

ORIGINAL ARTICLE

Epidemiological profile of work-related injuries in Lombardy: Insights from Emergency Department data

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Abstract. *Background and aim:* Occupational injuries represent a major public health challenge, impacting workforce productivity and healthcare systems worldwide and Lombardy region, one of the most industrialized area in Europe, is a key region to monitor the phenomenon of work-related injury. *Methods:* This retrospective observational study analyzed 69,187 work-related injuries reported to Emergency Departments (EDs) across Lombardy, Italy, in 2023. Data were extracted from the Emergency-Urgency Online System (EUOL) and categorized into demographic, temporal, geographic, and clinical variables. *Results:* Results showed that 69.9% of cases involved male workers, with the highest injury rates among individuals aged 50–55 years (13.4%). Injuries peaked in May and July, with a daily peak at 12:00. Most cases (88.1%) were classified as low severity (green triage). Trauma was the predominant injury type (95.9%), and 91.6% of patients were discharged home. *Conclusions:* Despite legislative advancements, including Law No. 85/2023, occupational injuries remain a significant issue. Findings highlight the need for enhanced workplace safety measures, targeted interventions for high-risk groups, and improved prevention strategies. Future research should integrate employment data and injury mechanisms to refine risk assessment. Strengthening safety culture and training initiatives is crucial to reducing the burden of occupational injuries in industrialized regions. (www.actabiomedica.it)

Key words: occupational injuries, workplace safety, emergency department data, epidemiology, Lombardy region

Introduction

Occupational injuries are a critical global health concern, significantly affecting workforce productivity, economic stability, and public health systems (1). According to the International Labour Organization (ILO), nearly 395 million non-fatal occupational injuries and over 2.6 million deaths occur globally each year (2). These incidents underline the pressing need for targeted interventions and robust safety protocols in workplaces (3). In Italy, Lombardy stands out as one of the most industrialized regions, hosting a diverse array of sectors, from manufacturing to services,

construction, and agriculture. Its large workforce and complex economic landscape make Lombardy a key area for monitoring occupational injuries. In recent years, significant efforts have been made to improve workplace safety, supported by regulatory measures such as the Legislative Decree 81/2008 (Testo Unico per la Sicurezza sul Lavoro) (4). After tragic events happened also to students during the education period, the Italian Law No. 85/2023 was released, strengthening workplace safety regulations, particularly in education and training. Key measures include the extension of INAIL insurance coverage to all educational environments, beyond laboratories and gyms, for the

2023–24 academic year. This ensures insurance protection for students and educators against work-related injuries. Additionally, risk assessment in school-to-work programs is reinforced, requiring companies to specify preventive measures and personal protective equipment. Lastly, a compensation fund is established for the families of students who suffered fatal accidents during training activities (5). Despite these efforts, occupational injuries remain a significant public health challenge.

This study focuses on analyzing data of work-related injuries reported to emergency departments (EDs). The aim of the study is to provide actionable insights to support evidence-based interventions, because few research analyzed this phenomenon (6). The findings are intended to inform regional policymakers, healthcare providers, and occupational health practitioners about current patterns and risk factors for work-related injuries.

Methods

This study was designed as a retrospective observational analysis. Data were extracted from the Emergency-Urgency Online System (EUOL), a centralized database used by hospitals and emergency services in Lombardy. The EUOL system records detailed information on patient demographics, clinical conditions, and the circumstances surrounding emergency presentations. The study encompassed all EDs across Lombardy that reported occupational injuries between January 1 and December 31, 2023. Lombardy, located in northern Italy, is home to over 10 million residents and is characterized by a high density of industrial and commercial activities. The inclusion criteria for this study encompassed all cases classified as occupational injuries based on the ICD-9 coding system, provided that the patients presented to an emergency department (ED). Only cases with complete demographic and clinical data were considered eligible for analysis. Conversely, the exclusion criteria eliminated injuries unrelated to workplace activities, such as those occurring during recreational activities. The variables analyzed in this study were categorized into demographic, temporal, geographic, and clinical dimensions.

Demographic variables included age, gender, and nationality, allowing for the characterization of affected worker populations. Temporal variables encompassed the date and time of emergency department presentation, enabling the identification of trends in injury occurrences across different periods. Clinical variables included injury type, triage severity, and treatment outcomes, facilitating an understanding of the medical implications and resource utilization associated with occupational injuries. Descriptive statistics were employed to summarize data distributions. Temporal trends were analyzed to identify patterns in injury occurrences by month and hour. Gender and age distributions were stratified to highlight at-risk groups. A multivariable logistic regression analysis was performed to identify factors associated with hospitalization. Odds ratios (OR) with 95% confidence intervals (CI) were calculated to quantify the strength of associations, and statistical significance was set at $p < 0.05$. All analyses were conducted using Stata version 14.0 (StataCorp, College Station, TX).

Results

A total of 69,187 work-related injuries were reported in Lombardy EDs during 2023. The majority of injuries involved male workers (69.9%, $n = 48,336$), while females accounted for 30.1% ($n = 20,851$). The mean age of injured workers was 41.9 years, with a slightly higher mean age for females (43.3 years) compared to males (41.3 years). Injury rates varied across months, peaking in May (6,740 cases, 9.7%) and July (6,716 cases, 9.7%). The lowest injury rates were observed in August (4,388 cases, 6.3%) and December (4,963 cases, 7.2%) (Table 1). Hourly trends revealed a marked increase in injuries around midday, with a peak at 12:00 (5,376 cases, 7.8%). Secondary peaks were noted at 11:00 (5,008 cases, 7.2%) and 17:00 (4,779 cases, 6.9%) (Figure 1). Injuries were unevenly distributed across the four SOREUs in Lombardy. The SOREU Alpi region reported the highest number of cases (21,439, 31.0%). The highest injury rates were observed in the 50–55 age group (9,240 cases, 13.4%), followed by the 45–50 age group (8,770 cases, 12.7%). Workers aged 20–25 years also represented a

Table 1. Characteristics of Work-Related Injuries in Lombardy, 2023

	Category	Number of Injuries	Percentage (%)
Gender	Male	48336	69,8
	Female	20851	30,2
Nationality	Italian	56180	81,2
	Foreigner	13007	18,8
SOREU	Alpi	21439	31,0
	Laghi	17555	25,4
	Metropolitana	13464	19,4
	Pianura	16729	24,2
Triage Code	White code	3185	4,6
	Green code	59228	85,6
	Yellow code	6269	9
	Red code	427	0,6
	Not reported	78	0,1
Referring healthcare provider	Own decision	55869	80,7
	Operations Center 118	10010	14,4
	Other	2432	3,5
	Specialist	375	0,5
	General practitioner	198	0,3
	Not reported	180	0,3
	Transfer from another hospital	62	0,1
	Continuity of Care Doctor	61	0,1
Outcome	Discharge to home	63.405	91,6
	Patients leave the ED before being seen by a physician	2.387	3,5
	Admission to an inpatient ward	1.471	2,1
	Discharge to outpatient facilities	1.092	1,6
	Patients leave the ED during evaluations and/or before the medical record is closed	480	0,7
	Transfer to another institution	176	0,3
	Refusal of admission	126	0,2
	Unidentified	46	0,1
	Deceased in the ED	4	0,0

significant proportion (8.9%) (Figure 1). Most injuries (88.1%) were classified as green triage codes, indicating low severity. A small proportion (0.6%) required red triage codes for life-threatening conditions. Workplace trauma most commonly affects the limbs, with a significant proportion of injuries classified as low-intensity. According to data, the most frequent outcomes

include generic causes (6,934 cases, 10.0%), hand injuries (6,077 cases, 8.8%), lower limb (6,238 cases, 9.0%), upper limb sprains (904 cases, 1.3%), and back pain (4,429 cases, 6.4%). Together, these cases account for a total of 24,582 injuries (35.5% of reported workplace incidents). Despite their relatively low severity, such injuries can impact workers' efficiency, leading to

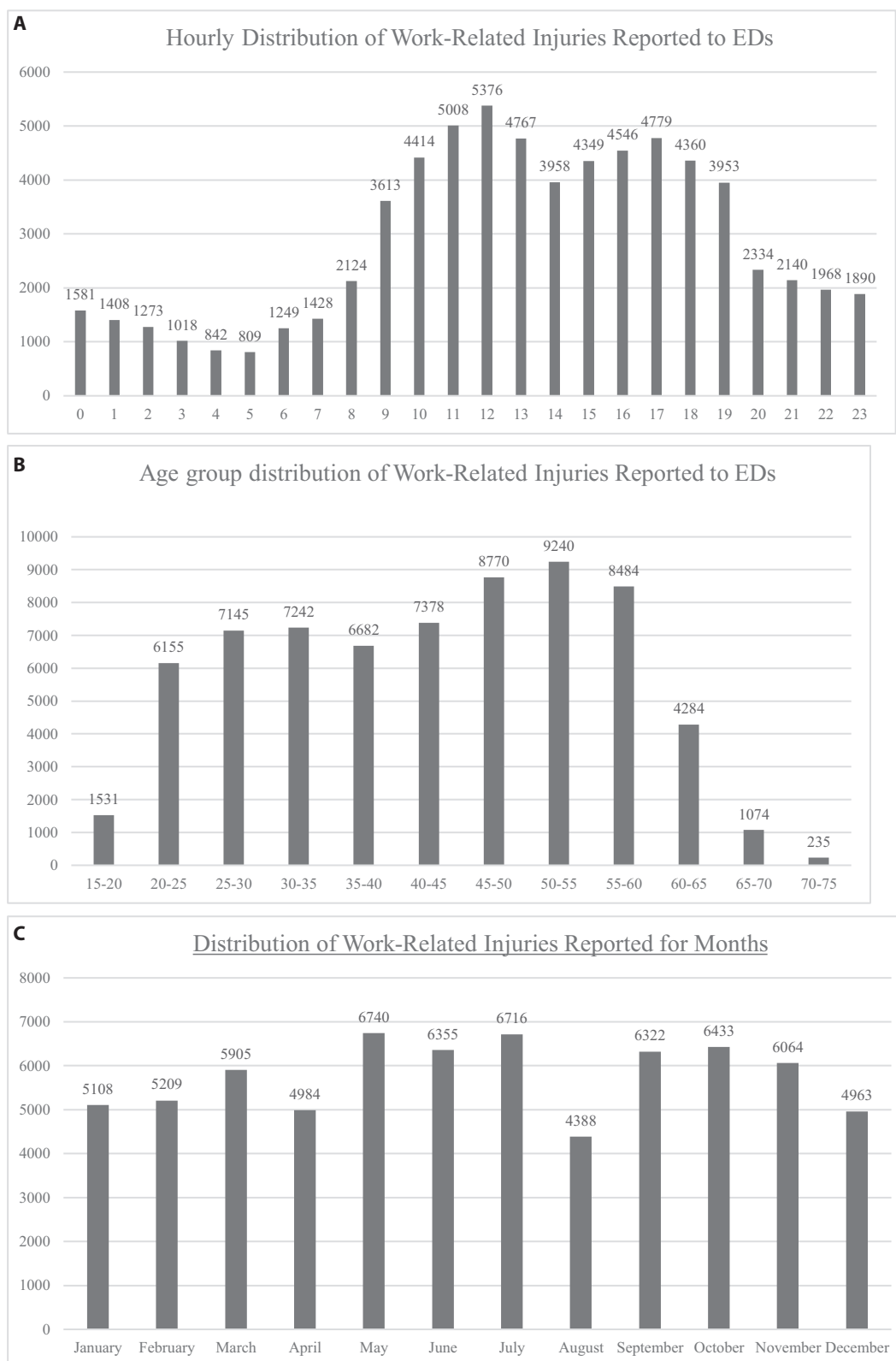


Figure 1. Distribution of Work-related injuries in EDs.

prolonged recovery times and, in some cases, chronic discomfort. Implementing preventive measures and early intervention strategies is essential to reducing these incidents and promoting workplace safety. The main access modality was patient's own decision (80,7%) followed by contact of 118 Operations Center (14,4%). As regards the discharge modalities, the majority of patients (91.6%) were discharged home. A small proportion of patients left the ED before being seen by a physician (3.5%) or during evaluations and/or before the medical record was closed (0.7%). Admissions to inpatient wards accounted for 2.1% of cases, while 1.6% were discharged to outpatient facilities. Mortality was extremely low, with only 4 cases reported as deceased in the ED or arrived deceased.

Regarding the outcome, male workers (OR 2.2, 95% CI 1.9–2.5; $p < 0.001$), those presenting with a higher severity code (Red and Yellow triage) (OR 18.3, 95% CI 16.5–20.3; $p < 0.001$), and individuals younger than 60 years (OR 2.2, 95% CI 1.9–2.5; $p < 0.001$) exhibited a higher likelihood of hospitalization.

Discussion

This study analyzed occupational injuries reported in the Lombardy region in 2023, one of Italy's most industrialized and densely populated areas. Given its high economic activity, Lombardy is particularly exposed to occupational risks. The study aimed to describe the epidemiological profile of work-related injuries presented to Emergency Departments (EDs) using data from the EUOL system, focusing on gender, age distribution, injury type, and outcomes. A total of 69,187 work-related injuries were recorded in Lombard EDs in 2023. At a Regional level, 109,849 work-related injuries were reported the same year (6), showing that 37% of workers with injuries does not go to ED. Data also reported a total of 172 work-related deaths (6), only 4 of which were present in the ED dataset of this study, underlying the fact that almost all death had place before the patients could arrive to hospital. Gender differences were evident, with men accounting for approximately 70% of cases, consistent with national data (7, 8). This reflects their higher representation in high-risk sectors such as construction, heavy industry,

and agriculture. Regarding age, workers aged 45–60 were the most affected (38.3%), followed by younger workers (20–35 years) at 29.7%, raising concerns about workplace safety among newer employees. Lombardy, with its extensive industrial and commercial network, remains at high risk for occupational injuries. INAIL data from early 2024 (9) indicate an increase in both total and fatal injuries compared to the previous year, likely driven by higher production demands, a shortage of qualified workers, and the rise of precarious employment, all of which may have negatively impacted workplace safety. It must be acknowledged that a significant number of work-related injuries can be associated with commuting incidents, which, in our context, predominantly involve road accidents (10, 11). Among the limitations of this study, it is important to highlight the inability to calculate injury rates based on the number of workers in different geographical areas, due to the lack of publicly available data on the employed population. These rates could deepen the interpretation of the number of injuries across different SOREU. Other important data that might be collected would include the mansion of the worker and the modality of injury. It is hoped that such analyses will be conducted in the future to provide a greater contribution to the early identification of high-risk situations characterized by a high incidence of occupational injuries. Additionally, although the administrative database used might include inaccuracies due to potential errors during data entry.

Conclusion

Our findings confirm that occupational injuries remain a significant public health issue despite institutional and corporate efforts. Enhancing safety culture, promoting the proper use of personal protective equipment, and providing targeted training for high-risk workers are essential measures to mitigate the impact of workplace injuries on the healthcare system and workers' quality of life.

Conflict of Interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity

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