Workplace Environmental Conditions And Reported Health Outcomes Among Workers In Cold Rooms At Jomo Kenyatta International Airport - Kenya

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Abstract: Continuous exposure to extreme temperature variations at workplaces is an occupational hazard. A cold workplace is attributed to an ambient temperature of between -10 to 15°C. The primary objective of the study was to explore temperature variations and the associated health outcomes of workers in cold rooms at Jomo Kenyatta International Airport. The research was conducted at JKIA in Embakasi, Nairobi County, and included 10 companies with refrigerated cold rooms. A cross-sectional analytical study design was used to collect primary data through structured questionnaires and observation checklists. Stratified random sampling technique was used and a sample size of 293 staff members was taken to represent the study population. Chi-square tests and logistic regression analysis were then employed to identify relationships between two variables. The findings revealed a significant association between workplace environmental conditions (fluctuating air temperatures) and reported health outcomes among workers (p=0.01). Workers exposed to these conditions were 2.469 times more likely to experience health issues compared to those who were not exposed (AOR = 2.469, 95% CI=1.25-7.33. Prolonged exposure also correlates with higher sickness rates (p=0.001). To address these issues, organizations should install nonmetallic deflectors on air conditioners to minimize direct cold air exposure and educate workers about temperature-related health risks.

Keywords: Workplace, Environmental Conditions, Health Outcomes, Cold Rooms, Airport

I. INTRODUCTION

Safety at workplace is a platform for sustainable development and investments in OSH that would ensure the achievement of the 2030 Sustainable Development Agenda. More precisely, the health and safety at workplace assists in the attainment of the Standard Development Goals (SDG) 3 which aims to guarantee healthy lives and uphold the wellbeing of every person of every age. However, poor OSH environment compromises the sacrosanct quality of life, for instance, high temperatures in the organization negatively affect workers. There also exists incidences of high levels of noise that result in progressive deafness, unhygienic workplace environment causes infections. Moreover, poor safety and health, and emotional and physical harm result in costly impacts on the individual, the workplace, and society at large (OSHA 2007).

Exposure to cold workplaces is a key factor of risk for industrial activities, when combined with extra risks such as force, repetition, static and awkward postures, and vibration, the potential for the development of musculoskeletal disorders that are work-related increases. The problems linked to occupational exposure to cold include pain sensation and thermal discomfort especially in extreme cases, decrease in work performance as a result of cold hands (Stjernbrandt *et al.*, 2017). Exposure to cold conditions in the work environment is common in cold chain logistic systems. The cold chain is applied to perishable commodities and distribution, where products are maintained at suitable cool temperatures from harvesting to the point of sale to preserve

quality. The World Cold Chain Summit (2013) asserted that only 10% of perishable goods globally are refrigerated. In Kenya, the primary driver of the cold chain is the fresh-cut flowers export industry, with exports primarily destined for the EU (Ministry of Agriculture, 2018).

The cold chain that is made up of pre-cooling, cool storage, and cool transport comprises the key pillars of the post-harvest management chain. Despite its importance, there exist weaknesses in the cold chain system or its inexistence in some countries as noted by the World Cold Chain Summit (2013), only 10% of perishable goods globally are refrigerated. There is a varied level of growth and fragmentation of the cold chain capacity of developing countries, with the highest concentration existing in urban centers, and close to transport terminals.

STATEMENT OF THE PROBLEM

The export of perishable produce in Kenya has contributed to the country's economic growth that employs thousands of people annually. This has seen an increased number of cold rooms at the ports such as JKIA for processing of these products that brought along health and safety challenges resulting from workers being exposed to the cold temperatures in these cold rooms leading to cold-induced injuries and sickness. To promote a healthy workforce, the government has enacted laws for health and safety protection including the Occupational Safety and Health Act (OSHA) 2007. However, there is still less compliance with OSHA 2007.

Exposure to different temperatures, for instance from warm temperatures to prolonged cold temperatures such as working in cold rooms causes adverse health effects on workers' health. Vulnerable occupations include businesses such as construction, farming, and fishing, as well as first responders, recreational workers, and snow cleanup crews. Additionally, work that require frequent exposure to lowtemperature, such as cold room workers, are also at a risk for cold-related injuries and accidents.

However, there are limited studies and reports on working conditions and workers' health in refrigerated warehouses in Kenya. This research aimed to investigate the association between temperature variations and the health of workers in cold rooms in JKIA; Kenya's biggest airport refrigerated warehouses for the fresh export produce sector.

II. LITERATURE REVIEW

WORKPLACE ENVIRONMENT AND WORKERS' HEALTH

A physical workplace environment entails the external and internal arrangement, comfort zone, temperature, heating, and ventilation. The features enhance the aesthetic and functional elements of a workplace for ultimate improvement of employees' experience and necessitate better performance. Places of work have been for a long time designed to move products or support equipment. Workers have been seen to adapt to them to the extent that the workplace has received less attention in the manner they fit in. A research study focused on extreme cold weather temperatures in 2012 in Greece, reported increasing number of cold injuries caused by wetness/dampness, improper dressing, and poor physical conditioning, have become safety hazards at the workplace (Nastos & Saaroni, 2024).

A systematic review carried out in Croatia of how cognitive working performance is in thermal environments that are moderately cold revealed that, in moderately cold environments, there is a decrease in work performance. There is also a decrease in executive function, reaction time, and attention. The decrease in the work processes was found to occur for a while following exposure to cold despite the stabilization of the skin and core temperature (Zlatar 2015).

A study was conducted in London to investigate how the physical environment at a workplace impacts well-being and health from the perspective of employees who worked for large institutions. The study focused on two types of work environments, decentralized facilities and single facilities (Suresh, 2016). The results of the study were that, based on the model of occupational wellbeing and environmental satisfaction, employees' view of the physical environment at the workplace and their well-being was a multidimensional and complex contrast. Well-being was found to incorporate self-esteem, self-efficacy, a sense of belonging, and selfactualization. The factors of well-being were found to play a critical role in the development of a transactional relationship between the environment, valorization, and operational agency (Suresh, 2016).

REPORTED HEALTH OUTCOME

Understanding what constitutes cold stress and how to prevent its effects is very important. Low temperatures have precarious impacts on human beings and their ability to cope with them. Body exposure to extreme temperatures impacts negatively making one vulnerable to both freezing and noncold injuries. (Holmér, 1994). These cold injuries are experienced initially in the outer parts of the body and then gently proceed to inner soft tissues and the entire body. A prolonged body's core temperature below 35^oC usually results in hypothermia, which alongside frostbite are some of the most severe injuries of long work in refrigerated environments (Kong et al., 2021).

An investigation was carried out on 24 employees working in extremely low-temperature conditions of -43 to -62° C in a refrigerated dried coffee company in Colombia. The study found out that, the most relevant cold-related health problem in terms of prevalence was episodic finger symptoms (50%) and coming in next was respiratory symptoms (21%), symptoms of peripheral circulation (20%), and repeated musculoskeletal system pain (12%). There was a 21% incidence of musculoskeletal reports related to the neck and lower back due to extremely low temperatures was 21% in each (Phanprasit et al., 2021).

A survey conducted between 2006 to 2010 by the Centers for Disease Control and Prevention of the United States on 74 million UK workers, showed that 63% of deaths were attributed to cold while the researchers who analyzed US deaths reported in May 2015 showed extreme cold temperatures in occupational health were linked to 7.4% of all deaths compared to 0.4% for high temperatures, a ratio of 18 to 1 (Amirkhani *et al.*, 2022).

A study undertaken in Chennai, India sought to investigate the effect of heat increase in different places of work, evaluate the assessment tools, and an exploration of solutions. According to the research, work-related exposure to heat was a problem that affected workers' productivity and health status. The problems were expected to become worse due to expected climate changes. Conventional methods of managing heat stress were assessed and the most effective outcome that equaled water in thermal strain reduction was buttermilk-India's traditional fermented dairy beverage. The buttermilk was also found to have a protective property on renal function (Lundgren Kownacki, 2018).

The outcome of Occupational Heat Stress on workers' productivity and health in Southern India's steel industry showed that exposures to high levels of heat and heavy work negatively affected the health of workers in addition to reducing their capacities at work. The study recommended the implementation of welfare facilities that enhanced the industry, the design of mitigation interventions, and more physiological studies using a sporadic technique. Clinical trials were also required to reinforce the evidence for the development of policies that were comprehensive in the protection of workers employed in industries involved in high-heat activities (Krishnamurthy et al., 2017).

III. METHODOLOGY

An analytical cross-sectional design was used to collect data among 293 workers comprising both men and women working in 10 companies with cold rooms at JKIA. The workers included in the study comprised those who had worked in the cold rooms for more than six months and had given consent to participate. Therefore, workers working in other departments besides the cold rooms of JKIA were excluded.

The study was conducted in Jomo Kenyatta International Airport (JKIA) located in Kenya's Nairobi County, Embakasi region which is 15 km southeast of the central business district of Nairobi on 36 55.33'E Longitude: 01 19.07'S Latitude: and 5,327 Feet elevation above sea level. JKIA is a regional hub where cargo airlines fly to a large network of destinations globally due to its strategic geographical location. The tropical climate experienced is moderate with averages temperature of 25 degrees Celsius. Reasons for choosing JKIA as the appropriate study location was informed by its growth as an international business in the hub of Africa and because there are several privatized refrigeration companies operating large-scale cold room operations.

Table 1 shows distribution of the participants by the sampled companies;

| | | Frequency | Percentage |
|-----------------------|---------------|-----------|------------|
| | | (266) | (%) |
| Gender | Male | 173 | 65 |
| | Female | 93 | 35 |
| | 18-30 (years) | 80 | 30 |
| Age | 31-50 (years) | 120 | 45 |
| | >51 (years) | 66 | 25 |
| Level Of Education | Secondary | 120 | 45 |
| | Tertiary | 146 | 55 |

Table 1: Sample Size Distribution

IV. FINDINGS

SOCIO-DEMOGRAPHIC CHARACTERISTICS OF THE RESPONDENTS

The total self-administered questionnaires were 293, out of which 266 were completed representing 91% response rate. Most (65%) of the participants were male while female participants made 35%. In terms of age, majority 65% (173) of the respondents were male and 35% (93) were female are working in the cold rooms in JKIA because most of the work is strenuous and physically demanding. The highest proportion of respondents, 45% (120) were in the age bracket of 31-40 years while the lowest were aged 51 years and above. The sampled population was fairly educated as 55% (146) of them had attained tertiary training while 45% (120) had attained secondary education. Table 2 below presented the outlined statistics;

| No | Strata | Total | Sample |
|----|------------------------|------------|--------|
| | | Population | Size |
| | Siginon Aviation Ltd | 105 | 25 |
| 2 | Kenya African Handling | 78 | 18 |
| | Ltd | | |
| 3 | Swiss port | 95 | 22 |
| 4 | Africa Flight Services | 118 | 28 |
| 5 | Kuehne-Nagel | 239 | 57 |
| 6 | Panalpina Ltd | 190 | 45 |
| 7 | Freightwings Ltd | 175 | 41 |
| 8 | Maya Freight | 60 | 14 |
| 9 | Freight in Time | 130 | 31 |
| 10 | DB Schenker | 50 | 12 |
| | TOTALS | 1240 | 293 |

 Table 2: Distribution of socio demographic characteristics of the respondents

WORKPLACE ENVIRONMENTAL CONDITIONS IN THE COLD ROOMS

The assessment of workplace environmental conditions and reported health among workers in cold rooms in JKIA was done using four questions that served as environmental indicators (Table 3).

| | | Frequency (266) | Percentage (%) |
|------------------------|----------|-----------------|----------------|
| Unsteady Air Temp | Agree | 161 | 61 |
| | Disagree | 105 | 39 |
| Dropping Air Temp | Agree | 202 | 76 |
| | Disagree | 64 | 24 |
| Rising Air Temp | Agree | 206 | 77 |
| | Disagree | 60 | 23 |
| Accident In Extreme | Agree | 208 | 78 |
| Temp | Disagree | 58 | 22 |

Table 3: Workplace Environmental Conditions In The Cold Rooms

Majority 61% (161) of the respondents agreed that cold rooms have unsteady air temperature while 39% (105) disagreed with the statement. The majority 76% (202) agreed that cold room's air temperature often while 24% (64) disagreed with the statement. Lastly, the respondents agreed. Most of the respondents 77% (206) agreed that cold rooms' air temperature is often raised compared to 23% (60) who disagreed with the statement. Lastly, majority 78% (208) of the respondents agreed that there are more accidents occurring at high temperature extremes while 22% (58) disagreed with the statement.

EXPOSURE TO COLD AND ITS OUTCOMES ON HEALTH AMONG WORKERS

The assessment was done using four questions that served as indicators (Table 4).

| | | Frequency | Percentage |
|--------------------------|----------|-----------|------------|
| | | (266) | (%) |
| Physical Factors | Agree | 151 | 57 |
| | Disagree | 115 | 43 |
| Psychological Factors | Agree | 159 | 60 |
| | Disagree | 107 | 40 |
| Osh Awareness | Agree | 172 | 65 |
| | Disagree | 94 | 35 |
| Exposure Duration | Agree | 206 | 77 |
| | Disagree | 60 | 23 |

Table 4: Exposure to Cold and its Outcome on Health among Workers

The findings showed that majority 57% (151) of the respondents agreed there was an association between mechanical factors such as heavy lifting and reported health among workers in cold rooms in JKIA compared to 43% (115) who disagreed. The majority 60% (159) of the respondents agreed that there was an association between psychosocial factors and reported health among workers in cold rooms in

JKIA as compared to 40% (107) who disagreed with the statement. The majority, 65% (172) of the respondents agreed with the statement that there was an association between awareness of occupational health safety and reported health among workers in cold rooms while 35% (94) disagreed with the statement. Lastly, the majority 77% (206) of the respondents agreed that the duration of working in the cold room had an association with the reported health among workers in cold rooms while 23% (60) disagreed.

BINARY LOGISTIC REGRESSION ANALYSIS

Using the health outcomes as the dependent variable, and environmental conditions as the independent variable, a bivariate analysis was done as shown on table 5. The unsteady, dropping and rising air temperatures in the coldrooms were significantly associated with the reported health outcomes at (p=0.01) and respondents who were exposed to such conditions had a higher likelihood of getting sick and the odds ratio was 2.469.

| Variables | Chi | OR | P Value | 95% Ci |
|---|--------|-------|---------|--------|
| | Square | | | |
| | Values | | | |
| Environmental | 16.77 | 2.469 | 0.01 | 1.68- |
| Conditions | | | | 6.45 |
| T-11. 5. A interla - C E internet dition dition dition dition dition dition | | | | |

Table 5: Associated of Environmental conditions with reported health outcomes in the cold-rooms

MULTIVARIATE ANALYSIS

At multivariate analysis, the unsteady, dropping and rising air temperatures in the cold-rooms were significantly associated with the reported health outcomes at (p=0.01) and respondents who were exposed to such conditions were 2.469 times more likely of getting sick than those who were not exposed (AOR = 2.469, 95% CI=1.25 -7.33) as indicated in Table 6;

| Variables | AOR | P VALUE | 95% CI |
|---------------|-------|---------|-----------|
| Environmental | 2.469 | 0.01 | 1.25-7.33 |
| conditions | | | |

Table 6: Multivariate analysis between variables

V. CONCLUSIONS

This study reported the unsteady, dropping, and rising air temperatures (workplace environmental conditions) in the cold-rooms were significantly associated with the reported health outcomes and respondents who were exposed to such conditions were more likely of getting sick than those who were not exposed. This finding aligns with the results of a systematic review conducted in Birmingham on the biological and health effects of exposure to cold temperatures in both healthy and diseased adults, including the elderly (Arbuthnott, 2021). The aim of this review was as a matter of fact to systematically assess existing evidence regarding the impact of ambient cold air temperature exposure on cardiovascular and respiratory physiology, as well as cardiovascular and respiratory health. The review highlighted that exposure to cold air can significantly affect respiratory physiology, with documented effects such as cooling and drying of mucosal surfaces in the upper airways. These effects extend to the lower airways during physical activity, characterized by a buccal pattern of breathing. Cold air exposure also induces bronchoconstriction, either directly through cooling effects on the lower airways or via neural reflex responses triggered by facial cooling. Additionally, cold exposure leads to airway congestion, increased mucous secretion, decreased ciliary clearance, and reduced mucosal perfusion (Clemente-Suárez et al., 2023).

VI. RECOMMENDATIONS

From the analysis of the study, the following recommendations were put forth on the association of temperature variations with the worker's health working in the cold-rooms.

- ✓ Organizations operating cold rooms should create an ample working environment in the cold rooms for their workers through the installation of nonmetallic deflectors onto the air conditioners to minimize direct cold air from directly hitting the workers.
- ✓ The Directorate of Occupational Safety and Health should emphasize to the safety departments in the various organizations to educate the cold-room workers through toolbox talks and forums to create awareness of the association of temperature variations on the health of its workers.
- Organizations operating cold rooms should put in place a PPE policy and proper training on their use as well as implementing the laid down regulations from the OSH Act to safeguard the health of its workers and promote good working practices.
- ✓ From the reported health outcomes, it should be clear for organizations operating cold rooms to come up with flexible working schedules for their workers to prevent the most common health outcomes from occurring.

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