were able to make a highly satisfactory

Table 3. Cleaners level of knowledge concerning occupational health safety and hazards.

Questionnaire Parameters	High	Mid	Low	Mean \pm SD
Can you explain what you understand by occupational hazards?	123 (51.25%)	72 (30%)	45 (18.75%)	2.33 \pm 0.77
What are the occupational hazards in cleaning	101 (42.08%)	109 (45.42%)	30 (12.50%)	2.30 \pm 0.68
List the chemicals you work with that could harm you	97 (40.42%)	124 (51.67%)	19 (7.92%)	2.33 \pm 0.62
Explain how you can protect yourself against these chemicals	87 (36.25%)	133 (55.42%)	20 (8.33%)	2.28 \pm 0.61
List a few guidelines that must guide you when you clean	80 (33.3%)	110 (45.83%)	50 (20.83%)	2.13 \pm 0.73

list while the remaining 20.83% provided an unsatisfactory list. A mean value of 2.13 suggests that the level of knowledge here is between mid and high.

4.1.4. Relationship between Exposure to Training and Level of Knowledge

This section establishes the relationship between exposure to training and level of knowledge concerning occupational health safety and hazards. Both variables were converted into continuous variables by calculating the overall training score and knowledge score for each of the study participants. The relationship between the two variables was then established using the Pearson Correlation Analysis as shown in **Table 4**. The Pearson Correlation Analysis shows the direction and strength of relationship between any two variables. A value of +1 represents maximum positive relationship while a value of -1 represents maximum negative relationship. The p value shows how statistically significant the relationship is. The correlation analysis has showed a strong and positive relationship between exposure to training and levels of knowledge. This is indicated by a positive value of 0.524. The positive relationship between both variables is highly statistically significant as indicated by a p value less than 0.01.

4.1.5. Adherence to Occupational Health and Hazards Guidelines

This section shows the adherence of the respondents to occupational health and hazard guidelines while carrying out their cleaning duties. The responses were grouped into three categories which include: every time, sometimes and never (**Table 5**). Responses to each question were allotted scores of 3, 2 and 1 for every time, sometimes, and never, respectively. About 63% of the cleaners put on a pair of gloves every time they discharge their cleaning duties. Another 28.33% never use hand gloves during cleaning, while the remaining 7.92% makes use of the gloves only sometimes. A mean value of 2.35 suggests that majority of the cleaners make use of gloves every time. Only 42.08% of the respondents agreed that they wear a pair of protective glasses and nose shields while cleaning. A total of 45.38% insists that they never wear a pair of protective glasses and nose shields, while the remaining 12.08% agree to wearing it sometimes. A mean value of 1.96 suggests that majority of the cleaners never wear safety glasses and nose shields during cleaning. Only 38.75% of the cleaners wear protective coveralls every time they discharge their cleaning duties. Most of the cleaners

Table 4. Correlation between exposure to training and level of knowledge.

Parameters	Level of Knowledge	Exposure to Training	p
Level of Knowledge	1	0.524	0.0013*
Exposure to Training	0.524	1	

*Indicates a statistically significant result.

Table 5. Adherence to occupational health and hazards guidelines.

Questionnaire Parameters	Every time	Sometimes	Never	Mean \pm SD
I wear a pair of gloves every time I clean	153 (63.57%)	19 (7.92%)	68 (28.33%)	2.35 \pm 0.89
I wear protective glasses and nose shields when cleaning	101 (42.08%)	29 (12.08%)	110 (45.38%)	1.96 \pm 0.94
I cover my whole body with protective overalls while working	93 (38.75%)	32 (13.33%)	115 (47.92%)	1.91 \pm 0.93
I know the side effect of all the chemicals I work with and I protect myself from them	112 (46.67%)	15 (6.25%)	113 (47.08%)	2.0 \pm 0.97
I wear slip resistant footwear during cleaning	76 (31.67%)	41 (17.08%)	123 (51.25%)	1.80 \pm 0.89

(47.92%) agree to never wearing protective overalls during cleaning, while 13.33% agree that they wear protective overalls during cleaning sometimes. A mean value of 1.91 suggests that majority of the cleaners do not wear protective coveralls during cleaning. Most of the participants (47.08%) agree that they never know all the side effects of the chemicals they work with. About 46.67% agree that they always know the side effects of the chemicals they work with, while the remaining 6.25% were uncertain about this. Furthermore, most (51.25%) of the cleaners agreed that they never wear slip-resistant footwear while discharging their cleaning duties. Only 31.67% of the cleaners agreed that they always wear a slip resistant footwear when carrying out their cleaning duties. About 17.08% agreed that they sometimes wear slip-resistant footwear while discharging their cleaning duties. A mean value of 1.80 suggests that majority of the cleaners do not wear slip resistant footwear while discharging their cleaning duties.

4.1.6. Relationship between Level of Knowledge and Adherence to Occupational Hazards Guidelines

This section establishes the relationship between level of knowledge and adherence to occupational health guidelines. Both variables were converted into continuous variables by calculating the overall knowledge score and adherence score for each of the study participants. The relationship between the two variables was then established using the Pearson Correlation Analysis as shown in **Table 6**. The Pearson Correlation Analysis shows the direction and strength of relationship between two variables. A value of +1 represents maximum positive relationship while a value of -1 represents maximum negative relationship. The p value shows how statistically significant the relationship is. The correlation analysis has showed a positive relationship between levels of knowledge and adherence to occupational health safety guidelines. This is indicated by a positive value of 0.126. The positive relationship between both variables is statistically significant as indicated by a p value less than 0.05.

4.1.7. Health History of the Study Participants

This section describes the health history of participants since they started

Table 6. Correlation between level of knowledge and adherence to occupational hazard guidelines.

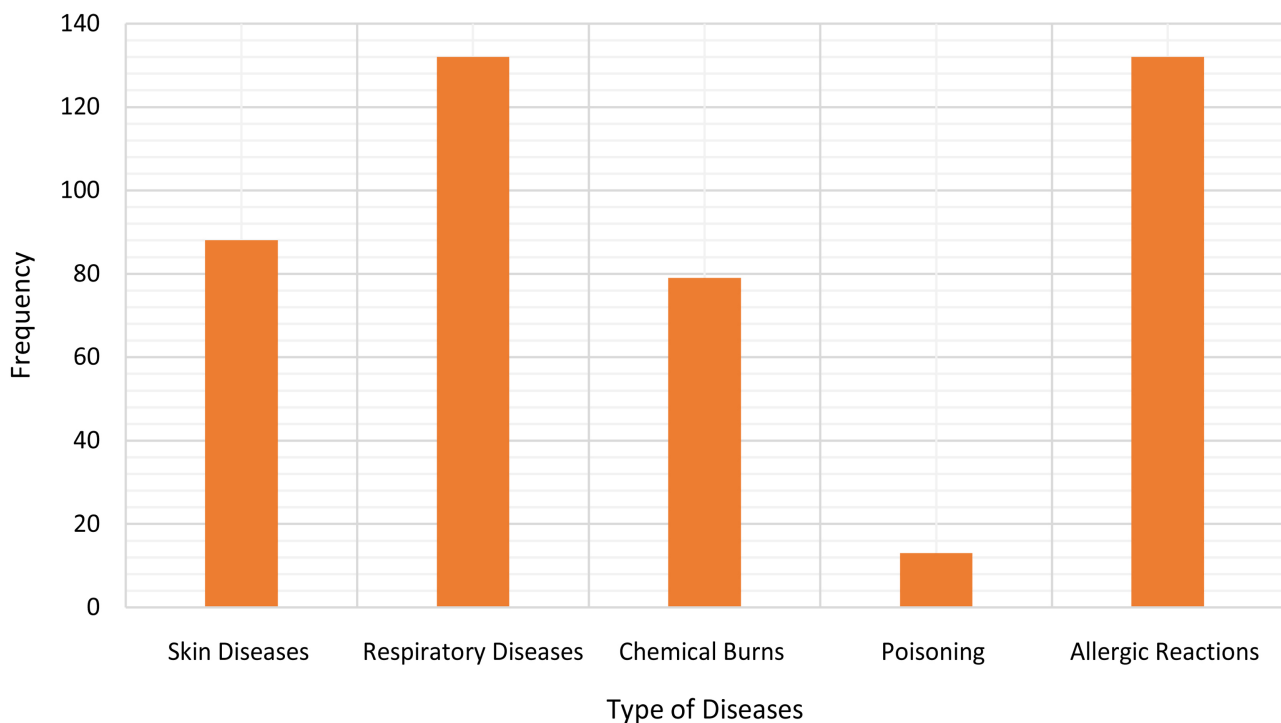
Parameters	Level of Knowledge	Adherence to Occupational health guidelines	p
Level of Knowledge	1	0.126	
Adherence to Occupational health guidelines	0.126	1	0.045*

*Indicates a statistically significant result.

working as a cleaner at their respective organizations. The responses to each statement were categorized as agreed, not sure and disagreed. A value of 3 was assigned to agreed, 2 was assigned to not sure, while 1 was assigned to disagree. These values were used to generate the mean for each of the statements as shown in **Table 7**. Only 33.6% of the respondents have been diagnosed of a skin disease ever since they started working as a cleaner with their respective organizations. About 58.3% have never been diagnosed of a skin disease, while the remaining 5% were uncertain. A mean value of 1.78 indicates that majority of the cleaners have not been diagnosed with skin diseases since they started working with their organization. Most of the respondents (55%) have been diagnosed with a respiratory disease since they started working as a cleaner at their respective organizations. About 42.08% have never been diagnosed, while the remaining 2.92% are uncertain. A mean value of 2.13 suggests that majority of the respondents have been diagnosed with a respiratory disease while working as a cleaner with their respective organizations. Also, 32.92% of the respondents have been diagnosed with a chemical burn since working as a cleaner with their current organizations. About 64.17% have never been diagnosed with a chemical burn, while the remaining 2.92% are uncertain. A mean value of 1.69 suggests that majority of the respondents have never been diagnosed with chemical burns since they started working as a cleaner. Only 13% of the respondents have been diagnosed with poisoning since they started working as cleaner at their current organization. About 87.5% of the respondents have never been diagnosed of poisoning since they started working as a cleaner. The remaining 7.08% were not certain. A mean value of 1.18 suggests that majority of the respondents have never been diagnosed of poisoning since they started working as a cleaner at their respective organizations. Most of the respondents (55%) have been diagnosed with allergic reactions since they started working as cleaner with their current organizations. Only 43.75% of them have never been diagnosed with an allergic reaction since they started working as a cleaner with the respective organizations. The remaining 1.25% were uncertain about their medical history regarding allergic reactions. A mean value of 2.11 suggests that majority of the respondents have been diagnosed with an allergic reaction ever since they started working as a cleaner with their current organizations. In addition, **Figure 2** shows the frequency of

Table 7. Health history of study participants.

Questionnaire Parameters	Agree	Not sure	Disagree	Mean \pm SD
I have been diagnosed of skin disease since I started this job	88 (36.67%)	12 (5%)	140 (58.33%)	1.78 \pm 0.95
I have been diagnosed of a respiratory disease since I started this job	132 (55%)	7 (2.92%)	101 (42.08%)	2.13 \pm 0.98
I have been diagnosed of chemical burns since I started this job	79 (32.92%)	7 (2.92%)	154 (64.17%)	1.69 \pm 0.94
I have been diagnosed of poisoning since I started working here	13 (5.42%)	17 (7.08%)	210 (87.5%)	1.18 \pm 0.51
I have been diagnosed of allergic reactions since I started working here	132 (55%)	3 (1.25%)	105 (43.75%)	2.11 \pm 0.99

**Figure 2.** Frequency of diseases among study respondents.**Table 8.** Correlation between adherence to occupational hazard guidelines and health history.

Parameters	Exposure to Training	Adherence to Occupational health guidelines	p
Exposure to Training	1	0.145	
Adherence to Occupational health guidelines	0.145	1	0.025*

*Indicates a statistically significant result.

diseases among the study participants. Respiratory diseases and allergic reactions appear to be the most frequent disease among the study participants, with poisoning ranking the lowest.

4.1.8. Relationship between Adherence to Occupational Health Safety Guidelines and Health History

The section establishes the relationship between adherence to occupational health guidelines and the health history of the study participants. Both variables were converted into continuous variables by calculating the overall adherence score and health history score for each of the study participants. The relationship between the two variables was then established using the Pearson Correlation Analysis as shown in **Table 8**. The Pearson Correlation Analysis shows the direction and strength of relationship between any two variables. A value of +1 represents maximum positive relationship while a value of -1 represents maximum negative relationship. The p value shows how statistically significant the relationship is. The correlation analysis showed a positive relationship between adherence to occupational health safety guidelines and the health history of study participants. This is indicated by a positive value of 0.145. The positive relationship between both variables is statistically significant as indicated by a p value less than 0.05.

4.2. Discussion

4.2.1. Improving Knowledge of Occupational Health and Hazards through Training

Just like every other job responsibility, cleaning is also largely associated with certain hazards which pose severe risk to the wellbeing of cleaners. Usually, the most important means workers ensure that they stay clear of occupational hazards is by ensuring that they have adequate knowledge about the health hazards associated with the work that they do. One basic way through which cleaners can acquire enough knowledge about the hazards associated with cleaning is by taking formal trainings on occupational health safety and hazards.

In this study, the number of cleaners that have been exposed to trainings on occupational health and safety appears to be very high. However, a good number of the cleaners still lack basic trainings on occupational health safety and hazards. Close to half of the cleaners did not take a training on occupational health safety and hazard when they resumed working as a cleaner. Also, almost half of them have not taking any formal training since they started working as a cleaner. Despite the fact that several studies such as [11] [12] [13], have emphasized the importance of goal-oriented risk communication of occupational hazards between employers and employees, the culture of conducting routine occupational health safety and hazard training remain very poor in most organizations [14] [15] especially developing countries such as Nigeria [16], as well as among unskilled labour such as cleaners [17] [18]. The lack of occupational health safety and hazards training among cleaners in Nigeria can be attributed to the perception among Nigerian employers that most of the cleaners are unskilled and can

hardly comprehend a formal set of rules.

4.2.2. Knowledge of Environmental Safety and Hazards

The level of knowledge concerning occupational health safety and hazards among the cleaners is fair, with more than half of the cleaners showing a fairly good knowledge of environmental safety and hazards and only a few of them showing extremely unsatisfactory knowledge of occupational health safety and hazards. Although there are no existing studies targeted at the cleaners in the oil and gas industries, there are however other occupational health safety and hazard studies in other sectors to which these reports of this study can be compared to. For instance, a similarly high level of occupational health safety and hazard knowledge has been reported by [19] among the cleaning staff of a university in Southern Nigeria. Similarly, Osungbemi *et al.* [20] reported a high level of occupational health safety and hazards awareness among government health workers in Ondo State, Nigeria. However, other studies have also made differing reports by reporting a low level of occupational health safety and hazards among different categories of workers in Nigeria. For instance, Joshua *et al.* [21] reported an unsatisfactory level of knowledge among bakers in Kaduna State, Northern Nigeria. Similarly, Van Kampen *et al.* [15] reported a low level of occupational health, safety and hazards awareness among street cleaners in Nigeria. The differing reports shown in literature suggest that certain factors facilitate increased level of knowledge and awareness while these factors also hinder the level of knowledge and awareness. As shown in this study, there is a strong correlation between exposure to training and the actual knowledge of occupational health, safety and hazards. This implies that cleaners with higher exposures to formal trainings show a higher level of knowledge and awareness. Previous studies such as [22] and [23] have also identified the quality training as a prerequisite to increased level of knowledge and awareness about occupational health safety and hazards. Although cleaners are generally perceived as having a low level of education, more than half of the cleaners in this study have gone through one or more formal training on occupational health safety and hazard. Hence, the fairly high level of knowledge shown by the cleaners.

Similar to the level of knowledge, the level of adherence to occupational health and hazard guideline among the cleaners was only fair. Although a good number of the cleaners put on a pair of gloves before getting to work, majority of them carry out their cleaning duties without goggles, nose shields, slip resistant foot wears and protective coveralls. This exposes them to a lot of occupational hazards such as slipping, physical injuries, chemical burns and respiratory diseases [24]. Due to the limited studies concerning the adherence to occupational health safety and hazard guidelines, there are very few studies that can be used to form a baseline comparison with this study. Nevertheless a few studies have documented the level of adherence to occupational health safety and hazard guidelines among cleaners. For example, Mpe [25] also reported poor compliance

with occupational health, safety and hazard guidelines among cleaners in the rural areas of South Africa. Similarly, Melese [26] reported a low level of compliance with occupational health, safety and hazard guidelines among Mekelle University in Ethiopia. The poor compliance with occupational health safety and hazard guidelines among cleaners is usually attributed to the poor level of knowledge about occupational hazards and unavailability of protective equipment such as gloves, goggles and coveralls. In this study, a significant correlation between level of knowledge and adherence to occupational health, safety and hazard guidelines suggests that people with higher level of knowledge showed a corresponding higher level of compliance and vice-versa. Hence level of knowledge is a significant determining factor of level of compliance among the cleaners.

4.2.3. Common Occupational Hazards/Diseases amongst Cleaners

Diseases, physical injuries and sometimes death have been reported as the most frequent effect of occupational hazards on workers in various fields of works [27] [28] [29]. In this study respiratory diseases and allergic reactions are the most frequent diseases with which cleaners have been diagnosed with during their time working as a cleaner. Respiratory diseases such as prolonged cough, catarrh, asthma and lung cancer are some of the most common respiratory diseases associated with the chemicals used in cleaning [29] [30] [31]. The high prevalence of respiratory diseases among these cleaners can be attributed to the low usage of nose shields during activities. Cleaning chemicals such as bleach, ammonia, Volatile Organic Compounds (VOCs) have been known to irritate respiratory linings and cause respiratory diseases when inhaled or when ingested [7]. When cleaners refuse to use their nose masks while cleaning with these chemicals, it increases their chances of suffering from respiratory diseases. Allergic reactions were also highly reported among the cleaners. Just like respiratory diseases, allergic reactions from cleaning chemicals have been extensively reported in literature. Allergic reactions such as wheezing, blisters, itching, rashes and swelling of the eyes can be caused by various chemicals such as bleaches and solvents. The high prevalence of allergic reactions among the cleaners could be associated with the low usage of nose shields and protective coveralls while working with cleaning chemicals. Wearing clothes that exposes the skin can easily cause reactions such as blisters and rashes when the chemicals get in contact with the skin. Skin diseases and chemical burns were also fairly common among the cleaners. This can also be attributed to the fact that cleaners hardly wear protective coveralls during their cleaning duties.

5. Conclusion

The respiratory diseases mean value of 55% and allergic reactions 55% are the most frequent or prevalent health defects reported among the cleaners. These adverse effects are as a result of the low level of knowledge about occupational

health safety and hazards, which translates to low compliance with occupational health safety and hazards.

This study revealed that cleaners in oil and gas industries in Nigeria suffer from health conditions such as asthma, prolonged cough, allergic reactions, chemical burns, skin irritation and chemical poisoning as a result of their prolonged exposure to toxic chemicals such as chlorine (Cl), Sodium Hydroxide (NaOH), Hydrogen peroxide (H₂O₂), Sodium Hypochlorite (NaClO), Ammonia (NH₃), and trisodiumphosphate (Na₃PO₄) found in cleaning chemicals such as bleaches and solvents.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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