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Research Article

Evaluation of Health and Safety Management Practices on Building Construction Sites in Benue State, Nigeria.

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Abstract-Worried by the frequent occurrence of accidents in building sites in Benue State, the researchers conducted an evaluation of health and safety management on building construction sites in Benue State. The study was guided by three objectives. The study adopted the survey research design. The population of the study comprises 600 site managers, supervisors, artisans, and labourers. A sample of 120 site workers was selected using multiple stage sampling techniques. The research instrument used for data collection was a structured questionnaire titled: Health and Safety Management on Building Construction Sites Questionnaire and interview. The instrument was validated by two Building Technology Lecturers in the Department of Vocational and Technical Education and one expert in Educational Research and Measurement, all in the Faculty of Education, Benue State University, Makurdi. Upon successful validation, the instrument was trial tested in order to determine the reliability. Split half reliability method time was used and when compared the halves were found to be same indicating that the instrument was reliable and ready to use. The researcher personally moved from one building site to another in Gboko, Makurdi, and Otukpo to administer the questionnaire to the respondents. Mean and standard deviation were used for answering the research questions. The finding revealed that major accidents occurring on building construction sites in Benue State are workers falling from height, followed by one being struck by an object, and the least of them is someone having contact with electricity. It was found that the causes of accidents on building construction sites in Benue State are excessive working hours resulting in mental fatigue, horseplay by workers, unsafe acts or non-compliant behaviour, inadequate maintenance of tools and equipment, communication issues, and drugs and alcohol, among others. The finding also shows that health and safety measures which could be taken are health and safety training, strict monitoring and enforcement of safety regulation, effective communication system on site, regular and frequent breaks for rest, use of personal protective equipment. Protected edges, safe access and secure edge protection, and the use of appropriate scaffolding with good edge protection should be made available on the building construction site to reduce falling from height. It was recommended, among others, that conducting monthly health and safety training sessions, providing personal protective equipment for all workers according to their needs, and allowing all workers to take a break after 3-4 hours of work to avoid fatigue would help to avoid most on-site accidents.

Article Key Information

Keywords: Health, safety, building, accident, causes of accident

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1. Introduction

The basic infrastructural facilities necessary for human survival include food, energy supply, water, and shelter. Shelter has been a fundamental human need since the earliest civilizations, evolving from caves to modern high-rise buildings (Chen *et al.,* 2020). Advances in construction technology have enabled the development of diverse building structures, including bungalows, multi-story buildings, and skyscrapers. Building construction, as a subset of the construction industry, integrates knowledge of soil properties, material science, and labor-saving technologies to enhance efficiency and safety. The industry provides essential infrastructure, including housing, hospitals, and transportation networks, benefiting society at large (Eze *et al.,* 2017).

The construction industry significantly contributes to national economies, particularly in developing countries, where it is a major driver of economic growth (Zhou *et al.,* 2013). In most developing nations, the industry contributes approximately 11% of the Gross Domestic Product (GDP) (Tunji-Olayeni *et al.,* 2018). In Nigeria, construction remains a key pillar of the domestic economy, accounting for roughly 11% of the GDP and employing about 33% of the workforce (Okoye, 2018; Williams, 2019). However, the industry is also among the most hazardous due to risks associated with working at heights, confined spaces, falling objects, manual handling of loads, hazardous substances, noise, dust, and exposure to live electrical cables (Umeokafor *et al.,* 2014). These risks are further amplified in urban environments, where rapid urbanization and increased demand for housing, offices, and infrastructure contribute to high accident rates on construction sites.

Globally, the construction industry is considered highly hazardous, with accident rates significantly higher than in other industries. Construction workers are two to three times more likely to experience fatal accidents on the job, and the likelihood of serious injuries is nearly three times higher than in other sectors (Idoro, 2008; Udo, 2016). In Nigeria, the absence of reliable accident data and poor record-keeping make it difficult to assess the full extent of construction-related hazards. However, reports of major accidents, such as building collapses in Port Harcourt and Lagos, highlight the critical safety challenges in the industry (Khosravi *et al.,* 2014; Belayutham & Ibrahim, 2019). These incidents underscore the need for improved health and safety measures to protect workers and prevent further loss of life and property damage.

Health and safety in construction are not only a humanitarian concern but also an economic imperative. Ensuring workplace safety minimizes accidents, improves productivity, and enhances overall project quality (Kukoyi & Smallwood, 2017). Unfortunately, many construction firms in Nigeria view safety measures as an additional cost burden rather than an investment. This misconception often leads to inadequate safety training, poor enforcement of regulations, and limited provision of personal protective equipment (Abas *et al.,* 2020; Belayutham & Ibrahim, 2019). Research suggests that investment in construction safety leads to increased profitability by reducing project delays, enhancing worker morale, and lowering turnover rates (Tanko *et al.,* 2020).

In Benue State, the building construction sector is thriving, yet safety considerations are frequently neglected. Many construction projects, especially in Makurdi, lack proper health and safety management, exposing workers to various hazards (Eze *et al.,* 2017). Safety is often discussed in management meetings but takes a low priority in budgeting and project planning. Many site managers believe that implementing safety measures will increase costs and reduce profits, ignoring the long-term benefits of accident prevention. Consequently, accidents such as falls, injuries from falling objects, exposure to hazardous substances, and electrocutions remain prevalent on construction sites. If left unaddressed, these safety issues will not only endanger workers' lives but also compromise the structural integrity of buildings, leading to project failures and financial losses.

This study aims to evaluate health and safety management practices on building construction sites in Benue State, Nigeria. Specifically, it seeks to:

i Identify the types of accidents occurring on building construction sites in Benue State.

ii Examine the causes of accidents on construction sites and explore potential solutions.
iii Assess the effectiveness of health and safety measures implemented on project sites and determine their adequacy.

By analyzing these aspects, the study will provide valuable insights into current safety practices and propose recommendations for improving health and safety management in the construction industry. Given the high risk associated with construction activities, it is essential to implement proactive safety measures to protect workers and ensure project sustainability.

2. Literature Review

2.1 Construction Safety Risks

The construction industry is widely recognized as one of the most hazardous sectors due to its high rate of workplace accidents and fatalities (Idoro, 2008). Workers in this industry are exposed to various risks, including falls from heights, being struck by falling objects, electrocutions, machinery-related injuries, exposure to hazardous substances, and structural collapses (Umeokafo *et al.,* 2014). These risks are more pronounced in developing countries like Nigeria, where safety regulations are poorly enforced and construction activities often involve informal labor with limited training (Belayutham & Ibrahim, 2019).

Studies indicate that the major causes of construction accidents include unsafe working conditions, human error, and lack of proper supervision (Eze *et al.,* 2017). Long working hours, fatigue, and a lack of personal protective equipment (PPE) further exacerbate the risks (Tanko *et al.,* 2020). Additionally, construction workers in urban areas face increased risks due to the complexity of high-rise buildings, inadequate scaffolding, and poor site management (Zhou *et al.,* 2013). The absence of proper accident reporting systems also contributes to the high fatality rates, as incidents are often underreported or ignored, preventing the implementation of corrective measures (Khosravi *et al.,* 2014).

In Nigeria, recent high-profile accidents, including building collapses in Lagos and Port Harcourt, have raised concerns about safety practices in the construction industry (Belayutham & Ibrahim, 2019). Despite these alarming incidents, many construction companies continue to neglect essential safety protocols due to cost concerns, leading to preventable injuries and fatalities (Abas *et al.,* 2020).

2.2 Regulatory Frameworks for Construction Safety

Effective regulation is crucial for reducing accidents and improving workplace safety in the construction industry. However, Nigeria's construction safety regulations remain weak, poorly enforced, and inconsistently applied (Okoye, 2018). The country has several occupational health and safety (OHS) policies, but compliance remains low due to inadequate government oversight and a lack of employer commitment (Williams, 2019).

Internationally, countries with strict construction safety regulations, such as the United Kingdom and the United States, have significantly lower accident rates. These nations have implemented mandatory safety training, frequent site inspections, and stricter penalties for non-compliance, which have led to improved safety records (Udo, 2016). In contrast, Nigeria lacks a centralized construction safety regulatory body, and enforcement is often left to state-level agencies with limited resources (Kukoyi & Smallwood, 2017).

Existing Nigerian safety policies emphasize general occupational health and safety measures but fail to address specific construction-related hazards, such as scaffold stability, fall protection, and safe handling of hazardous materials (Tunji-Olayeni *et al.,* 2018). The Construction Industry Development Board (CIDB) Act and the Factories Act are among the key regulations addressing workplace safety, but their implementation remains inadequate (Okoye, 2018). The absence of standardized safety audits further weakens compliance, as many construction firms operate without regular inspections (Tanko *et al.,* 2020).

Despite these challenges, some states in Nigeria have made progress in improving safety compliance through local initiatives. For example, Lagos State has introduced mandatory safety training for construction workers and

regular safety audits for large-scale projects. However, these measures are yet to be widely adopted across the country (Eze *et al.,* 2017).

2.3 Best Practices in Construction Safety Management

To mitigate construction safety risks, several best practices have been identified globally. These include:

i Comprehensive Safety Training Programs – Regular safety training significantly reduces accidents by ensuring workers are aware of potential hazards and proper preventive measures (Sunindijo, 2015). Training should include hazard recognition, emergency response, and the correct use of personal protective equipment (PPE) (Williams *et al.,* 2019).

ii Strict Enforcement of Safety Regulations – Countries with strong safety cultures enforce zero-tolerance policies for safety violations, including heavy fines and project shutdowns for non-compliance (Belayutham & Ibrahim, 2019). In Nigeria, construction firms that prioritize regular safety inspections and compliance audits report lower accident rates (Tanko *et al.,* 2020).

iii Use of Advanced Safety Technology – The integration of wearable safety devices, real-time hazard detection systems, and AI-driven site monitoring has been effective in reducing accidents (Zhou *et al.,* 2013). For instance, construction firms in developed nations use drones for site inspections, improving safety monitoring without exposing workers to risks.

iv Encouraging a Strong Safety Culture – A positive safety culture is essential for accident prevention. Studies have shown that construction firms with strong leadership commitment, employee involvement, and incentive programs for safety compliance experience fewer accidents (Kukoyi & Smallwood, 2017). Rewards for adhering to safety protocols and penalties for violations create a proactive safety environment (Okoye, 2018).

v Improved Worksite Organization and Housekeeping – Keeping worksites organized minimizes hazards such as trip-and-fall risks, unsecured scaffolding, and exposure to hazardous materials (Umeokafor *et al.,* 2014). Regular housekeeping and proper storage of equipment contribute to a safer work environment.

vi Effective Communication and Reporting Systems – Transparent accident reporting systems help identify recurring safety issues and implement preventive measures (Eze *et al.,* 2017). Encouraging workers to report hazards without fear of retribution improves overall safety compliance (Tanko *et al.,* 2020).

While some of these best practices have been introduced in parts of Nigeria, full implementation remains limited due to financial constraints, lack of skilled safety personnel, and resistance from construction firms (Belayutham & Ibrahim, 2019). However, government incentives such as tax breaks for safety-compliant firms and mandatory safety training requirements could encourage broader adoption.

2.4 Summary of Literature Gaps

Despite the extensive research on construction safety, gaps remain in the Nigerian context. Key issues include:

i Limited empirical data on accident trends in different Nigerian states.

ii Inadequate research on the effectiveness of existing regulatory frameworks in reducing construction accidents.

iii Lack of comparative studies between Nigerian safety practices and international best practices.

iv Minimal focus on the role of safety technology in improving construction site safety in Nigeria.

This study aims to address some of these gaps by evaluating health and safety management on construction sites in Benue State, assessing common accidents, causes, and existing safety measures, and providing practical recommendations for improvement.

3. Methodology

The study adopted the survey research design. The population of the study comprises 600 site managers, supervisors, artisans, and labourers. A sample of 120 site workers was selected using multiple stage sampling

techniques. Firstly, the cluster sampling technique was used to select the three major towns in Benue State, namely, Makurdi, Gboko, and Otukpo. Secondly, a systematic random sampling technique was used to choose two (2) project sites in each of the three major towns of the state, making a total of six building project sites. Finally, a simple random sampling technique was used to select twenty (20) site workers comprising of site managers, supervisors, artisans, and labourers in each of the six identified building project sites, making a sample size of 120 workers.

The research instrument used for data collection was a structured questionnaire titled: Health and Safety Management on Building Construction Sites Questionnaire. The questionnaire was structured into four sections labeled A, B, C, and D. Section A addresses the socio-demographic characteristics of the respondents while sections B, C, and D sought information based on the objectives of the study. The questionnaire was developed based on four scale responses of Strongly Agreed (SA), Agreed (A), Disagreed (D), and Strongly Disagreed (SD) with the following corresponding nominal values of 4, 3, 2, and 1, respectively.

The instrument was validated by two Building Technology Lecturers in the Department of Vocational and Technical Education and one expert in Educational Research and Measurement, all in the Faculty of Education, Benue State University, Makurdi. Upon successful validation, the instrument was trial tested in order to determine the reliability. The split-half reliability method, which evaluates reliability across time, was used. The researcher distributed the instrument to the site workers and thereafter split them and compared halves, which were found to be the same, indicating that the instrument was reliable and ready to use.

The researcher personally moved from one building site to another in Gboko, Makurdi, and Otukpo to administer the questionnaire to the respondents. This helps to ensure one hundred percent (100%) collection of questionnaires given and also, create an avenue for further explanations to respondents as the need arose. In analyzing the data collected through the questionnaire, the weighted mean ratio was adopted for answering the research questions. The mean score, which was 2.5 and above, was accepted, while below 2.5 was rejected.

4. Results

The results of the study are presented according to the research questions and hypotheses.
Research question 1: What are the kinds of accidents on the building sites in the study area?

Table 1: Kinds of Accidents Found on the Building Construction Sites in Benue State

S/N	Kinds of Accidents	Frequency	Percentage (%)
1	Fall from height	48	40.0
2	Contact with machinery	12	10.0
3	Struck by object	16	13.3
4	Struck by moving vehicle	8	6.7
5	Contact with electricity	5	4.2
6	Struck against	15	12.5
7	Slip, trip, fall on the same level	6	5.0
8	Trapped by something collapsing	10	8.3
	Total	**120**	**100%**

The data presented in Table 1 showed that out of the eight (8) kinds of accidents identified on the building site in Benue State, 48 fall from height kind of accident was found which represent 40%, 12 contact with machinery accident representing 10%, 16 struck by object accident which represent 13.3%, 8 struck by moving vehicle accident representing 6.7%, 5 contact with electricity which represent 4.2%, 15 struck against accident representing 12.5%, 6 slip, trip, fall same level accident which represent 5.0% and 10 trapped by something collapsing representing 8.3% respectively on the building site in Benue State. Table 1 shows that the major accidents occurring on building construction sites in Benue State are workers falling from height, followed by one being struck by an object, and the least of them is someone having contact with electricity.

The pie chart (Figure 1) shows the kinds of accidents that often occur in building construction sites.

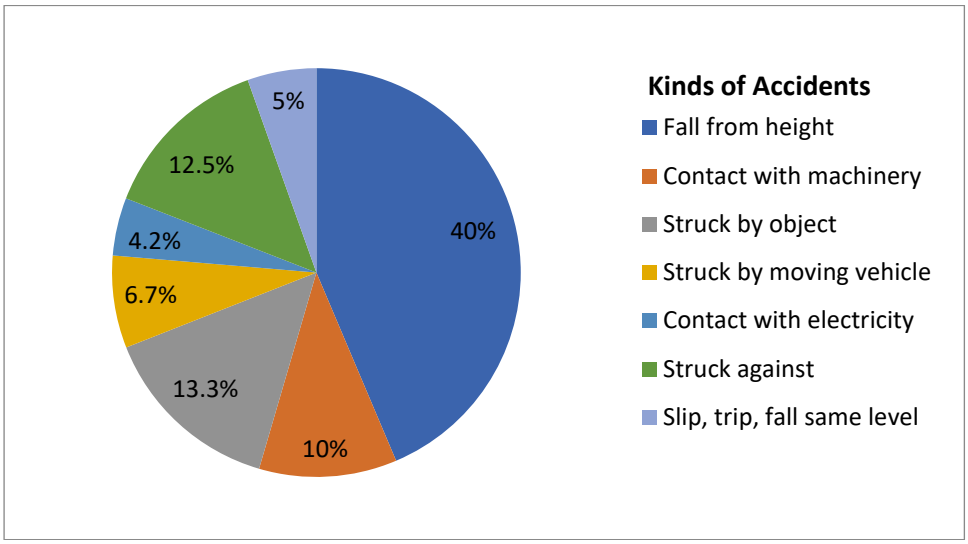

Figure 1: Pie Chart of Kinds of Accidents Found on the Building Construction Sites

Research question 2: What are the causes of accidents on the building sites in the study area?

Table 2: Mean Ratings of Building Site Workers' Response on Causes of Accidents on the Building Construction Site in Benue State

S/N	Items	$\bar{X}$	SD	Remark
1	Excessive working hours resulting in mental fatigue	4.24	1.14	Strongly Agree
2	Horseplay by workers	4.33	0.81	Strongly Agree
3	Hazardous machine operations	3.98	1.08	Strongly Agree
4	Unsafe working conditions	4.15	1.02	Strongly Agree
5	Space congestion	3.68	1.30	Strongly Agree
6	The pressure to meet production targets	3.73	1.26	Strongly Agree
7	Inadequate safety management systems	3.69	1.27	Strongly Agree
8	Failure to learn lessons from previous incidents	3.74	1.30	Strongly Agree
9	Sun exposure	3.68	1.27	Strongly Agree
10	Unsafe acts/violations/non-compliant behaviour	4.19	1.05	Strongly Agree
11	Improper use of safety items/equipment and tools	3.85	1.25	Strongly Agree
12	Lack of competency	3.74	1.26	Strongly Agree
13	Inadequate procedures	3.91	1.17	Strongly Agree
14	Inadequate maintenance of tools and equipment	4.08	1.11	Strongly Agree
15	Communication issues	4.21	1.01	Strongly Agree
16	Lack of management commitment	3.97	1.12	Strongly Agree
17	Ignorance of PPE (Personal Protective Equipment)	3.88	1.20	Strongly Agree
18	Poor management practices	4.14	1.04	Strongly Agree
19	Inadequate training	4.53	0.84	Strongly Agree
20	Drugs and alcohol	4.39	1.01	Strongly Agree
21	Poor accident reporting systems	3.82	1.37	Strongly Agree

Weighted Mean	**4.00**	**1.14**	**Strongly Agree**

Results in Table 2 show that the items 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, and 21 with corresponding mean scores of 4.24, 4.33, 3.98, 4.15, 3.68, 3.73, 3.69, 3.74, 3.68, 4.19, 3.85, 3.74, 3.91, 4.08, 4.21, 3.97, 3.88, 4.14, 4.53, 4.39 and 3.82 respectively were all strongly agreed by building site workers as causes of accidents on the building sites in Benue State. The weighted mean of 4.00 with a standard deviation of 1.14, which is above the decision mean of 2.50, is an indication that all the 21 items listed are causes of accidents on building construction sites in Benue State. This implies that the causes of accidents on building construction sites in Benue State are excessive working hours resulting in mental fatigue, horseplay by workers, Unsafe acts or non-compliant behaviour, inadequate maintenance of tools and equipment, communication issues, and drugs and alcohol, among others.

Further interview was conducted to determine the ten most frequent causes of accidents in building sites in Benue State. Building site workers were asked to mention one cause of an accident they had in the last three months. The result is presented in Table 3.

Table 3: Ten Most Frequent Causes of Accidents in Building Sites

S/N	Causes of Accident	Frequency	Percentage
1	Excessive working hours	26	21.6%
2	Horseplay by workers	8	6.6%
3	Hazardous machine operations	6	5%
4	Unsafe working conditions	17	14%
5	Space congestion	10	8.3%
6	The pressure to meet production targets	14	11.7%
7	Inadequate safety management systems	10	8.3%
8	No use of Personal Protective Equipment	20	16.7%
9	Inadequate safety training	6	5%
10	Drugs and alcohol	3	2.5%
	Total	**120**	**100**

Table 3 shows the interview results on the ten most frequent causes of accidents in building sites in Benue State. Table 3 shows that 21.6% of accidents were caused by excessive working hours, 16.7% of the accidents were caused by non-use of personal protective equipment, and 14% of the accidents were caused by unsafe working conditions, while pressure to meet production targets caused 11.7% of the accidents. Table 3 further shows that 8.3% of the accidents were cause by space congestion, another 8.3% of the accidents were caused by inadequate safety management systems, 6.6% of the accidents were caused by horseplay among workers, 5% of the accidents were caused by hazardous machine operations, another 5% of the accidents were caused by inadequate safety training while drugs and alcohol accounted for 2.5% of the accidents.

In order to enhance clarity and visualization of the ten most frequent causes of accident, the data in Table 3 is presented in a bar chart.

The chart below shows the ten most frequent causes of accidents in building sites.

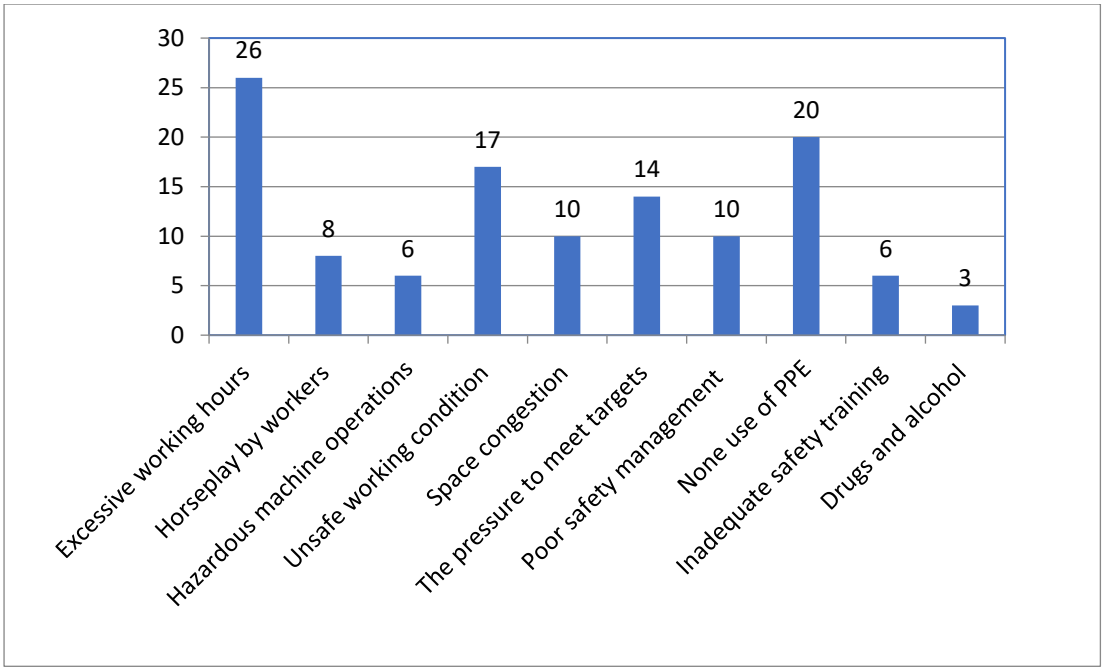

Figure 2: Chart showing the ten most frequent causes of accidents at building sites.

The practical significance of this finding is that there are different causes of accidents at building sites. The practical implication is that avoidance of excessive working hours, proper use of personal protective equipment, and ensuring a safe working environment will reduce 52.3% of building site accidents in Benue State.

Research question 3: What are the health and safety measures used on project sites in the area?

Table 4: Mean ratings of building site workers' response on health and safety measures used on the building construction site in Benue State

S/N	Items	$\overline{X}$	SD	Remark
1	Client commitment to bring an improvement to safety	3.86	1.35	Strongly Agree
2	Health and safety training and induction programmes	4.21	0.93	Strongly Agree
3	Exchanges of knowledge and experiences on HS best practices	3.72	1.11	Strongly Agree
4	Strict monitoring and enforcement of safety regulations	4.23	0.94	Strongly Agree
5	Rewards and penalties for defaulters	4.49	0.68	Strongly Agree
6	Effective communication system on site	4.57	0.84	Strongly Agree
7	Government support and commitment	3.46	1.25	Strongly Agree
8	Creation and implementation of HS plans	3.66	1.27	Strongly Agree
9	Proper workers' welfare	3.94	1.16	Strongly Agree
10	Daily toolbox or safety meetings	4.06	1.03	Strongly Agree
11	Reduce the amount of night work	3.97	1.05	Strongly Agree
12	Regular and frequent breaks	4.16	1.01	Strongly Agree
13	Clear signage to warn of danger	4.15	1.14	Strongly Agree
14	Introduce a warm-up or callisthenics exercise	4.02	1.13	Strongly Agree
15	Avoid sunlight to minimize fatigue and glare	4.09	1.17	Strongly Agree
16	Practice defensive driving/parking/backing up	4.05	1.03	Strongly Agree
17	Encouraging healthy eating and monitoring workers' diets	4.31	0.75	Strongly Agree
18	The use of personal protective equipment	4.62	0.52	Strongly Agree
19	Correct placement of the ladder through proper supervision	4.44	0.90	Strongly Agree
20	Management commitment to HS practices	4.22	1.09	Strongly Agree
21	Site discipline among workers	4.41	0.98	Strongly Agree
22	Appropriateness in the usage of safety items	4.12	1.13	Strongly Agree
23	Regular inspection and maintenance of tools and equipment	4.32	0.88	Strongly Agree

24	Efficient accident reporting systems	4.01	1.15	Strongly Agree
25	Provision of adequate safety facilities	4.15	0.87	Strongly Agree
	Weighted Mean	**3.96**	**1.01**	**Strongly Agree**

Table 3 shows that items 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24 and 25 with corresponding mean scores of 3.86, 4.21, 3.72, 4.23, 4.49, 4.57, 3.46, 3.66, 3.94, 4.06, 3.97, 4.16, 4.15, 4.02, 4.09, 4.05, 4.31, 4.62, 4.44, 4.22, 4.41, 4.12, 4.32, 4.01 and 4.15 respectively were all strongly agreed by building site workers as safety measures. This means that health and safety measures are health and safety training, strict monitoring and enforcement of safety regulation, effective communication system on site, regular and frequent breaks for rest, use of personal protective equipment.

A further interview was conducted to obtain the ten most frequently adopted health and safety measures. The result is presented in Table 5.

Table 5: Ten most frequently adopted health and safety measures.

S/N	Items	Frequency	Percentage
1	Health and safety training	20	16.7%
2	Strict monitoring and enforcement of safety regulations	12	10%
3	Observing regular and frequent breaks	16	13.3%
4	The use of personal protective equipment	20	16.7%
5	Correct placement of the ladder	8	6.7%
6	Regular inspection and maintenance of tools and equipment	15	12.5%
7	Provision of adequate safety facilities	13	10.8%
8	Rewards and penalties for defaulters	7	5.8%
9	Site discipline among workers	5	4.2%
10	Efficient accident reporting systems	4	3.3%
	Total	**120**	**100**

Table 5 shows the interview results on the ten most frequently adopted health and safety measures in building sites in Benue State. Table 5 revealed that health and safety training account for 16.7% of health and safety measures, use of personal protective equipment account for 16.7%, regular inspection and maintenance of tools and equipment accounted for 12.5%, observing regular and frequent breaks accounted for 13.3%, provision of adequate safety facilities account for 10.8% while strict monitoring and enforcement of safety regulation accounted for 10%. Table 5 also revealed that correct placement of the ladder accounted for 6.7%, rewards and penalties for defaulters accounted for 5.8%, site discipline among workers accounted for 4.2%, and efficient accident reporting systems accounted for 3.3%. A clear visualization of the health and safety measures is represented in the bar chart (Figure 3).

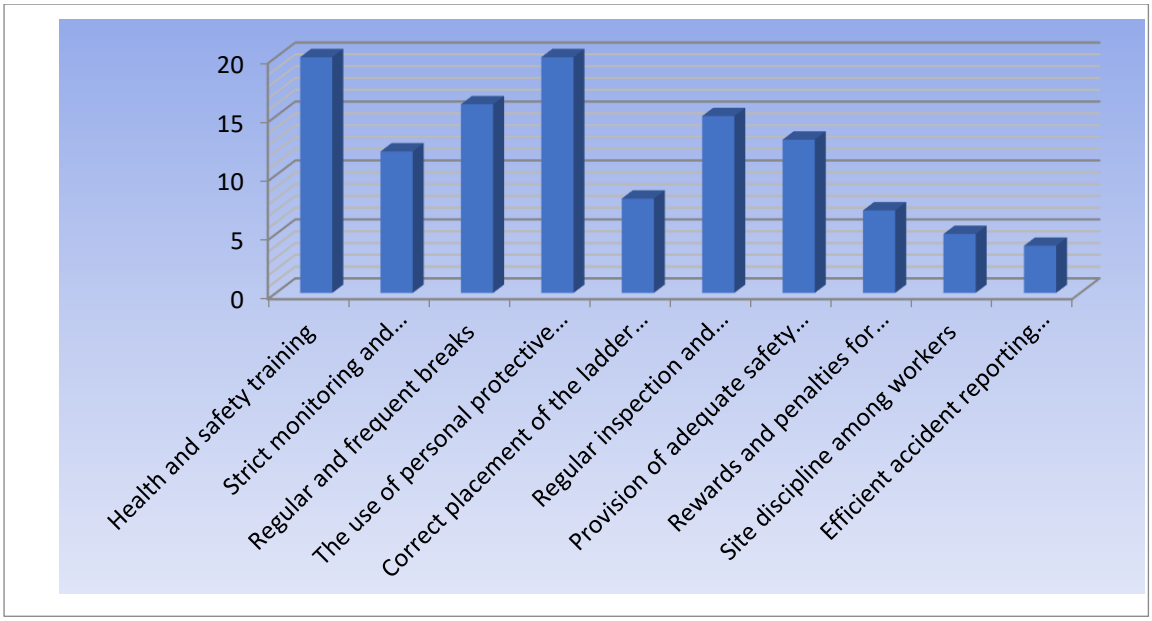

Figure 3: Chart showing the ten most frequently adopted health and safety measures.

The practical significance of these findings is that accidents at building sites can be prevented using many measures, and one single measure is not enough to prevent accidents. As can be seen in Table 5, various health and safety measures accounted for different percentages of accident prevention measures. The practical implication is that all health and safety measures must be observed in order to prevent accidents in building sites.

5. Discussion of the Findings

The findings from research question one revealed that there are eight kinds of accidents on the building construction sites in Benue State, as seen in Table 1. The finding revealed that the kind of accidents are fall from height, contact with machinery, struct by object, struck by moving vehicle, contact with electricity, struct against, slip, trip, fall same level and trapped by something collapsing. However, hypothesis one revealed that there is no significant difference among the respondents in the identified accidents on the building sites in the study area. This finding is in line with the assertion by Belayutham and Ibrahim (2019), who established that the most occurring accident that causes fatal and major injuries to workers on the building construction site in Benue State is falling from height. During accidents, fatal injuries could be minimized (and mitigated to lost working time injuries) by decreasing falling from height. This decrease could be achieved through the use of secure edge protection, safe access, and an appropriate scaffold with good edge protection. Moreover, an effective way to protect workers from falling from high places is using safety belts.

The findings from research question two shown that the top ten causes of accidents are inadequate safety training, drugs and alcohol, horseplay by workers, excessive working hours resulting in mental fatigue, communication issues, unsafe act, /violations/ non-compliance behaviour, unsafe working condition and poor management practices, inadequate maintenance of tools and equipment and hazardous machine operations. The least five causes are lack of competency, pressure to meet production targets, inadequate safety management systems, space congestion, and sun exposure. It is important to stress that regardless of the relative ranking of the assessed variables, they all contribute to accidents on building construction sites in Benue State. However, hypothesis two revealed that the cause of accidents on the building construction sites has no significant influence on health and safety management on building sites in Benue State. This finding corroborates that of Arunkumar and Gunasekaran (2018), who found that the major causes of accidents on building construction sites are unsafe acts, unsafe working conditions, communication barriers, management commitment, and lack of training. The finding is also in agreement with Yusof and Misnan (2019), who found that lack of training on safety management, communication issues, poor safety motivation, and poor safety culture of the organization are among the major causes of accidents on building construction sites. The finding is in affirmative with the report of Williams, Hamid and Misnan, (2019) some of the major causes of accidents are; violation of safety standards, poor supervision of

working platform installations, over speeding of vehicle, wrong selection of working tools, non-usage of personal protective equipment, improperly installed equipment, horseplay, and poor housekeeping. The finding is also similar to that of Zou et al. (2007), who reported that accidents on-site were blamed on pressure from the construction projects, long hours spent on construction work, hazardous machine operations, and unsafe work environment.

The findings from research question three revealed that the top ten health and safety measures (as seen in Table 3) on building construction sites are; rewards and penalties for defaulters, the use of personal protective equipment, effective communication system on-site, correct placement of ladder through proper supervision, Site discipline among workers regular inspection and maintenance of tools and equipment, encouraging healthy eating and monitor workers diets, strict monitoring and enforcement of safety regulation, management commitment on HS practices, and health and safety training and induction programmes. The least five health and safety measures on building construction sites are: proper workers' welfare, client commitment to bring an improvement to safety, exchanges of knowledge and experiences on HS best practices, creation and implementation of HS plans and government supports and commitment. However, hypothesis three revealed that the health and safety measures practiced on the building construction site have no significant influence on health and safety management on building sites in Benue State. This finding agrees with Belayutham and Ibrahim (2019), who found that rewards and penalties for defaulters, an effective communication system on-site, and health and safety training programs were among the HS improvement strategies. The finding is in line with Sunindijo (2015), who advocated for safety training incentives and supports to enable companies to improve on their training programmes. The finding is also in line with Tanko et al. (2020) recommendation for the provision of safety training and penalties to workers who fail to comply with PPE usage. The finding corroborate that of Williams, Hamid and Misnan (2019) who submitted that appropriate health and safety measures for the occurrence of accidents are; management enforcing compliance with safety standards, the use of personal protective equipment, correct placement of ladder through proper supervision, constant training on right selection and use of equipment/tools, correctness of design, an inspection of equipment, site discipline among workers, appropriateness in the usage of safety items, conspicuous location of warning signs, regular maintenance of tools and equipment, and reporting of accidents. Management commitment and support is the key to ensuring strict monitoring and enforcement, ensuring effective communications between workers and supervisors and management. Construction workers should also be encouraged to eat healthily and dieting,

6. Conclusion and Recommendations

6.1 Conclusion

The researchers concluded that with adequate health and safety training courses for employees, more emphasis on health and safety during the project planning phase, and greater penalties for poor health and safety practices, the risk of construction to the lives and well-being of workers could be reduced. Based on the findings of the study, it is concluded that health and safety measures in construction sites need to be further improved and monitored frequently for their effectiveness. From the survey conducted on the case study, it is believed that the members of the project team had an awareness about health and safety measures on building construction sites. However, improvements in many aspects need to be considered in order to ensure its effectiveness.

6.2 Recommendations

Based on the findings of this research, the following recommendations are made:

i Conduct monthly health and safety training sessions.
ii Provide personal protective equipment for all workers according to their needs.
iii All workers take a break after 3-4 hours of working to avoid fatigue.

Declarations

Ethical Approval and Consent to Participate:

Informed consent, both verbal and written, was obtained from all participants before data collection. The study was conducted with full transparency.

Consent for Publication:

All authors consent to the publication of this manuscript and confirm that the work is original, has not been published elsewhere, and is not under consideration for publication elsewhere.

Competing Interests:

The authors declare no competing interests related to this study.

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Data Availability:

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

Authors' Contributions:

Write each author's contribution. See the example below.

Hime I.I: Conceptualization, methodology, and manuscript drafting. Hime I.I, Upwa E.F, Nule J.S: Data collection, analysis, and figure preparation. Hime I.I, Upwa E.F, Hime E.A, Gowon E.K, Hime B.U: Literature review and critical manuscript revision. All authors read and approved the final manuscript.

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