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Investigating Safety Standards and Occupational Hazards in the Timber Sector: An Assessment of Timber Market in Multan, Pakistan

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Abstract: The timber industry is associated with extremely hazardous working conditions that threaten human health or even life. In Pakistan, little or almost no data is available on safety standards or occupational hazards related to this industry. This study was designed to assess the current scenario of occupational hazards and safety standards in the timber market of Multan and the impact of personal protective equipment (PPE) at the workplace. A standardized questionnaire method was used to interview the individual stakeholders and timber market workers. A total of 150 respondents were included in the interview, with 3 different age groups. The analysis examined the impact of PPE use on various health problems and injury rates, considering differences by work hours and experience. Our findings showed that the use of PPE reduced the occurrence of serious injuries such as fractures. However, injury rates are also associated with work experience (increasing with decreasing experience). The investigation showed that middle-career workers worked significantly longer shifts. Based on our findings, it is strongly recommended that timber industry stakeholders enforce the consistent use of personal protective equipment (PPE) to mitigate serious injuries and targeted safety training programs should be mandated for all employees. Future work should focus on the long-term impact of adjusting working hours alongside PPE usage. This can be used to design practical measures for reducing injury and sustainable work conditions in the timber industry.

Keywords: Timber market; Occupational hazards; Safety standards; personal protective equipment

INTRODUCTION

The timber industry is a major sector worldwide, particularly in developing countries, in terms of employment opportunities and economic growth (Kirillova et al., 2019; Mirabelli et al., 2003; Trømborg & Buongiorno, 2000). Over recent decades, the demand for wood-based products has surged significantly, driven by urbanization and increased construction activity (Svatoš-Ražnjević et al., 2022). The Food and Agriculture Organization (FAO) projected a 45% rise in global timber product usage by 2020, while the World Bank anticipates that worldwide timber demand will quadruple by 2050 (Favero et al., 2022). However, the timber industry involves extremely hazardous working conditions that threaten workers' health and lives (Odibo et al., 2018). Despite the implementation of advanced personal protective equipment (PPE), occupational health risks remain a concern (Landekić et al., 2021). Numerous studies have examined logging safety hazards and related injuries (Lefort et al., 2003; Myers & Fosbroke, 1994; Neely & Wilhelmsom, 2006; Patterson, 2007; Shaffer & Milburn, 1999; Wempe et al., 2019; Wempe & Keefe, 2017). Factors related to individual worker health hazards are often overlooked when developing preventive measures (Schulte et al., 2012). This situation is also prevalent in Pakistan, where occupational safety and health (OSH) is still informal and fails to follow

established safety measures. There is a significant lack of benchmarks regarding OSH practices in the Pakistani timber market, which hampers the development of effective safety regulations and policies (International Labour Organization, 2017).

The improvement of occupational safety and health standards is an important issue globally (Gul, 2020). The Decent Work Agenda, launched by the International Labor Organization (ILO) in 1999, which later emerged as an integral part of the United Nations Sustainable Development Goals (SDGs); Goal number 8 (International Labour Organization, 2023; Rantanen et al., 2020). The term "Safety culture" can be defined as a sound working environment that impacts principles of safety management in any organization (Cooper, 2000). Recent statistics regarding occupational accidents and diseases are very alarming (Abdalla et al., 2018). According to the International Labor Organization, annual global deaths at the workplace have reached the disturbing number of 2.78 million, approximately 7600 persons per day. The International Labor Organization predicts the cost of workplace accidents and illnesses at 3 trillion dollars annually worldwide (International Labour Organization, 2023). All these facts indicate the importance of occupational accidents and health problems. All these evolving concepts suggest that the timber market must improve health and sustainability status.

Studies have established that timber workers are often at high risk of developing health problems such as respiratory diseases from exposure to wood dust, noise, chemical compounds, and ergonomic hazards (Knecht et al., 2024). Such conditions ultimately result in acute health complications, including musculoskeletal disorders (Rahman et al., 2019). Some ergonomic factors that influence the likelihood of accidents occurring at work are a disturbing psychosocial environment, lack of appreciation at work, low self-esteem, smoking, poor physical condition, and a history of diseases affecting the muscles and joints (Gellerstedt, 2000). The right working structure, education, and training can reduce or mitigate the effects of these elements.

In the context of these hazards, the present study is expected to offer a detailed report on the occupational safety and health situation among the employees of Timber Market Multan, Pakistan (Figure 1). Multan city is located in Southern Punjab, Pakistan, with longitudes 71.5249º E and latitudes 30.1575º N (Zubair et al., 2022). Multan is a great hub that provides wood and wood-products purchasers with a wide range of high-quality wood and wood-products at an affordable price (Manzoor et al., 2019; Zubair et al., 2022). Since no study has been carried out on this aspect, this study will serve as a baseline to determine the current practices, level of safety awareness, and areas that require attention to enhance the safety and health of workers related to this sector. To some extent, this research is the first to offer empirical suggestions on the status of OSH measures in Pakistan's timber market and, therefore, can help improve the occupational safety discourse of timber industries.

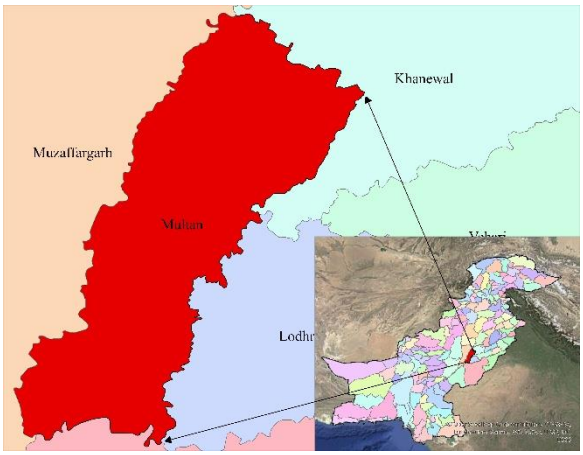

Figure 1: Map showing the geographical location of the study area.

MATERIALS AND METHODS

A cross-sectional survey design was adopted to interview all the relevant stakeholders and timber market labor. Cross-sectional surveys are an appropriate tool for such cases where the collected data is based on self-reported beliefs and behavior (Mitchual et al., 2015). The survey was completed in the following three steps: (1) questionnaires were developed, (2) a total number of 150 respondents were chosen using purposive sampling methods, and (3) interviews. The interviews were based on a standardized questionnaire and face-to-face discussions with the selected timber market employees, managers, and health and safety professionals. The questions about workplace risks in the TMW, respondent perceptions about the reasons behind occupational accidents, and the status of protective measures in place were included in the questionnaire. Reflexes and physical power naturally decrease with age, but awareness and preventive health consciousness increases hence, to understand the effects of age on the survey, we divided the respondents into three different age groups i.e., first group includes workers under the age of 25, second group comprises of workers between the ages of 25-45, and third group involves workers above 45 years of age.

Data Structure and Analysis

A series of analyses were performed to examine the relationship between workplace factors and health consequences. The structure of the dataset was examined to ensure that data types were correct and standardized. We investigated how working schedules were allocated in different age groups. Age data was converted to numerical values and classified into three age groups. A boxplot was used to demonstrate how labor hours fluctuated with age and to highlight any notable trend or difference among age groups. We also analyze the relationship between work experience and injuries using qualitative data and examine

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the relationship between work hours and age groups. The purpose of this examination was to find out whether people with high work experience get injured less or more.

In this study, we examine the effect of PPE use on injury and health issues. The proportion of different health conditions, such as body pain and respiratory problems, among people who use PPE was compared to those who do not use it displayed in the result. The color pattern of the plot was specifically designed to distinguish between various health issues. Cross-tabulation was used to examine the correlation between PPE use and injury types. Furthermore, whether longer work hours associated with a higher occurrence of injuries, the relationship between work hours and various injury categories was also investigated using a bar plot.

Additionally, to determine whether smoking is related to any specific kind of health problem, the relationship between smoking status and health difficulties was also investigated. A bar plot was used to depict the percentage of health issues among smokers and nonsmokers. All these investigations contribute to our understanding of workplace safety and help shape better preventative techniques and tactics by offering valuable information about how various workplace environments impact health outcomes.

RESULTS & DISCUSSION

Health Problem vs PPE Use

The percentage of various health issues reported by respondents who used PPE and those who did not. The most common health problems cited by workers who did not use PPE are skin irritation (19%), followed by eye irritation (13%), headache (12%), breathing issues (11%), hearing problems (9%), and body pain (6%). In this group, a small percentage (4%) of workers reported no health issues (Figure 2).

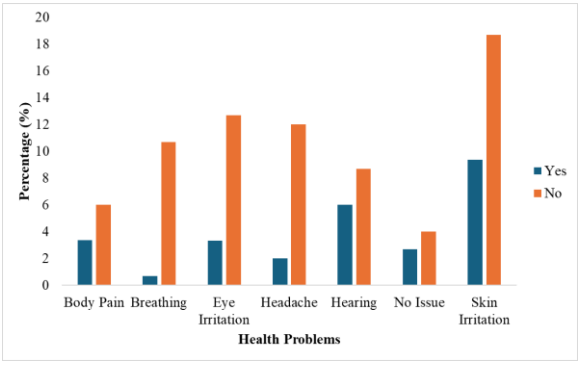

Figure 2: Percentage of body pain, breathing problems, eye irritation, headache, hearing problems, skin irritation, and no issues reported by the timber market workers using or not using PPEs.

On the other hand, skin irritation (9%) remained the most frequent issue among workers using PPE. Lushniak (2003) also found that skin diseases are most common in the TMW occupation (Lushniak, 2003). The proportion of workers reporting no health issues was lower in this group compared to the group not using PPE. Similarly, the percentages for other problems, including breathing (1%), headaches (2%), eye irritation (3%), body pain (3%), and hearing issues (6%), were lower among PPE users than non-users (Figure 2). These results suggest that while PPE is effective in reducing certain problems, it does not mitigate health risks related to hearing. The vibration exposure of chainsaws causes hearing loss and spinal issues (Anderson et al., 2018; Neitzel & Yost, 2002). Haeberle (2020) also found that long-term use of timber industry tools such as chainsaws can increase the risk of hand-arm vibration syndrome symptoms (Haeberle, 2020). Lie et al. (2016) and Weier (2020) identified noise exposure in the timber industry as a causal factor for hearing problems (Lie et al., 2016; Weier, 2020). These findings indicate a need to improve PPE related to skin protection and noise reduction. However, limited studies have examined this issue in TMW (Fonseca et al., 2015; McLain et al., 2021). Additionally, educating timber market workers (TMW) about the availability and benefits of such PPE is highly recommended.

Injuries vs PPE Use

The relationship between the usage of PPE and the incidence of various injury categories was analyzed. The results showed that 37 incidences of bruises, 53 incidences of cuts, and 19 incidences of fractures were recorded among workers not using the PPE. However, this number was significantly lower in workers using PPE (15 incidences of bruises, 24 incidences of cuts, and only 2 cases of fractures). Figure 3 shows the percentage of injuries observed among individuals using PPE compared to those not using PPE. These findings showed that wearing PPE not only lowers the frequency but also reduces the seriousness of injuries in timber market workers, especially those related to fractures and amputations. Previous study, Diwe et al. (2021), also supports these findings while conducting a study in South-Eastern State in Nigeria (Diwe et al., 2016).

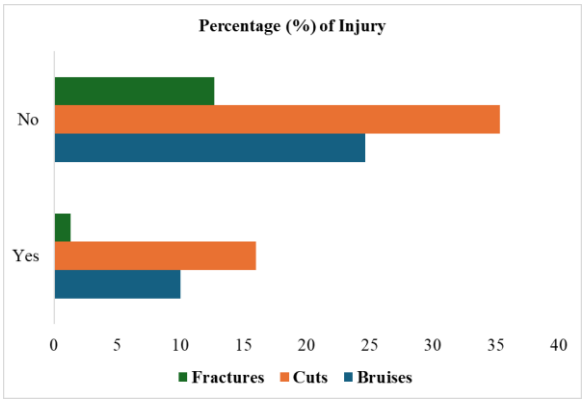

Figure 3: Percentage of injuries observed among individuals using PPE compared to those not using PPE.

Smoking vs Health Problem

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The percentages of different health problems among smoking and non-smoking TMW were significantly different. The results showed that skin irritation is the most common problem among both smoking (18%) and non-smoking (10%) TMW, accounting for approximately 28% of the overall proportion. In the workers who do not smoke, eye irritation (6%), headache (2.7%), breathing problems (4.7%), body pains (1.3%), hearing (0.7%), and no issues (8.7%) were recorded. On the other hand, eye irritation (10.7%), headache (12.7%), breathing problems (11.3%), body pain (10.7%), hearing (1.3%), and no issue (1.3%) showed a higher percentage for the workers who smoked. Interestingly, there was a fair number of workers who reported "no issue" among the non-smoking workers, and such a proportion was almost absent among the smoking workers. Figure 4 demonstrates the overall health problems (in percentage) between smokers and non-smokers, TMW. Smoking has a detrimental impact on health conditions by showing a clear link between smoking and an increased occurrence of respiratory and physical discomfort issues. These findings also align with Kachuri et al. (2017), who found that TMW can also be exposed to smoke and dust particles, which increase the respiratory problems (Kachuri et al., 2017).

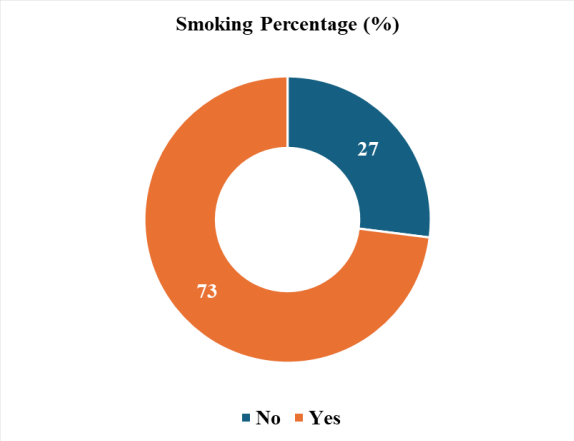

Figure 4. Percentage of the overall health problem ratio between smokers and non-smoker workers in the Multan timber market.

Injury vs Work Experience

We divided the years of work experience into four groups for a better understanding of injury ratio and work experience: (1) 0-10years, (2) 11-20years, (3) 21-30years, and (4) 31-40years. Figure 5 shows the percentage of each type of injury among the work experience groups. The highest injury rate was recorded among workers who had less than 10 years of experience (40.7%). We observed that the injury rate decreased as work experience increased, and the frequency of cuts showed a higher rate at every level of experience. Bruises were the second common injury among the workers and fractured occurred occasionally at all levels of experience. Altogether, it can be concluded that injuries appeared to be more common in the early phases of work experience (less than 10 years of experience); however, results suggest that injuries can occur at any level of experience. These findings align with Guerin et al. (2020), who found that young workers face a higher rate of injury than older/experienced workers (Guerin et al., 2020).

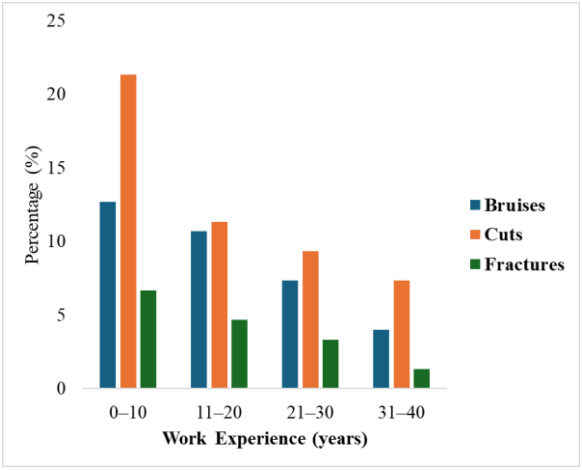

Figure 5. The occurrence of different workplace injuries in relation to the work experience of the workers.

Work Hours vs Age Groups

As we mentioned earlier, we selected three different age groups (below 25 years, 25-45 years, and above 45 years) for a better understanding of working hours among younger, middle-aged, and older TMW. The results showed that younger TMW work fewer hours (average 9 hours) than the other two groups. Similarly, middle-aged TMW work longer hours (average 11 hours) than the other two groups. The older age TMW works between the younger and middle-aged groups (average 10 hours). All three groups showed some outliers that represent their IQR range of working hours (Figure 6).

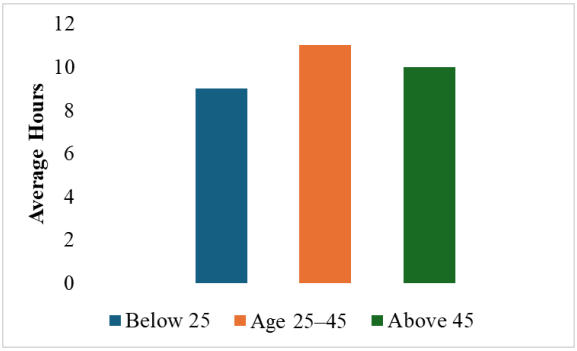

Figure 6. Distribution of work hours by Age group: analyzing variability, concentration, and outliers across different age ranges.

Additionally, we found an interesting relationship between work experience and work hours. The results indicate that workers with 8-12 years of work experience work the most, similarly to the above result that middle-aged TMW work the most. It was interesting to note that work

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hours were the least in workers with less than 8 and more than 12 years of work experience. These results showed that professionals in their mid-career work longer hours than those in the early or late stages of their professional career. After 12 years of experience, work hours decrease dramatically. These findings align with the prior studies from Hsu & Chen, (2020), where mid-career professionals were found to work for more hours due to increased responsibilities, which leads to higher exposure to workplace hazards (Hsu & Chen, 2020). Figure 7 shows that mid-career/experience TMW had more injuries than other categories.

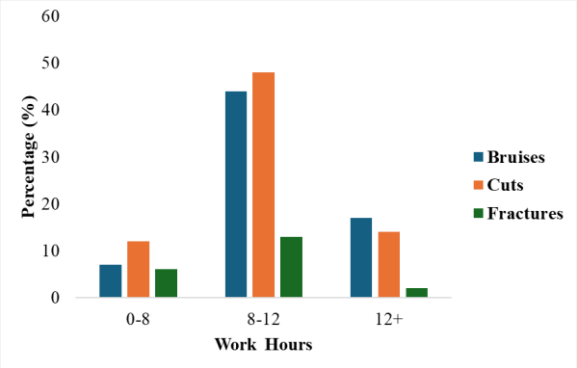

Figure 7. The association between work hours and the prevalence of specific workplace injuries (the study of how different work hours are related to the likelihood of specific types of injuries).

Tree Species Preference

The distribution tree/wood type used in the Multan timber market is displayed in Figure 8. The results showed that 62 TMW used the most common tree species such as Kikar (Acacia niltica), Sheesham (Dalbergia sissoo), Jaman (Syzygium cumini), and Diyar (Cedrus deodara). This result aligns with prior research that for wood purposes, TMW and landowners use common tree species such as Kikar (Acacia niltica) (Qadir et al., 2023). In contrast, 49 TMW used specific species, which are less common. Only 39 TMW used Any Tree Species. This lower number indicated that fewer TMW were adaptable in their wood selection, potentially due to practical concerns such as availability, cost, or unique demands that necessitate a specific type of wood. These results provide insights into wood usage patterns, which could affect market availability, increase environmental concerns, and influence forest management, as some wood types may be higher in demand than others.

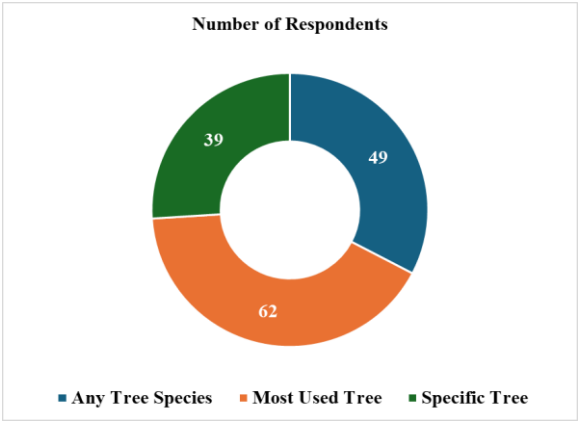

Figure 8: Distribution of tree/wood types used by individuals in the Multan timber market.

CONCLUSION

The results of this study showed how occupational factors affect the health outcomes of TMW. While it was clear that PPE can prevent major injuries, the study also highlighted the correlation between employment experience and injury rates, suggesting that, for workers with less experience, preventive measures and targeted safety training are essential. Numerous health issues were found to be linked to smoking, which emphasizes the need for smoking cessation programs as part of workplace health initiatives. Moreover, the working hours were positively related to different types of injuries and were influenced by the length and intensity of work shifts. Finally, the greatest number of TMW were found working on commonly found tree species, which showed less adaptability of TMW to work on other tree species. Overall, this study showed how important the use of PPE is in reducing health issues. However, further studies must be done in other timber markets to assess other parameters, like cost and design of PPE, that may hinder the use of such equipment by the TMW.

Author's contributions

All authors contributed to the conception and design of the study. Material preparation MTT, NQ, and DS performed analysis, FR and MZ supervised. The first draft of the manuscript was written by MTT, and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Declaration of Competing Interest

The authors declare no conflict of interest and have nothing to declare.

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Data Statement

Data will be shared upon reasonable request to the corresponding author.

Ethical Considerations

This study was a non-interventional, survey-based investigation involving no clinical procedures, medical interventions, or collection of sensitive personal data. The only demographic information gathered was participants' age, and no identifiable information (e.g., names or contact details) was recorded. In Pakistan, non-interventional studies do not require formal ethical approval. All participation was voluntary, and respondents were informed about the study's purpose. It is important to note that clinical trials and studies involving medical or invasive procedures strictly require prior approval from a recognized institutional ethics review board (IRB) in Pakistan. This study did not fall under that category.

Conflict of Interest

There are no conflicts of interest declared by the authors.

Statement and Declaration:

We, the undersigned authors, declare that the submitted paper titled "Investigating Safety Standards and Occupational Hazards in the Timber Sector: An Assessment of Timber Market in Multan, Pakistan" is our original work. We affirm that this manuscript has not been previously published and is not currently under consideration for publication elsewhere. We confirm that the research presented in this paper complies with ethical standards and guidelines, including the proper treatment of human/animal subjects where applicable. The paper adheres to the submission guidelines and formatting requirements of the Journal of Agroforestry and Environment.

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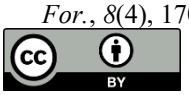

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