Assessment of Heat Related Occupational Hazards and Health Illnesses Among Construction Workers in Cabanatuan City

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Abstract- ***This study investigated the vulnerability of construction workers to heat-related occupational hazards and illnesses. The diverse workforce surveyed spanned various age groups (25-54 years old being the majority) and job roles, with skilled trades like carpentry and electrical work constituting the largest occupational group. The analysis revealed a consistent perception among workers regarding the prevalence and severity of heat hazards. They overwhelmingly agreed that these hazards intensify during summer months, peak sun hours, and in areas with direct sunlight and poor ventilation. While workers acknowledged the importance of managing heat exposure duration and the effectiveness of personal protective equipment (PPE), the study identified potential gaps. A moderate level of agreement suggested areas for improvement in training and ensuring consistent access to appropriate PPE. Intriguingly, the study found a positive correlation between age and the frequency of heat-related hazards. Older workers appeared to be more susceptible, highlighting the need for age-specific interventions. Similarly, different job roles demonstrated varying degrees of exposure, underscoring the importance of tailored strategies. To address these findings, the study proposes a comprehensive Heat Hazard Response Plan. The plan emphasizes the importance of regular monitoring and evaluation to ensure continuous improvement in protecting workers from heat-related hazards. This study emphasizes the need for a multi-pronged approach to safeguard construction workers' health. By implementing the proposed plan, fostering a culture of heat stress awareness, and developing targeted interventions based on age and job role, construction companies can create a safer and healthier work environment, ultimately reducing the incidence of heat-related illnesses.***

Indexed Terms- ***Rewards, Employee Satisfaction, Organizational Heat Stress; Construction Workers; Age; Intervention; PPE (Personal Protective Equipment)***

I. INTRODUCTION

The construction industry in Cabanatuan City, like many urban areas in the Philippines, faces the challenge of protecting its workers from the adverse effects of heat-related occupational hazards. With temperatures frequently soaring to high levels, especially during the dry season, construction workers are at increased risk of heat stress, heat exhaustion, and even heat stroke. These hazards not only jeopardize the health and safety of workers but also have implications for productivity and overall project efficiency.

The rationale behind this study stems from the urgent need to address the gaps in knowledge and understanding surrounding heat-related occupational hazards among construction workers in Cabanatuan City. Despite the critical nature of the issue, there is a paucity of localized data and research focusing specifically on this population. Most existing studies tend to generalize findings from broader contexts or urban centers, failing to capture the unique challenges faced by construction workers in smaller cities like Cabanatuan.

One significant gap that this study aims to fill is the lack of comprehensive data on the frequency, severity, and specific nature of heat-related hazards encountered by construction workers in Cabanatuan City. By conducting a thorough assessment, the study seeks to shed light on the prevalent hazards, their

underlying causes, and their impact on worker health and safety.

Moreover, there is a notable gap in the literature regarding the perspectives and experiences of construction workers themselves. By actively involving workers in the research process, this study aims to provide a more holistic understanding of the challenges they face, as well as their perceptions of existing safety measures and practices.

In addition, while the importance of heat safety protocols is widely recognized, there is limited research on their implementation and effectiveness at the local level. This study seeks to evaluate the current practices and identify areas for improvement to enhance the protection of construction workers from heat-related illnesses and injuries.

The significance of this study lies in its potential to inform evidence-based interventions and policies aimed at improving the occupational health and safety of construction workers in Cabanatuan City. By generating localized data and insights, the study can provide valuable inputs for the development of targeted strategies to mitigate heat-related hazards and promote a safer working environment.

Furthermore, the active involvement of construction workers in the research process not only enhances the validity and relevance of the findings but also empowers workers to actively participate in the identification of solutions that directly impact their well-being.

The assessment of heat-related occupational hazards among construction workers in Cabanatuan City is not only timely but also imperative for safeguarding the health and safety of this essential workforce. Through collaborative efforts between researchers, policymakers, employers, and workers, meaningful progress can be made towards creating a safer and healthier working environment for all.

II. LITERATURE REVIEW

The review of related literature provides a foundation for understanding the existing knowledge and research findings relevant to the assessment of heat-related occupational hazards and health illnesses among construction workers in Cabanatuan City. This section synthesizes key studies and scholarly works that contribute to the understanding of the topic.

Global Perspectives on Heat-Related Occupational Hazards. In a study by Nguyen, et al (2014). the global risk of deadly heat events was comprehensively assessed, shedding light on the increasing frequency and severity of heatwaves worldwide attributable to climate change. Employing climate models and mortality data, the research projected a significant rise in the frequency and duration of heatwaves, particularly in tropical and subtropical regions. The findings underscored the urgent need for effective heat mitigation strategies, emphasizing the disproportionate impact of heat-related hazards on vulnerable populations, including outdoor workers.

Furthermore, Yang, et al (2015) provided a comprehensive overview of the health impacts of climate change, including heat-related occupational hazards. Through a multidisciplinary approach, the study examined the escalating risks of heat stress, heat exhaustion, and heatstroke faced by outdoor workers, particularly in regions experiencing rising temperatures. The research highlighted the physiological effects of heat exposure, adaptation strategies, and the potential co-benefits of climate change mitigation efforts for public health. Overall, the study emphasized the importance of integrated approaches to address heat-related hazards and protect vulnerable populations from adverse health outcomes. Local Context and Climate Conditions. Understanding the local context and climate conditions is crucial for assessing heat-related occupational hazards and health illnesses among construction workers. Studies focusing on the Philippines' climate patterns and temperature trends provide valuable insights into the challenges posed by high temperatures and humidity levels, particularly in urban areas with dense construction activities.

The Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) regularly monitors and analyzes climate data to provide accurate forecasts and assessments of weather conditions across the country. Their reports offer valuable information on temperature variations,

rainfall patterns, and other meteorological factors that influence heat stress risks for outdoor workers.

Research by Wang, et al (2019) examined the impacts of climate change on urban heat islands (UHIs) in the Philippines, with a focus on densely populated cities like Manila. The study highlighted how UHIs exacerbate heat-related risks for construction workers and other outdoor laborers, emphasizing the need for localized interventions to mitigate heat stress in urban areas.

In addition, studies exploring heat-related illnesses and occupational hazards in specific regions of the Philippines offer insights into the localized challenges faced by construction workers. Research by Moraes, et al (2022) about heat stress among workers in Metro Manila, highlighting the significant impact of temperature and humidity levels on workers' health and productivity.

Research on the local context and climate conditions in the Philippines provides valuable context for assessing heat-related occupational hazards among construction workers. By understanding the specific environmental factors that contribute to heat stress risks, policymakers and stakeholders can develop targeted interventions to protect workers and promote a safer working environment.

Occupational Health and Safety in the Construction Industry. The construction industry is widely recognized as one of the most high-risk sectors for occupational hazards, including those related to heat stress and extreme weather conditions. Several studies have explored various aspects of occupational health and safety in the construction industry, shedding light on the challenges faced by workers and the effectiveness of existing safety measures.

Nada, et l (2022) conducted a comprehensive review of construction safety research, focusing on the identification and management of occupational hazards. The study highlighted the prevalence of accidents and injuries in the construction industry, emphasizing the need for proactive risk assessment and safety management strategies to prevent incidents and protect workers from harm.

Similarly, research by Silveira, et al (2023) examined the implementation of occupational health and safety practices in the construction sector, with a specific focus on developing countries like the Philippines. The study identified gaps in safety training, regulatory enforcement, and risk communication, highlighting the need for improved safety culture and compliance to reduce the incidence of workplace injuries and illnesses.

Moreover, studies have explored the effectiveness of specific interventions and safety protocols in mitigating occupational hazards in the construction industry. For example, research by Yatim, et al (2021) evaluated the impact of safety training programs on construction workers' knowledge and behavior, finding positive associations between training participation and safety performance.

Research on occupational health and safety in the construction industry provides valuable insights into the challenges and opportunities for improving workplace safety practices. By addressing gaps in safety training, regulatory enforcement, and risk communication, policymakers and stakeholders can enhance the protection of construction workers from a wide range of occupational hazards, including those related to heat stress and extreme weather conditions.
Worker Perspectives and Experiences. Understanding construction workers' perspectives and experiences is essential for gaining insights into the challenges they face and the effectiveness of existing safety measures. Several studies have explored the lived experiences of construction workers, shedding light on their attitudes, behaviors, and perceptions regarding occupational hazards and safety practices.

Research by Lu, et al (2020) investigated construction workers' perceptions of safety climate and risk-taking behaviors in the workplace. The study found that workers often prioritize productivity over safety, leading to underreporting of injuries and reluctance to use personal protective equipment (PPE). The findings underscored the need for organizational interventions to foster a positive safety culture and encourage workers to prioritize their own well-being.

Similarly, Lee, et al (2019) examined the experiences of migrant construction workers in urban settings,

highlighting the unique challenges faced by this vulnerable population. The study identified language barriers, lack of training, and precarious working conditions as significant factors contributing to increased risks of accidents and injuries among migrant workers. The findings underscored the importance of culturally sensitive interventions and effective communication strategies to promote safety and well-being in diverse construction environments.
Moreover, research has explored the role of social support and peer influence in shaping construction workers' safety behaviors. For example, studies by Wang, et al (2015) examined the influence of social networks and informal communication channels on safety-related decision-making among construction workers. The findings highlighted the importance of positive peer interactions and supportive work environments in promoting adherence to safety protocols and reducing the likelihood of accidents and injuries.

Effectiveness of Heat Safety Interventions. Heat safety interventions are crucial for mitigating the adverse effects of heat exposure, especially in occupational settings and during extreme weather events. Several studies have examined the effectiveness of various interventions aimed at preventing heat-related illnesses and injuries. Understanding the efficacy of these interventions is essential for developing evidence-based strategies to protect individuals from heat-related hazards.

Research by Grasgruber, et al (2018) evaluated the effectiveness of workplace heat safety programs in preventing heat-related illnesses among outdoor workers. The study found that comprehensive heat safety programs, including acclimatization protocols, access to shaded rest areas, hydration strategies, and training on recognizing heat illness symptoms, significantly reduced the incidence of heat-related illnesses. These findings underscore the importance of implementing multifaceted interventions to promote worker safety in hot environments.

Early warning systems and heat stress monitoring technologies play a crucial role in preventing heat-related injuries and fatalities. A study by Chung, et al (2017) assessed the effectiveness of a heat stress monitoring and early warning system in reducing heat-related hospitalizations during extreme heat events. The research demonstrated that timely alerts and targeted interventions based on real-time heat stress data helped to prevent heat-related illnesses and minimize the impact of heatwaves on public health. This study highlights the importance of proactive measures and technological innovations in managing heat-related risks.

In a nutshell, the review of related literature shows the complex interplay of environmental, organizational, and individual factors contributing to heat-related occupational hazards among construction workers. By synthesizing findings from existing studies, this review provides a comprehensive understanding of the current state of knowledge and informs the rationale for conducting the proposed assessment in Cabanatuan City.

III. CONCEPTUAL FRAMEWORK

In this study, the Input Process Output (IPO) framework serves as the guiding conceptual model for examining the dynamics of heat-related occupational hazards among construction workers. The adoption of the IPO framework facilitates a structured and systematic approach to understanding the interplay between key variables and outcomes. In the discussion of the conceptual framework, it is essential to recognize how each component of the IPO framework contributes to the overall understanding of heat-related risks in the construction industry.

In the input stage, the IPO framework allows for the comprehensive identification and characterization of key factors that shape the context of heat-related hazards among construction workers. By examining the profile of construction workers, including demographic characteristics and occupational roles, researchers can gain insights into the population at risk and their susceptibility to heat-related risks. Moreover, assessing the frequency of heat-related occupational hazards and the current incidence of heat-related illnesses provides a quantitative basis for understanding the magnitude and severity of heat exposure in construction settings. The IPO framework enables researchers to systematically collect and organize these input variables, laying the foundation for subsequent analysis and interpretation.

Moving to the process stage, the adoption of the IPO framework facilitates the systematic execution of data collection, analysis, and interpretation procedures. By employing a structured survey questionnaire and standardized data gathering procedures, researchers ensure consistency and reliability in data collection processes. The analytical phase involves the rigorous examination of collected data to identify patterns, correlations, and associations between input variables and outcomes. Through the systematic application of data analysis techniques, researchers can uncover meaningful insights into the relationships between the profile of construction workers, the frequency of heat-related hazards, and the incidence of heat-related illnesses. The IPO framework guides researchers through each step of the process, from data collection to interpretation, ensuring methodological rigor and coherence in research findings.

In the output stage, the IPO framework guides the development of actionable recommendations and interventions aimed at addressing heat-related occupational hazards in the construction industry. By synthesizing insights from the input and process stages, researchers can formulate targeted strategies and interventions to mitigate heat-related risks and promote worker safety and well-being. The output of this study, in the form of a heat hazard response plan, serves as a practical tool for stakeholders in the construction industry to implement evidence-based measures for preventing and managing heat-related illnesses and injuries. The adoption of the IPO framework facilitates a structured approach to translating research findings into actionable outcomes, thereby contributing to the advancement of occupational health and safety practices in the construction sector.

IV. RESEARCH PROBLEM

The general aim of the study is to comprehensively examine the profile, frequency of heat-related occupational hazards, and incidence of heat-related illnesses among construction workers, and to investigate the relationships between these factors. Specifically, the study aims to describe the profile of construction workers in terms of age and job role, characterize the frequency of heat-related hazards concerning seasonal variation, time of day, and work site conditions, and delineate the current incidence of heat-related illnesses based on duration of exposure and personal protective measures.

Specifically, it sought answers to the following questions:

1. How may the profile of the construction workers be described in terms of:
   1.1 age; and
   1.2 job role?
2. How may the frequency of heat-related occupational hazards among construction workers be described in term of:
   2.1 seasonal variation;
   2.3 time of day, and
   2.3 work site conditions?
3. How may the current incidence of heat related illnesses encountered by the construction workers be described in terms of:
   3.1 duration of exposure; and
   3.2 personal protective measures?
4. Is there a significant relationship between the profile of the construction workers and the:
   4.1 frequency of heat related occupational hazard; and
   4.2 incidence of heat related illnesses they encounter?
5. What heat hazard response plan protecting construction workers through proactive measures may be proposed based on the results of the study?

4.1 Hypothesis

The following hypothesis is offered:

H01: There is no significant correlation between profile of the construction workers and frequency of heat related occupational hazard.

H02: There is no significant correlation between profile of the construction workers and the incidence of heat related illnesses they encounter

4.3 Objective of the Study

Based on the provided statement of the problem, the objectives of the study can be outlined as follows:

1. To describe the profile of construction workers in terms of age and job role.
2. To characterize the frequency of heat-related occupational hazards among construction workers

in relation to seasonal variation, time of day, and work site conditions.
3. To delineate the current incidence of heat-related illnesses encountered by construction workers based on the duration of exposure and utilization of personal protective measures.
4. To determine the significant relationship between the profile of construction workers and both the frequency of heat-related occupational hazards and the incidence of heat-related illnesses they encounter.
5. To propose a heat hazard response plan aimed at protecting construction workers through proactive measures, based on the findings of the study.

V. METHODOLOGY

5.1 Research Design

The research design adopted for this study is a quantitative descriptive research design. This design is chosen to systematically describe and analyze the frequency and nature of heat-related occupational hazards among construction workers. Quantitative methods allow for the collection of numerical data that can be analyzed statistically, providing precise measurements and insights into the prevalence and characteristics of heat-related hazards in the construction industry.

In a descriptive research design, the primary focus is on describing phenomena as they naturally occur, without attempting to influence or manipulate them. In this study, the researchers aim to provide a comprehensive overview of heat-related occupational hazards among construction workers, including their frequency, patterns, and contributing factors. By using a descriptive approach, the study aims to paint a detailed picture of the prevalence and distribution of heat-related hazards, facilitating a better understanding of the scope and magnitude of the problem.

5.2 Research Locale

The locale of the study is Cabanatuan City, a vibrant urban center located in the province of Nueva Ecija, Philippines. Within Cabanatuan City, the research focuses on construction sites where ongoing construction projects are taking place. These construction sites may include various types of projects such as residential buildings, commercial establishments, and infrastructure developments.

Cabanatuan City serves as an ideal locale for the study due to its active construction industry and diverse range of construction projects. As one of the largest cities in Nueva Ecija, Cabanatuan City attracts significant investment in construction, leading to a multitude of construction sites scattered across the urban landscape. This provides ample opportunities to observe and analyze the prevalence of heat-related hazards among construction workers in different settings and contexts.

The selection of Cabanatuan City as the locale of the study also considers its regional climatic characteristics. Located in the tropical climate zone, Cabanatuan City experiences warm temperatures throughout the year, with occasional spikes in temperature during the dry season. These climatic conditions contribute to the potential risk of heat-related illnesses among construction workers, making Cabanatuan City a relevant and suitable locale for studying heat-related occupational hazards in the construction industry.

Through a focus on construction sites within Cabanatuan City, the study aims to provide valuable insights into the prevalence, patterns, and determinants of heat-related hazards among construction workers in this urban setting.

5.3 Data Gathering Procedure

The data gathering procedures employed in this study involved several steps to ensure systematic and comprehensive data collection from construction workers in Cabanatuan City. First, the researchers obtained ethical approval from the relevant institutional review board before proceeding with data collection. Once ethical clearance was obtained, the following procedures were implemented:

Preparation and Distribution of Questionnaires: The researchers prepared the researcher-developed questionnaire, incorporating feedback from content validation and pilot testing phases. Questionnaires were distributed using both online and paper-based modes to accommodate the preferences and accessibility of the target population. For online

distribution, the questionnaire was hosted on a secure platform, and respondents were provided with a unique link to access it. For paper-based distribution, trained enumerators visited construction sites in Cabanatuan City to personally administer the questionnaires to eligible respondents.

Informed Consent: Before participating in the study, respondents were provided with information about the research objectives, procedures, and their rights as participants. They were asked to provide informed consent indicating their voluntary participation in the study. For online surveys, respondents were required to read and acknowledge the consent statement before proceeding to the questionnaire. For paper-based surveys, enumerators verbally explained the consent statement to respondents and obtained their written consent.

Data Collection: Respondents were asked to complete the questionnaire independently, ensuring confidentiality and privacy. The questionnaire consisted of three parts: profiling of construction workers, assessment of heat-related occupational hazards, and evaluation of heat-related illnesses encountered. Respondents were instructed to provide accurate and honest responses to the items presented. Trained enumerators were available to clarify any questions or concerns raised by respondents during the data collection process.

Quality Control: Throughout the data collection period, the researchers implemented quality control measures to ensure the reliability and validity of the data collected. This included monitoring the completeness and accuracy of responses, conducting spot-checks to verify the integrity of the data, and addressing any inconsistencies or discrepancies identified during the process.

Data Management: Upon completion of data collection, the researchers organized and compiled the survey responses for analysis. Data entry was performed meticulously to minimize errors, and measures were taken to securely store and protect the confidentiality of respondent information.

These data gathering procedures were designed to facilitate systematic and ethical collection of data from construction workers in Cabanatuan City, ensuring the validity and reliability of the study findings.

5.4 Data Analysis

The study employed descriptive statistics as a primary method for analyzing the data gathered from construction workers in Cabanatuan City. Descriptive statistics are essential for summarizing and presenting key characteristics of the study variables in a clear and concise manner. In this context, descriptive statistics allowed the researchers to examine and understand various aspects of heat-related occupational hazards and illnesses encountered by construction workers, as well as their demographic profiles and job roles.

Through descriptive statistics, the researchers were able to calculate measures such as frequencies, percentages, means, and standard deviations to describe the distribution and central tendency of the data. For example, descriptive statistics were used to summarize the age distribution of construction workers, providing insights into the age demographics of the study population. Similarly, descriptive statistics were employed to analyze the frequency and severity of heat-related hazards experienced by construction workers across different work site conditions and time periods.

Furthermore, descriptive statistics were utilized to characterize the current incidence of heat-related illnesses encountered by construction workers, including the duration of exposure and utilization of personal protective measures. By summarizing the responses to questionnaire items, the researchers were able to identify patterns and trends in the occurrence of heat-related illnesses and assess the effectiveness of existing safety measures in mitigating these risks.

The use of descriptive statistics in the analysis of the data gathered allowed for a comprehensive and systematic examination of the study variables. It provided valuable insights into the prevalence, distribution, and characteristics of heat-related occupational hazards and illnesses among construction workers in Cabanatuan City. Descriptive statistics served as a foundation for understanding the current status of heat safety practices in the construction industry and informed the development of recommendations for improving occupational health

and safety measures in this context. To describe the profile of the construction workers, descriptive statistics using frequency and percentages were used.

VI. RESULTS AND DISCUSSION

6.1 Profile of The Construction Workers

Table 1. Profile of the Construction Workers

Variables	Frequency (n=385)	Percentage (100%)
Age		
18-24 years old	68	17.70
25-34 years old	137	35.60
35-44 years old	39	10.10
45-54 years old	141	36.60
Total	385	100.00
Job role		
Skilled Trades and Craftsmen Cluster	221	57.40
Support and General Labor Cluster	164	42.60
Total	385	100.00

The profile of construction workers revealed a diverse age distribution, with the majority falling between the ages of 25 to 54 years old. Specifically, 35.60% of respondents were aged 25-34, while 36.60% were aged 45-54. Workers aged 18-24 accounted for 17.70% of the sample, and those aged 35-44 comprised 10.10%. In terms of job roles, the majority of respondents (57.40%) belonged to the Skilled Trades and Craftsmen Cluster, including professions such as carpenters, electricians, and plumbers. The remaining 42.60% were classified under the Support and General Labor Cluster, which encompassed roles like laborers and apprentices/trainees. These findings highlight the diverse demographic composition of construction workers surveyed, providing valuable insights for developing targeted interventions and safety protocols tailored to different age groups and job roles within the industry

6.2 Frequency of Heat-Related Occupational Hazards Among Construction Workers

Table 2 Frequency of Heat-Related Occupational Hazards among Construction Workers

Dimensions	Mean	Verbal Description
Seasonal Variation	3.30	Strongly Agree/Always
Time Of Day	3.28	Strongly Agree/Always
Work Site Conditions	3.28	Strongly Agree/Always
Overall Mean	3.28	Strongly Agree/Always
Legend: 3.25-4.00 Strongly Agree/Always; 2.50-3.24 Agree/Often; 1.75-2.49 Disagree/Sometimes; 1.00-1.74 Strongly Disagree/Never		

The key findings from the analysis of heat-related occupational hazards among construction workers reveal consistently high levels of agreement across all dimensions. In terms of seasonal variation, respondents strongly agreed (Mean = 3.30) that heat-related hazards significantly increase during the summer months compared to other seasons. Similarly, regarding the time of day, respondents strongly agreed (Mean = 3.28) that the intensity of heat-related hazards varies throughout the day, with the highest occurrence during peak sunlight hours. Furthermore, respondents also strongly agreed (Mean = 3.28) that work site conditions play a crucial role in exacerbating heat-related hazards, especially in direct sunlight and poorly ventilated spaces. The overall mean of 3.28 indicates a consistent pattern of strong agreement across all dimensions, suggesting a robust perception among construction workers regarding the prevalence and severity of heat-related occupational hazards. These findings underscore the critical need for implementing comprehensive heat safety protocols and interventions tailored to address seasonal variations, time-of-day factors, and specific work site conditions to mitigate the risks faced by construction workers.

6.3 Incidence Of Heat Related Illnesses Encountered by The Construction Workers

Table 3. Incidence of Heat Related Illnesses Encountered by the Construction Workerrs

Dimensions	Mean	Verbal Description
Duration of Exposure	3.24	Agree/Moderate
Personal Protective Measures	3.07	Agree/Moderate
Overall Mean	3.16	Agree/Moderate
Legend: 3.25-4.00 Strongly Agree/High; 2.50-3.24 Agree/Moderate; 1.75-2.49 Disagree/Low; 1.00-1.74 Strongly Agree/Very Low		

The findings from the assessment of the "Incidence of Heat Related Illnesses Encountered by Construction Workers regarding Personal Protective Measures" reveal valuable insights into the perceptions of construction workers regarding heat-related hazards and the protective measures in place. Firstly, the mean score of 3.24 for "Duration of Exposure" suggests that workers generally agree on the significance of managing the duration of exposure to heat. This acknowledgment underscores a proactive attitude toward mitigating heat-related illnesses, highlighting a crucial aspect of occupational safety awareness among construction workers. It indicates a moderate level of agreement, signaling that while workers recognize the importance of managing exposure, there may still be variations in their experiences or perceptions based on specific work conditions or practices.

Secondly, the mean score of 3.07 for "Personal Protective Measures" reflects a moderate level of agreement regarding the effectiveness of protective measures in preventing heat-related illnesses. This finding implies that while construction workers generally believe in the efficacy of these measures, there might be some room for enhancement or optimization. It suggests a positive attitude toward the utilization of personal protective equipment (PPE) and other preventive measures but also hints at potential areas where improvements in implementation or accessibility could further enhance worker safety.

With an overall mean score of 3.16, construction workers demonstrate a collective agreement on the importance of managing heat-related hazards and implementing protective measures. This overall positive perception reflects a fundamental understanding of occupational safety practices within the construction industry. However, it also underscores the need for ongoing efforts to reinforce and improve these measures continually. Enhancing training programs, ensuring access to appropriate PPE, and implementing robust safety protocols are essential steps toward further safeguarding construction workers against heat-related illnesses. By addressing these aspects, stakeholders can foster a safer and healthier work environment for construction workers, reducing the incidence of heat-related illnesses and promoting overall well-being.

6.4 Relationship between the profile of the construction workers with the frequency of heat related occupational hazard and incidence of heat related illnesses they encounter

6.4.1 Relationship of the profile of the construction workers and frequency of heat related occupational hazard

Figure 1. Correlation

		Frequency of heat related occupation hazard	Age
Frequency of heat related occupation hazard	Correlation Coefficient	1.000	.320**
	Sig. (2-tailed)	.	<.001
	N	385	385
Age	Correlation Coefficient	.320**	1.000
	Sig. (2-tailed)	<.001	.
	N	385	385
		Frequency of heat related occupation hazard	Job Role
Frequency of heat related occupation hazard	Correlation Coefficient	1.000	.227**
	Sig. (2-tailed)	.	<.001
	N	385	385
Job Role	Correlation Coefficient	.227**	1.000
	Sig. (2-tailed)	<.001	.
	N	385	385

The correlation coefficient between the frequency of heat-related occupational hazards and age is found to be significant at 0.320 ($p < .001$), indicating a moderately positive correlation. This suggests that there is a relationship between age and the frequency of heat-related hazards experienced by construction workers. As age increases, there tends to be a higher frequency of heat-related hazards, highlighting the

vulnerability of older workers to such occupational risks.

Similarly, the correlation coefficient between the frequency of heat-related occupational hazards and job role is also significant at 0.227 ($p < .001$), indicating a moderately positive correlation. This implies that the type of job role within the construction industry influences the frequency of heat-related hazards encountered. Certain job roles may involve greater exposure to heat due to specific tasks or working conditions, leading to a higher incidence of heat-related occupational hazards.

The implications of these findings are twofold. Firstly, they underscore the importance of considering age and job role as significant factors when assessing and managing heat-related occupational hazards among construction workers. Employers and policymakers should tailor their strategies and interventions to address the specific needs and vulnerabilities associated with different age groups and job roles within the construction sector. Secondly, proactive measures such as providing adequate training, implementing heat stress management protocols, and ensuring access to appropriate personal protective equipment (PPE) should be prioritized to mitigate the risks posed by heat-related hazards in the workplace.

6.4.2Relationship between the profile of the construction workers and incidence of heat related illnesses they encounter

Figure 2. Correlation

		Incidence of heat related illnesses they encounter	Age
Incidence of heat related illnesses they encounter	Correlation Coefficient	1.000	.151**
	Sig. (2-tailed)	.	<.001
	N	385	385
Age	Correlation Coefficient	.151**	1.000
	Sig. (2-tailed)	<.001	.
	N	385	385
		Incidence of heat related illnesses they encounter	Job Role
Incidence of heat related illnesses they encounter	Correlation Coefficient	1.000	.122**
	Sig. (2-tailed)	.	.007
	N	385	385
Job Role	Correlation Coefficient	.122**	1.000
	Sig. (2-tailed)	.007	.
	N	385	385

7.1 The correlation coefficient between the incidence of heat-related illnesses encountered and age is statistically significant at 0.151 ($p < .001$), indicating a weak positive correlation. This suggests that there is a relationship between age and the incidence of heat-related illnesses among construction workers, albeit not particularly strong. Older workers may exhibit a slightly higher incidence of heat-related illnesses compared to their younger counterparts, highlighting the importance of considering age-related factors in heat illness prevention efforts.

Similarly, the correlation coefficient between the incidence of heat-related illnesses encountered and job role is also statistically significant at 0.122 ($p = .007$), indicating a weak positive correlation. This implies that there is a relationship between job role within the construction industry and the incidence of heat-related illnesses. Certain job roles may entail higher levels of physical exertion or exposure to heat, leading to an increased risk of heat-related illnesses among workers in those roles.

These findings have important implications for occupational health and safety practices in the construction sector. Firstly, they underscore the need for targeted interventions to address the specific vulnerabilities associated with age and job role in heat illness prevention programs. Employers should implement measures such as regular health monitoring, provision of adequate rest breaks, and hydration strategies tailored to the needs of different age groups and job roles. Secondly, efforts to improve workplace conditions, including proper ventilation, access to shade, and use of personal protective equipment, are crucial for reducing the incidence of heat-related illnesses among construction workers

6.5 Proposed heat hazard response plan protecting construction workers through proactive measures based on the results of the study

Figure 3. Heat Hazard Response Plan

Response Measure	Description	Responsible Party	Timeline	Monitoring and Evaluation
1. Heat Stress Training	Conduct comprehensive training sessions on heat stress awareness, recognition, and response	Health and Safety Department	Within 1 month	Regular assessments of workers' knowledge and behavior
2. Hydration Management	Ensure access to cool drinking water stations throughout the work site	Site Supervisors	Ongoing	Regular checks to confirm availability and functionality
3. Shade Provision	Set up shaded rest areas equipped with fans or misting systems	Facilities Department	Within 2 weeks	Routine inspections for shade integrity and equipment functionality
4. Work Schedule Adjustment	Implement flexible work schedules, allowing for breaks during peak heat hours	Project Managers	Within 1 month	Monitor adherence to new schedules and gather feedback from workers
5. Personal Protective Equipment (PPE)	Provide appropriate PPE such as cooling vests, hats, and sunscreen	Health and Safety Department	Within 1 month	Regular checks to ensure availability and proper usage

The key findings of the Heat Hazard Response Plan are as follows:

Heat Stress Training: The plan involves conducting comprehensive training sessions on heat stress awareness, recognition, and response. The Health and Safety Department is responsible for implementing this measure within one month. Regular assessments of workers' knowledge and behavior will be conducted to ensure effectiveness.

Hydration Management: Ensuring access to cool drinking water stations throughout the work site is crucial. Site Supervisors will oversee this measure on an ongoing basis, conducting regular checks to confirm the availability and functionality of water stations.

Shade Provision: Setting up shaded rest areas equipped with fans or misting systems is essential for worker comfort and safety. The Facilities Department is tasked with implementing this measure within two weeks. Routine inspections will be conducted to ensure the integrity of shade structures and the functionality of equipment.

Work Schedule Adjustment: Implementing flexible work schedules to allow for breaks during peak heat hours is an important proactive measure. Project Managers are responsible for this task, which should be completed within one month. Monitoring adherence to new schedules and gathering feedback from workers will help assess the effectiveness of this measure.

Personal Protective Equipment (PPE): Providing appropriate PPE such as cooling vests, hats, and sunscreen is vital for protecting workers from heat-related hazards. The Health and Safety Department will ensure the availability and proper usage of PPE within one month. Regular checks will be conducted to verify availability and adherence to PPE usage guidelines.

The Heat Hazard Response Plan outlines proactive measures to mitigate heat-related risks in the workplace and ensure the safety and well-being of construction workers. Regular monitoring and evaluation of these measures are essential to assess their effectiveness and make necessary adjustments to improve worker protection against heat hazards.

CONCLUSION

Based from the summary of findings, the following conclusions were drawn:

1. The construction workforce surveyed reflects a mix of ages, with a concentration between 25 and 54. Over half identify with skilled trades like carpentry and plumbing, while the remainder hold support or laboring positions. This diversity suggests the need for safety and training programs that cater to various worker demographics and roles.
2. Construction workers overwhelmingly agree that heat hazards are most severe during summers, peak sun hours, and in direct sunlight with poor ventilation. This strong consensus highlights the urgent need for heat safety measures that consider these key risk factors.
3. Construction workers acknowledge the importance of managing heat exposure and using protective measures (mean score of 3.16). However, room for improvement exists, suggesting a need for enhanced training, better PPE access, and stronger safety protocols to further reduce heat-related illnesses.

4. There is a connection between both age and job role with the frequency of heat hazards and illnesses. Older workers and those in roles with higher heat exposure experience these issues more often. This underscores the need for targeted interventions based on age and job role to protect construction worker health.
5. The proposed Heat Hazard Response Plan offers a proactive approach to worker safety through training, hydration access, shade provision, flexible schedules, appropriate PPE, and ongoing monitoring. By implementing these measures, construction companies can significantly reduce the risk of heat-related illnesses and create a safer work environment for their employees.

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