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Workplace Safety Deficits and Healthcare Infrastructure Burden: A Regional Analysis of Occupational Injuries in Northeast Greece

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Abstract

• Background

• Occupational accidents (OAs) present a substantial challenge to public health systems. However, regional disparities in injury patterns and their subsequent burden on healthcare infrastructure remain under-investigated in Greece.

• Aim

• This study analyzes a cohort of injured workers in the Thrace region to evaluate the impact of OAs on secondary/tertiary healthcare infrastructure and identify systemic gaps in occupational health and safety (OHS).

• Methods

• A retrospective analysis of 489 trauma cases presented to the Emergency Department (ED) of a tertiary hospital in Northeast Greece was conducted, yielding 385 verified OAs. Statistical analyses evaluated correlations between accident severity, duration of work absence, enterprise size, and safety training.

• Results

• The findings demonstrate a critical reliance on tertiary care, with 96.7% of victims bypassing Primary Health Care units to seek immediate treatment at the hospital ED. Bone fractures were the most prevalent injury type (74.8%), resulting in a substantial mean work absence of 48 days. Although 23.0% of OAs led to long-term disability, 85.6% of the participants reported a complete lack of OHS training. Additionally, 47.3% of workers internalized the cause of the accident as "personal carelessness," highlighting a significant deficit in workplace safety culture, particularly within small and medium-sized enterprises (SMEs).

• Conclusions

• OAs in Northeast Greece exert a disproportionate burden on tertiary emergency resources and the regional economy due to prolonged productivity loss. Shifting public health strategy from reactive hospital treatment to proactive, state-led preventive education and enhanced primary care involvement is essential.

1. INTRODUCTION & BACKGROUND

Occupational health is a cornerstone of global public health. Workplace injuries not only threaten the physical integrity of employees but also impose severe strains on national healthcare delivery and socioeconomic stability. According to the International Labour Organization (ILO), millions of occupational accidents occur annually, necessitating robust preventative and managerial frameworks [1]. In Greece, the recent financial crisis followed by the digital transformation of labor monitoring has significantly reshaped the landscape of occupational safety and health (OSH).

In peripheral regions such as Northeast Greece (Thrace), this challenge is amplified by two distinct factors. First, the regional economy is dominated by small and medium-sized enterprises (SMEs), which historically correlate with lower compliance with safety protocols and a lack of structured OSH training [2]. Second, geographical decentralization often drives a heavy reliance on hospital-based emergency care rather than preventative primary services. While recent national digital interventions—such as the January 2021 mandate for electronic workplace accident reporting via the e-EFKA platform—have enhanced statistical visibility [3], they do not directly mitigate underlying workplace hazards. Building upon classical safety science paradigms [4], this study investigates how regional workplace conditions intersect to influence injury patterns and systematically strain peripheral tertiary healthcare resources.

2. METHODOLOGY

We conducted a retrospective evaluation of 489 consecutive trauma cases presenting to the Emergency Department (ED) of the University General Hospital of Alexandroupolis, the primary tertiary referral center in Thrace. Following a comprehensive clinical chart review based on ICD-10 criteria, 385 cases (78.7%) were formally verified as occupational or commuting injuries (*accidents in itinere*). The study period spanned seven years (2017–2023).

To capture the underlying socio-technical factors and human error dynamics [5, 6], structured follow-up telephone interviews were conducted to record parameters regarding enterprise scale, employee training history, and personal cause attribution. Statistical associations were performed using SPSS via Chi-square tests with Monte Carlo exact estimations and Kruskal-Wallis group comparisons ($p < 0.05$).

Ethical Considerations & Institutional Approvals

Data collection and institutional clearance were strictly governed by formal administrative approvals. Formal ethical approval and academic clearance for the study protocol were reviewed and officially enacted by the **General Assembly of the Department of Medicine, Democritus University of Thrace (DUTH, Protocol No. 5349/17/26-09-2022)**. Furthermore,official permission for the retrieval and clinical use of hospital records was granted by the **Scientific Council of the University General Hospital of Alexandroupolis (Protocol No. 1332 / 10-01-2023)**. All procedures aligned with the General Data Protection Regulation (GDPR) standards, and oral informed consent was secured from all individuals participating in the follow-up interview phases.

Note on Secondary Analysis

While the baseline descriptive characteristics of this regional cohort have been previously outlined to establish a regional baseline [7], the present study executes a distinct, dedicated secondary analysis. It shifts focus entirely toward quantifying the operational burden shifted onto the tertiary healthcare infrastructure and exploring the socio-technical systemic failures within regional small-scale enterprises.

3. RESULTS AND KEY FINDINGS

The demographic core highlighted a prominent gender and age risk profile: men accounted for 66.5% of occupational accidents (OR = 1.94 [95% CI 1.28–3.08], $p < 0.05$), with the 45–54 age bracket being the single most vulnerable cohort (30.1%). Sectoral analysis indicated that Manufacturing/Production generated the highest injury density (28.3%), followed closely by Wholesale and Retail Trade (19.5%), mirroring systemic occupational vulnerabilities noted in classical safety science.

From a clinical and systemic resource perspective, two critical trends emerged:

1. **Infrastructure Strain**: Primary Health Care (PHC) channels were systematically bypassed; 96.7% of patients presented via direct, self-referred admission to the tertiary ED. Hospitalization was required for 19.0% of cases, and the cohort exhibited a 2.1% fatality rate.
2. **Injury Severity and Economic Loss**: Bone fractures dominated the clinical presentation (74.8%), primarily affecting the upper and lower extremities. This high severity translated into significant socioeconomic loss, yielding a mean work absence of 48 days, with 44.1% of victims incapacitated for over two months and 23.0% experiencing long-term functional impairment.

A highly significant correlation ($p < 0.001$) was observed between small enterprise scale and safety omission. While 66.2% of all recorded incidents occurred in small firms (fewer than 50 workers), 85.6% of the total sample reported never receiving formal vocational safety induction. Consequently, 47.3% of the injured workforce attributed their accident entirely to "personal carelessness," effectively masking structural deficits in employer-led safety protocols. Additionally, OHS measures and training correlated with the type of injury and the involved to the accident material agent (both with $p < 0.05$).

4. DISCUSSION & CONCLUDING RECOMMENDATIONS

The high emergency utilization rate (96.7%) reported in this study indicates that tertiary hospital settings are functioning as reactive primary caretakers for systemic workplace failures. This operational reality points to a safety vacuum within peripheral SMEs, where a deficit in organizational safety culture shifts socioeconomic and clinical accountability from the employer onto the individual worker and the state healthcare network.

To transition from a reactive to a proactive paradigm, public health strategies in expanding industrial peripheries must implement three urgent interventions:

1. **Targeted Inspectorate Mandates**: Transition from generic administrative labor reviews to strict, onsite safety audits specifically targeting manufacturing SMEs.
2. **Decentralized Incident Tracking**: Integrate occupational incident logging and initial triage into localized Primary Health Care structures to alleviate the frontline burden on overstretched tertiary EDs.
3. **Subsidized Safety Induction**: Establish state-enforced, mandatory safety training periods for new hires within their first 12 months, given that 32.0% of our cohort experienced injuries during their first year of employment.

Fostering a localized culture of safety is not merely a regulatory burden; it is a vital public health intervention necessary to preserve regional productivity and safeguard human capital.

Declarations

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Author Contribution

(A) wrote the main manuscript text and prepared tables 1-2. All authors reviewed the manuscript.

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Tables

Table 1: Socio-Demographic and Occupational Profile of the Injured Cohort (N = 385)

Parameter	Category	Frequency (n)	Percentage (%)
Gender	Male	256	66.5%
	Female	129	33.5%
Age Group	18–24	42	10.9%
	25–34	78	20.3%
	35–44	93	24.2%
	45–54	116	30.1%
	≥55	56	14.5%
Industrial Sector	Manufacturing & Production	109	28.3%
	Wholesale & Retail Trade	75	19.5%
	Construction & Infrastructure	68	17.7%
	Agriculture & Forestry	51	13.2%
	Transport & Logistics	44	11.4%
	Services & Other	38	9.9%
Enterprise Scale	Small / Micro (<50 employees)	255	66.2%
	Medium / Large (>50 employees)	130	33.8%

Table 2: Clinical Characteristics, Healthcare Utilization, and Safety Training Deficits

Core Indicator	Clinical & Institutional Variables	Metric / Value	Percentage (%)
Frontline Admission	Bypassed Primary Units (Direct ED Referral)	372	96.7%
	Utilized Primary Health Care (PHC)	13	3.3%
Injury Typology	Bone Fractures & Skeletal Trauma	288	74.8%
	Soft Tissue Injuries & Lacerations	97	25.2%
Clinical Severity	Required Inpatient Hospitalization	73	19.0%
	Fatality Rate	8	2.1%
Socioeconomic Impact	Mean Absence from Work (Days)	48 days	—
	Long-term Disability / Incapacity (>60 days)	170	44.1%
	Permanent Functional Impairment	89	23.0%
OHS Infrastructure	Received **Zero** Vocational Safety Training	330	**85.6%**
	Attributed Incident to "Personal Carelessness"	182	47.3%