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Original Article

Prevalence and Determinants of Non-Fatal Occupational Injuries Among Construction Workers in Kigali City, Rwanda.

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Abstract

Background: Occupational injuries present a major public health concern within the construction industry, particularly in developing nations like Rwanda. This study seeks to explore the prevalence and determinants of non-fatal occupational injuries among construction workers employed by NPD Ltd in Kigali City. Despite the enforcement of safety protocols, NFOI continue to occur, leading to decreased productivity, disability, and increased healthcare expenses. The study aims to address the existing knowledge gap by investigating factors contributing to these injuries, such as insufficient safety training, inadequate access to personal protective equipment (PPE), and poor supervision.

Methods: Using a quantitative cross-sectional approach, primary data was collected to estimate the prevalence of non-fatal occupational injuries, with a simple random sampling method applied to NPD Ltd workers. Descriptive statistics, including means, standard deviations, percentages, and frequencies, was used to summarize the data. Bivariate and multivariate analyses assessed relationships between variables, with adjusted odds ratios (AOR) and 95% confidence intervals (CI) used to quantify the strength of associations. All ethical guidelines was adhered to throughout the study.

Results: The results revealed a high prevalence of non-fatal injuries, with 52% of workers reporting at least one injury in the past 12 months. Statistically significant findings included a strong association between work experience and injury rates ($p = 0.000$), with workers in their current role for less than three months having the highest injury prevalence (84 out of 124). Additionally, workers with primary education had 75.5% lower odds

of injury compared to those with no education (AOR = 0.245, p = 0.001). Use of personal protective equipment (PPE), particularly gloves, was associated with a lower injury risk (AOR = 0.459, p = 0.001), while work shift duration also impacted injury rates, with those working 6–12 hours having a significantly higher risk of injury compared to those working over 12 hours (p = 0.011). Access to health services on-site was found to significantly reduce injury severity, with workers having access to these services reporting fewer fatal injuries (p = 0.016). The presence of a safety officer was another key factor, as sites with a designated safety officer reported fewer fatal injuries (p = 0.043).

Conclusion: These findings highlight the need for targeted safety interventions, improved safety training, and greater access to health services in the construction sector to mitigate the high risk of non-fatal injuries. The study also suggests that while PPE usage can reduce injury risk, better enforcement and consistent use are critical for further reducing injury rates in construction workplaces.

Keywords: Occupational injuries, Non-Fatal Injuries, Construction Workers, Kigali City, Rwanda

Introduction

Globally, Occupational injuries remain a significant public health concern, particularly in the construction industry, which is known for its physically demanding tasks, hazardous environments, and use of heavy machinery. Globally, the construction sector accounts for approximately 18% of all fatal workplace accidents, with non-fatal occupational injuries (NFOI) being even more prevalent (International Labour Organization [ILO], 2023). While fatal injuries tend to draw more attention, NFOIs result in long-term disability, loss of productivity, and increased healthcare costs, impacting both workers and employers (Hämäläinen et al., 2021). These injuries not only hinder the wellbeing of workers but also pose significant economic and public health challenges.

In sub-Saharan Africa (SSA), the construction industry is particularly vulnerable to high injury rates due to unsafe working conditions, poor enforcement of occupational health and safety (OHS) regulations, and low usage of personal protective equipment (PPE) (Kinyua & Mutiso, 2022). The sector has expanded rapidly due to urbanization and major infrastructure projects, exacerbating safety risks. For instance, a study in Ghana revealed that 43% of construction workers suffered at least one non-fatal injury in a year (Baah et al., 2022). Similar trends are seen in Ethiopia and Nigeria, where inadequate safety training, poor supervision, and weak enforcement contribute significantly to injury prevalence (Muche et al., 2023; Okafor et al., 2021). These persistent challenges underline the critical need for stronger regulatory frameworks and workplace safety interventions in the region.

Rwanda's construction sector has similarly experienced substantial growth, particularly in Kigali. However, the surge in construction activity has also led to growing safety concerns. Despite the presence of Rwanda's National Occupational Safety and Health Policy, enforcement is limited, contributing to a high prevalence of NFOI (Muragijimana et al., 2023). A recent study reported that 34% of construction workers in Kigali experienced at least one injury in the past year, with common causes being falls, equipment-related accidents, and manual handling tasks (Ndayambaje et al., 2023). Yet, research into the specific determinants of these injuries remains scarce, emphasizing the need for further investigation. Several key factors contribute to the elevated risk of injury in construction. First, inadequate use of PPE is a major contributor. Workers without helmets, gloves, or protective footwear are at greater risk of head injuries, cuts, and fractures. Research consistently shows that lack of PPE use is linked with higher injury rates, underscoring the importance of enforcing PPE policies at construction sites (Amponsah-Tawiah et al., 2022).

Safety training is another critical factor. Many workers, particularly those new to the field, do not receive adequate training in hazard recognition, machinery operation, and emergency response. This gap increases their vulnerability to accidents (Muche et al., 2023). Similarly, long working hours and fatigue significantly raise injury risk by impairing concentration and judgment (Omolo & Kariuki, 2021). Non-compliance with OHS regulations further compounds injury risks. Weak enforcement, lack of inspections, and minimal accountability lead to unsafe workplaces where preventable accidents occur frequently (Baffour-Awuah et al., 2022). Additionally, individual risk factors such as younger age, inexperience, and poor physical fitness also increase injury susceptibility (Muche et al., 2023).

Addressing these issues requires a multi-faceted approach involving robust safety training programs, consistent enforcement of OHS regulations, and widespread distribution and use of PPE. This study aimed to assess the prevalence and determinants of NFOI among construction workers at NPD Ltd in Kigali City. This study aims to bridge this knowledge gap by assessing the prevalence and contributing factors of non-fatal occupational injuries among NPD Ltd construction workers in Kigali City, ultimately providing recommendations to enhance workplace safety.

Methods

Study design and setting

The study was conducted under a cross-sectional design and a quantitative method among all NPD construction workers working in Kigali city, Rwanda.

Sample size and sampling

The study sample size was calculated based on the was calculated using the Cochran formula, employing a 95% confidence level and a 5% margin of error, based on an earlier estimate of 34% prevalence of non-fatal occupational injuries (NFOI) among construction workers in Kigali (Ndayambaje et al., 2023). Therefore, the sample size was 345 study respondents. Simple random sampling was employed where each worker was assigned a unique identifier, such as a number from 1 to 1,000. A random selection method was used to select 345 workers from this list. A random number generator in Microsoft Excel was employed to select the respondents for the study.

Study instruments

This work employed a questionnaire which was designed based on previous studies (Mekonnen et al., 2018; Bekele et al., 2022) and adapted to Rwanda's context. It collected standardized data on socio-demographics, obstetric history, maternal health, health-seeking behaviors, service utilization, and living conditions using both closed and open-ended questions.

Reliability and validity

To ensure reliability, a pilot study was conducted with 10% of participants from a different sector. Cronbach's Alpha was used to assess the tool's consistency, yielding a score of 0.73, indicating acceptable reliability. The questionnaire's validity was ensured by aligning it with study objectives and refining it with supervisors. The Content Validity Index (CVI), calculated as relevant items over total items, yielded a valid score of 0.81.

Statistical analysis

Following data collection, the researcher proceeded to clean and input the data into SPSS, in its version 21.0 in order to analyse the data. The non-fatal injury was assessed using the Yes or No for all individuals who have experienced the non-fatal injury. Descriptive statistical analysis included presenting data using frequency, percentage. For further analysis, univariate analysis was employed to explore descriptive statistics. Bivariate analysis utilized the fisher exact test, and significant variables identified were subjected to adjustment using logistic regression. The significance threshold was measured by a p value below 0.05 at 95% CI.

Ethical consideration

The study obtained ethical clearance from Mount Kigali University and permission from the Mayor of Kigali. Participants gave written informed consent, were assured of confidentiality, anonymity, and voluntary participation without financial compensation, and were informed that the findings aim to improve maternal and child health outcomes.

Results

Table 1 outlines the socio-demographic factors in this study that involved 345 construction workers, with the largest age group being 40–49 years (22.6%), followed by 19–29 years (20.6%) and 50–59 years (19.4%), indicating a mature, productive workforce. Males represented 53.9% and females 46.1%, reflecting growing female participation. Educationally, 27.8% had tertiary education, followed by primary (25.2%), secondary (24.6%), and no formal schooling (22.3%), suggesting a moderately educated workforce. Employment status showed 36.8% were permanent, while 63.2% were casual (skilled and unskilled), highlighting job instability linked to injury risks. Most had 9–14 years of construction experience (30.7%), but 35.9% had less than 3 months in their current roles, indicating high turnover. Additionally, only 29.6% reported their worksites were registered with the Rwanda Development Board, while 70.4% worked in unregistered or uncertain sites, pointing to widespread informal employment and potential safety concerns.

Table 4. 1. Socio-Demographic and Employment Characteristics of NPD Ltd Construction Workers in Kigali City (n = 345)

Variable	Category	Frequency	Percent (%)
Age Range	19–29 years	71	20.6
	30–39 years	63	18.3
	40–49 years	78	22.6
	50–59 years	67	19.4
	60 years and above	66	19.1
	Total	**345**	**100.0**
Gender	Male	186	53.9
	Female	159	46.1
	Total	**345**	**100.0**
Education Level	No formal schooling	77	22.3
	Primary education	87	25.2
	Secondary education	85	24.6
	Tertiary education	96	27.8
	Total	**345**	**100.0**

Current Job Role	Permanent staff	127	36.8
	Skilled casual worker	113	32.8
	Unskilled casual worker	105	30.4
	Total	**345**	**100.0**
Years in Construction Sector	3–8 years	81	23.5
	9–14 years	106	30.7
	15–20 years	79	22.9
	21 years and above	79	22.9
	Total	**345**	**100.0**
Time in Current Position	Less than 3 months	124	35.9
	Between 3 and 6 months	109	31.6
	More than 6 months	112	32.5
	Total	**345**	**100.0**
RDB Site Registration	Yes	102	29.6
	No	117	33.9
	Unknown/Other (coded as 3)	126	36.5
	Total	**345**	**100.0**

Source: Researcher,2025

The results presented in the figure 1 reflect the prevalence of non-fatal occupational injuries among construction workers employed by NPD Ltd in Kigali City, Rwanda, over the past 12 months. Out of a total of 345 respondents:180 workers, representing 52 %, reported that they had sustained at least one non-fatal injury while on duty during the previous year. In contrast, 165 workers, accounting for 48%, indicated that they had not experienced any injuries at work during the same period. This distribution demonstrates that more than half of the surveyed workforce has encountered occupational injuries within a 12-month timeframe, underscoring a high prevalence of non-fatal injuries among construction workers at NPD Ltd. The findings highlight the urgent need for enhanced workplace safety measures, improved adherence to safety protocols, and increased investment in occupational health services to reduce the incidence of injuries on construction sites.

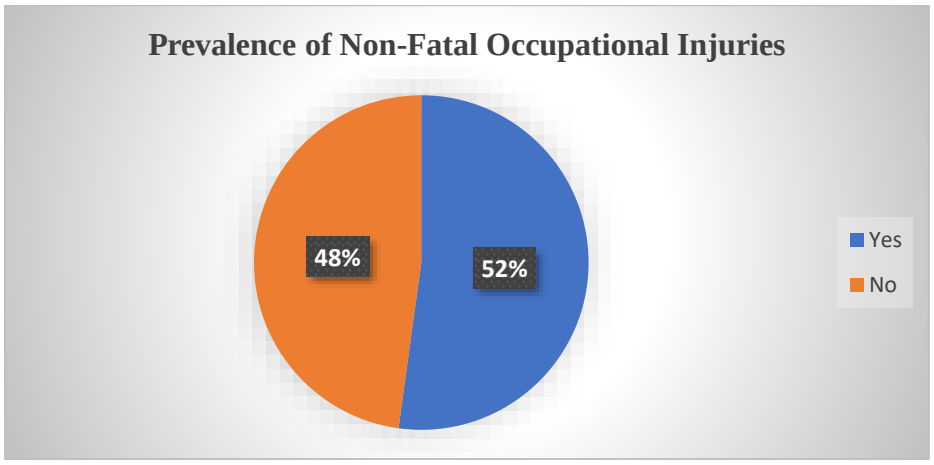

Figure 2 Prevalence of Non-Fatal Occupational Injuries

Table 2 displays the multivariate logistic regression analysis examined several factors associated with the occurrence of non-fatal injuries in the workplace. These factors included education level, work experience, specific injury types, protective measures, work shift duration, access to health services, overtime provisions, and perceived workplace safety. The analysis revealed significant relationships between certain variables and the likelihood of injury, highlighting key areas for potential interventions. Education level was found to be a significant factor influencing injury risk. Specifically, individuals with primary education had significantly lower odds of injury compared to those with no education (AOR = 0.245, 95% CI = 0.120–0.497, p = 0.001). This suggests that having at least a primary education provides a protective effect, potentially due to better awareness of safety practices and risk avoidance. On the other hand, secondary and tertiary education levels did not show statistically significant differences in injury risk compared to no education (AOR = 0.576, 95% CI = 0.302–1.096, p = 0.093 for secondary, AOR = 0.794, 95% CI = 0.418–1.507, p = 0.480 for tertiary), implying that the protective effect of education may be most evident at the primary education level. Work experience was another critical factor. Workers with 1–3 years of experience had significantly lower odds of injury compared to those with less than one year of experience (AOR = 0.193, 95% CI = 0.105–0.353, p < 0.001). Similarly, workers with 4–6 years of experience also had a reduced injury risk (AOR = 0.400, 95% CI = 0.223–0.718, p = 0.002). This suggests that as workers gain more experience, they become more skilled at avoiding injuries, possibly due to improved knowledge of hazards and safety procedures. However, workers with more than six years of experience did not exhibit a significant reduction in injury risk, indicating that beyond a certain point, additional experience may not further decrease the likelihood of injury. The analysis also examined the association between sharp object injuries and the overall injury risk. While individuals who experienced sharp object injuries had higher odds of experiencing injuries in general (AOR = 1.503, 95% CI = 0.917–2.464), this relationship was not statistically significant (p = 0.106). This suggests that while sharp object injuries may be a factor in injury occurrence, they may not be the most dominant predictor of overall injury risk. Access to health services at the workplace was associated with a slight increase in the odds of injury, though the result was not statistically significant (AOR = 1.575, 95% CI = 0.980–2.532, p = 0.060). This may indicate that access to healthcare services might correlate with more hazardous working conditions or greater awareness of workplace injuries rather than a direct cause of injury occurrence. Wearing gloves significantly reduced the odds of injury (AOR = 0.459, 95% CI = 0.270–0.780, p = 0.004). This finding highlights the importance of protective equipment in preventing injuries in the workplace.

Workers who wore gloves had a lower likelihood of sustaining injuries, indicating that the use of protective measures is an effective strategy for injury prevention.

The duration of work shifts was also a key factor in injury risk. Workers with shifts lasting 6 hours had significantly lower odds of injury compared to those with shifts exceeding 12 hours (AOR = 0.387, 95% CI = 0.196–0.766, p = 0.006). This suggests that longer shifts may lead to fatigue and reduced alertness, increasing the likelihood of accidents. However, the injury risk for workers on 8-hour or 12-hour shifts did not differ significantly from those working more than 12 hours, implying that the effect of work shift duration may be most pronounced for very long shifts (i.e., exceeding 12 hours). The presence of overtime provisions did not significantly affect the odds of injury (AOR = 0.690, 95% CI = 0.426–1.116, p = 0.130). This suggests that while overtime work may be a factor in fatigue or overwork, it was not strongly linked to a higher risk of injury in this analysis. Perceptions of workplace safety were also explored. Workers who perceived their workplace as safe had slightly higher odds of injury, but this relationship was not statistically significant (AOR = 1.136, 95% CI = 0.706–1.827, p = 0.600). This indicates that subjective perceptions of safety may not align with the actual risk of injury in the workplace, suggesting that other factors, such as actual safety practices or workplace conditions, may play a more significant role in preventing injuries. The multivariate logistic regression analysis reveals that several factors significantly influence the likelihood of non-fatal injury occurrence. Key protective factors include primary education, work experience, and wearing gloves. In contrast, the presence of overtime provisions and perceived workplace safety were not significantly associated with injury risk. The findings highlight the importance of education, experience, and protective measures in reducing workplace injuries and underscore the need for targeted interventions that address these factors to improve safety outcomes.

Table 2. Multivariate Logistic Regression Results for Factors Associated with Non-Fatal Injury Occurrence

Variable	Category	AOR	95% CI for AOR	p-value
Education Level				**0.001**
	Primary vs No education	0.245	0.120 – 0.497	
	Secondary vs No education	0.576	0.302 – 1.096	
	Tertiary vs No education	0.794	0.418 – 1.507	
Work Experience				**0.001**
	1–3 years vs <1 year	0.193	0.105 – 0.353	
	4–6 years vs <1 year	0.400	0.223 – 0.718	
Sharp Object Injury	Yes vs No	1.503	0.917 – 2.464	0.106
Access to Health Services at Work	Yes vs No	1.575	0.980 – 2.532	

Wore Gloves	Yes vs No	0.459	0.270 – 0.780	
Work Shift Duration				**0.05**
	6 hours vs >12 hours	0.387	0.196 – 0.766	
	8 hours vs >12 hours	0.585	0.293 – 1.170	
	12 hours vs >12 hours	0.628	0.319 – 1.236	
Overtime Provisions	Yes vs No	0.690	0.426 – 1.116	0.130
Perceived Workplace Safety	Safe vs Not Safe	1.136	0.706 – 1.827	0.600

Source: Researcher,2025

Discussion

This study examined the prevalence and determinants of non-fatal occupational injuries among construction workers employed at NPD Ltd in Kigali City, Rwanda. The discussion integrates these findings with existing national and international literature, including the Rwanda Demographic and Health Survey (RDHS) and independent scholarly sources, to contextualize the results and highlight policy and practice implications. The results revealed that 52% of surveyed workers had sustained at least one non-fatal injury within the past 12 months. This high rate is consistent with global evidence that construction remains one of the most injury-prone sectors (International Labour Organization [ILO], 2023; Alazab et al., 2021). In Rwanda, the 2020 RDHS reported a relatively lower overall rate of work-related injuries in the general population; however, these national figures often underrepresent high-risk sectors such as construction. Scholars like Tamene (2020) emphasize that national surveys may not accurately capture occupational risks specific to informal or semi-formal employment contexts. The discrepancy underscores the need for sector-specific surveillance to guide targeted interventions.

Comparable regional studies reinforce these findings: in Kenya, Otieno et al. (2022) reported a 50.4% injury prevalence among construction workers, while in Ethiopia, Desta et al. (2021) observed a 47% injury rate. These similarities suggest that despite national safety regulations, enforcement and on-the-ground compliance remain insufficient across many low- and middle-income countries (LMICs), including Rwanda. Research by Barimah and Akorsu (2020) supports this, highlighting that while safety policies may exist on paper, limited regulatory capacity and weak inspection mechanisms severely hinder their implementation in the construction sector. Gender and age were not significantly associated with injury prevalence ($p = 0.672$ and $p = 0.925$, respectively), which aligns with RDHS (2020) findings that occupational risks are broadly distributed across adult age groups. Similarly, recent work by Wu et al. (2022) found no consistent relationship between age or sex and injury occurrence, noting that task type and environmental risk factors often outweigh demographic variables. However, educational attainment showed a strong protective effect. Workers with primary or tertiary education had significantly lower odds of injury, a finding supported by both RDHS (2020) and independent research by Cheng

et al. (2019), which found that higher educational levels correlate with greater compliance to safety procedures. Multivariate analysis confirmed this: those with primary education were 75.5% less likely to be injured (AOR = 0.245), emphasizing the role of basic education in enabling workers to follow safety procedures and understand warning signs. The duration of time in the current role was a strong predictor of injury, with new employees (under three months in the job) accounting for the highest injury rates. This pattern mirrors RDHS (2020) observation that newly employed or seasonal workers in Rwanda often lack adequate induction and safety orientation. Likewise, independent studies (Oswald et al., 2018) argue that inexperienced workers are often unaware of job hazards and thus require targeted onboarding programs. In this study, those with more than one year of experience had significantly reduced injury odds (AORs of 0.193 and 0.400), reinforcing the value of hands-on experience and familiarity with tasks and safety protocols.

Different occupational roles demonstrated varying injury risks. While masonry was the only role with a statistically significant association ($p = 0.024$), other manual trades like plumbing, roofing, and carpentry also showed elevated injury rates. The RDHS does not provide occupation-specific injury data for construction trades but does indicate that manual laborers have higher exposure to unsafe environments, poor working conditions, and lack of protective equipment. Additionally, Kiconco et al. (2021) note that job specialization in construction is often associated with uneven safety protocol enforcement, with masons and roofers typically experiencing higher injury rates due to falls and tool-related hazards. The use of PPE, particularly gloves, was not statistically significant in bivariate analysis ($p = 0.590$), yet multivariate analysis showed it significantly reduced injury odds (AOR = 0.459). This suggests PPE is protective when properly used. The RDHS (2020) noted inconsistent availability and adherence to PPE protocols across Rwanda's labor force, especially in informal and semi-formal sectors. Independent findings by Tamene and Afework (2020) and Ahmed et al. (2018) echo this, citing lack of PPE access, discomfort, and limited employer enforcement as common barriers to usage. This aligns with the present study's finding that reasons for not using PPE such as discomfort, cost, or lack of availability—contributed to suboptimal safety outcomes.

Interestingly, workers on 6–12 hour shifts had higher injury rates than those on >12 hour shifts ($p = 0.011$). This may seem counterintuitive, as longer shifts are typically associated with fatigue and accidents, but could be due to different workloads or job types assigned during standard shifts. While the RDHS does not specifically address shift work in construction, it does warn about the health impacts of prolonged working hours, particularly in physically demanding sectors. Independent researchers like Costa et al. (2021) suggest that shift length must be analyzed alongside task intensity and rest breaks to fully understand injury risks. Although most injuries occurred

between 8:00 a.m. and 5:00 p.m., the time of injury was not significantly associated with injury rates (p = 0.297). Similarly, sharp object injuries though common did not significantly correlate with overall injury risk (p = 0.907), suggesting they are frequent but not always severe. This points to the need for hazard-specific interventions like cut-resistant gloves and better equipment handling training, as supported by findings from Zhang and Fang (2022), who advocate for task-specific safety measures in construction zones. Despite these valuable insights, this study has limitations. Its cross-sectional design restricts the ability to infer causality. Additionally, reliance on self-reported data may introduce recall bias or underreporting of injuries, common challenges in occupational health studies. This study shows an urgent need for stronger safety measures in Rwanda's construction sector. Key actions include enforcing OHS laws, providing safety training for new workers, ensuring PPE use, and requiring safety officers and on-site health services. Education and awareness are critical in reducing injury risks. Strong regulation and employer accountability are essential for safer workplaces.

Conclusion

The study found a high prevalence (52%) of non-fatal injuries among NPD Ltd construction workers in Kigali. Key contributors include limited experience, poor safety training, and low PPE use. New workers (under 3 months) had the highest injury rates, while experienced workers had fewer injuries, showing the protective role of job familiarity. PPE use, though not significant in bivariate analysis, reduced injury risk in multivariate analysis. Safety officers and on-site health services were linked to lower injury severity. The study calls for stricter safety enforcement, better training, and improved safety practices to protect workers.

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