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Research Article

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Impact of Falls from Occupational Injuries: A Comparative Analysis of Mortality and Disability Across Sociodemographic Index 2010 to 2019

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Abstract

This study investigates the impact of falls from occupational injuries on disability, focusing on a comparative analysis across diBerent Socio-Demographic Index (SDI) categories from 2010 to 2019 using data from the GBD database. The primary aim is to identify trends, disparities, and contributing factors to the rate of Years Lived with Disability (YLD) resulting from occupational falls. A retrospective cross-sectional observational design was employed, analyzing data from various global regions categorized by high, middle, and low SDI.

The results indicate a significant disparity in disability outcomes related to occupational falls across SDI categories. Lower SDI groups consistently showed higher rates of YLD, suggesting an increased burden and a lack of suBicient occupational health policies and safety measures in these regions. The regression analysis revealed a statistically significant relationship between SDI groups and the rate of YLD (p-value = 0.004), while the relationship between year and the rate of YLD was not statistically significant (p-value = 0.197).

These findings are crucial for informing policies and interventions to reduce occupational falls. The study highlights the need to enhance safety standards, especially in low SDI areas, and suggests that global health policies prioritize tailored interventions for diBerent sociodemographic groups. Understanding these disparities and contributing factors provides evidence-based insights to help mitigate the impact of occupational injuries on worker health and well-being.

1. Introduction

Falls from occupational injuries constitute a significant and persistent threat of morbidity and mortality within various demographic groups. The incidence, mortality, and disability resulting from these incidents are influenced by factors including age, gender, socioeconomic status, and geographical location, aBecting individuals across all age groups. Despite their preventable nature, falls continue to pose substantial risks in modern healthcare settings, necessitating the implementation of safety measures and interventions [1].

In younger populations, falls can result in severe disabilities such as traumatic brain injuries or spinal cord injuries, while older adults may experience heightened morbidity due to comorbid conditions such as osteoporosis or medication usage [2]. Surprisingly, falls often remain overlooked as a global issue, despite their ranking as a leading cause of disability-adjusted life years and unintentional injury-related deaths [3].

In the Global Burden of Diseases, Injuries, and Risk Factors Study 2017 (GBD 2017), falls emerged as a significant contributor to the burden of disease, ranking among the top causes of disability-adjusted life years and unintentional injury-related deaths [4].

Beyond the personal toll, these falls are also economically costly, with implications for healthcare expenditure, loss of productivity, and long-term disability costs. According to the National Institute of Safety and Health at Work (INSST) in Europe, the economic burden of occupational falls reaches upwards of 476 billion euro. The Health and Safety Executive (HSE) has calculated that work-related injuries and illnesses in the United Kingdom amount to £14 billion, approximately 1% of the GDP [5].

The International Labour Organization (ILO) reports that approximately 2.3 million individuals globally die each year from work-related accidents or diseases, which equates to more than 6000 deaths daily. Additionally, there are about 340 million occupational accidents and 160 million cases of work-related illnesses worldwide every year [6].

While existing research on falls has predominantly focused on older populations, it is imperative to understand their impact across all age groups and demographics. The World Health Organisation reports that falls are a leading cause of injury-related deaths among those aged 65 and older, emphasising the need for comprehensive studies to assess the distribution of falls-related morbidity and mortality [3].

The GBD Study serves as a vital resource for analysing the global burden of falls, oBering comprehensive estimates of mortality, non-fatal health outcomes, and risk factors across various demographics and regions. However, to date, there has been limited examination of falls specifically within the occupational setting. In this study, the GBD 2017 framework was used to investigate the impact of falls from occupational injuries on mortality and disability, conducting a comparative analysis across sociodemographic indices from 2010 to 2019 [7].

While occupational falls are well-documented as major causes of morbidity, mortality, and economic burdens, research on variations across countries of diBering economic statuses is sparse. Most studies focus on general data, not on how socioeconomic factors distinctly influence outcomes in diBerent regions. This gap underscores the need for this study, which analyses variations across countries with diBerent SDI levels. This research extends existing literature and provides crucial insights for more tailored and eBective global workplace safety interventions.

The primary aim of this dissertation was to conduct a comparative analysis of mortality and disability following falls from occupational injuries across sociodemographic indices. Specifically, the study seeks to quantify trends, identify disparities, and elucidate the factors contributing to diBerential outcomes [8].

2. Method

A retrospective cross-sectional observational design was adopted, utilizing data from the GBD database from 2010 to 2019. This approach facilitated the analysis of trends and patterns in falls-related mortality and disability across diBerent sociodemographic indices globally, categorizing data into high, middle, and low SDI groups.

The GBD 2019 study provides comprehensive estimates for incidence, prevalence, mortality, and Years Lived with Disability (YLDs) for 369 diseases and injuries across 204 nations. The study uses diverse data sources, including population censuses, household surveys, civil registration systems, disease registries, health service data, and air pollution monitors [9]. YLDs are estimated by combining prevalence figures with disability weights specific to each condition [10,11].

Data were extracted using structured injury risk codes from the GBD 2019 study, focusing specifically on occupational injuries due to falls. The data selection process involved choosing 'Deaths' and 'YLDs' from the 'Measure' category, refining metrics to 'Number' and 'Rate', and setting 'Occupational Injuries' as the risk parameter. Data were further categorized by SDI levels (low, middle, high) and covered the years 2010-2019. Rates were calculated per 100,000 individuals.

The study included data on all age groups and both sexes across all SDI categories. Exclusion criteria were set to omit data unrelated to occupational injuries and falls, including non-occupational injuries, other types of workplace accidents, and records with incomplete sociodemographic information or unverifiable outcomes. This ensured a focused and reliable analysis over the 10-year period.

The analysis was stratified by SDI, which is calculated using income per capita, average educational completion over age 15, and total fertility rate under age 25. This index spans from 0 (lowest development levels) to 1 (highest development levels), providing a comprehensive assessment of development across regions. Primary variables included the number of deaths and YLDs attributable to occupational falls [12,13].

To minimize bias, a standardized protocol for data extraction and analysis was employed, with cross-referencing for accuracy. The GBD's methodology ensures comparability across countries and time, accounting for variations in data quality and availability [14].

Descriptive statistics provided an overview of mortality and disability trends. Time-series analysis identified changes and trends over the specified period [15]. Data analysis was conducted using IBM SPSS Statistics software (version 29.0.2.0). A scatter plot illustrated the rate of death by year for High, Medium, and Low SDI groups, including a linear regression line to indicate overall trends using the results and data. The p-value assessed the statistical significance of these relationships [16].

3. Results

Year	SDI	Rate of Death	Rate of Years Lived with Disability
2010	Low	0.574517831	21.38
2010	Medium	0.5976352	20.86
2010	High	0.331498479	37.22
2011	Low	0.561072054	21.06
2011	Medium	0.58821312	21.02
2011	High	0.329612425	37.43
2012	Low	0.540693139	20.74
2012	Medium	0.584029905	21.29
2012	High	0.326170083	37.73
2013	Low	0.525425784	20.51

2013	Medium	0.582441914	21.65
2013	High	0.323436538	37.59
2014	Low	0.513568595	20.83
2014	Medium	0.579110439	22.13
2014	High	0.321172425	37.63
2015	Low	0.500782867	20.49
2015	Medium	0.576069499	22.65
2015	High	0.314805193	37.06
2016	Low	0.493683536	21.35
2016	Medium	0.57761932	23.41
2016	High	0.314309909	38.25
2017	Low	0.488302557	22.1
2017	Medium	0.56989291	24.11
2017	High	0.313789355	39.5
2018	Low	0.480532028	22.04
2018	Medium	0.556778463	24.37
2018	High	0.311962884	39.53
2019	Low	0.475836408	22.29
2019	Medium	0.550355336	24.93
2019	High	0.312366881	40.07

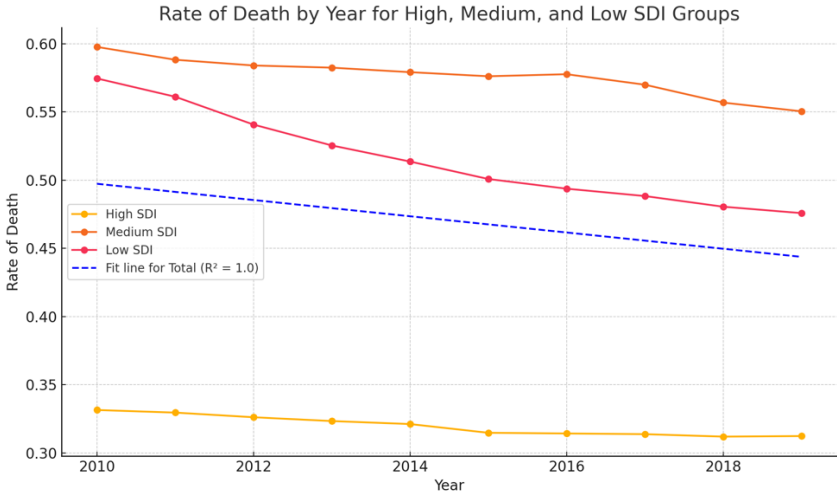

Figure 1: Scatter Plot of the Rate of Death by Year for High, Medium, and Low SDI Groups, Including a Linear Regression Line Indicating the Overall Trend (Data Extracted from SPSS).

The scatter plot (Figure 1) illustrates the rate of death by year for three SDI groups (High, Medium, Low) from 2010 to 2019. The High SDI group consistently exhibits the lowest mortality rates across all years, with data points clustered near the bottom of the plot, indicating stable and low rates of death. The Medium SDI group shows higher mortality rates, with data points scattered near the top of the plot, suggesting slight variability but consistently higher rates compared to the High SDI group. The Low SDI group displays a declining trend in mortality rates over the observed period, with data points gradually decreasing from higher to lower positions on the plot.

The linear regression line, which fits the overall data, shows a slight negative slope, indicating a general decrease in the rate of death from 2010 to 2019. However, the Rsquared value of 0.024 suggests that the year explains only 2.4% of the variance in the rate of death, indicating that the year alone is not a strong predictor of mortality rate changes across the SDI groups. The p-value for the Year variable was 0.218, indicating no statistical significance at the 95% confidence level. However, the p-value for the SDI Group variable was less than 0.001, indicating a statistically significant relationship between SDI groups and the rate of death at the 95% confidence level. This significant pvalue suggests that changes in SDI groups are associated with significant changes in the rate of death.

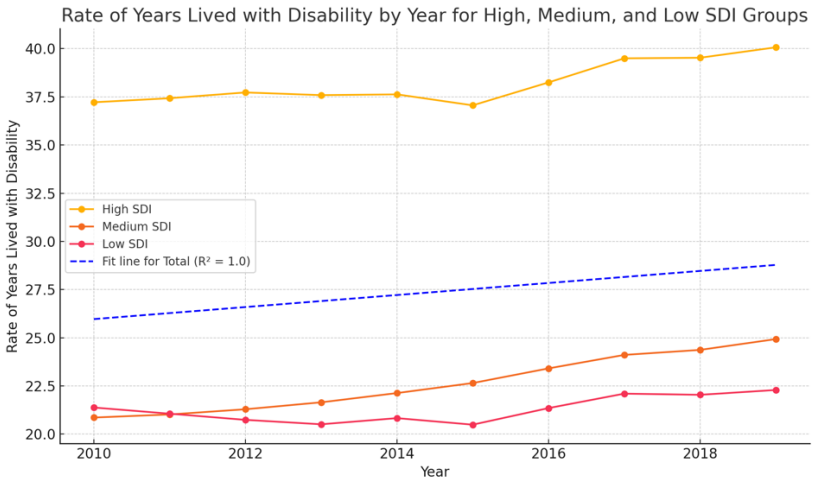

Figure 2: Scatter Plot of Rate of Years Lived with Disability by Year for High, Medium, and Low SDI Groups with Linear Trend Line (Data extracted from SPSS).

The scatter plot (Figure 2) presents the rate of YLD by year for three SDI groups (High, Medium, Low) from 2010 to 2020. Each data point represents the rate of YLD for a specific SDI group in a given year. The High SDI group consistently shows the lowest rates, with data points clustered near the bottom of the plot, indicating stable and low disability rates across the years. The Medium SDI group exhibits the highest rates, with data points consistently near the top of the plot. The Low SDI group shows varying rates but generally falls between the High and Medium SDI groups.

A linear regression analysis was conducted to determine the relationship between SDI groups, year, and the rate of years lived with disability. The p-value for the Year variable was 0.197, indicating no statistical significance at the 95% confidence level. However, the p-value for the SDI Group variable was 0.004, indicating a statistically significant relationship between SDI groups and the rate of YLD at the 95% confidence level. This significant p-value suggests that changes in SDI groups are associated with significant changes in the rate of years lived with disability.

The regression line in Figure 2, fitted to the overall data, shows a slight positive slope, indicating a general increase in the rate of years lived with disability from 2010 to 2020. However, the R-squared value of 0.013 suggests that the year explains only 1.3% of the variance in the rate of YLD, indicating that the year alone is not a strong predictor of disability rate changes across the SDI groups. Despite this, the significant relationship between SDI groups and the rate of YLD emphasises the importance of sociodemographic factors in understanding health outcomes.

4. Discussion

This dissertation has comprehensively examined the epidemiology of occupational falls across groups of varying sociodemographic indices, utilising a decade of data from the Global Burden of Disease study. Through this analysis, the research has illuminated significant trends and disparities in the incidence and consequences of occupational falls, oBering a detailed understanding of their global impact.

Contrary to expectations, high SDI countries exhibit higher reported death and morbidity rates. Enhanced reporting systems and health surveillance in regions with high SDI were observed to potentially lead to a more precise collection of data regarding non-fatal injuries. The improvement in diagnostic capabilities, coupled with a stronger focus on the systematic recording and monitoring of occupational injuries, was noted to contribute to an increase in the documented cases of morbidity. The comprehensive availability of such detailed records might also facilitate greater recognition and classification of chronic health conditions as being related to occupational environments. This shift towards more thorough documentation and classification practices is likely to have a significant impact on the understanding of the scope and scale of occupational health issues within these high SDI region [17,18]. Such developments are critical for providing a clearer picture of occupational health trends and for formulating more eBective workplace health policies and interventions. These observations underscore the importance of continuous improvements in health surveillance systems to enhance the accuracy and comprehensiveness of occupational health data.

In this study, higher rates of morbidity were notably observed in regions with middle and high SDI levels. Individuals in higher socioeconomic groups often have better access to healthcare and legal resources, enabling them to report injuries more frequently and pursue compensation claims eBectively, leading to more robust data on occupational injuries [19]. Studies have shown that workers' compensation claims are substantially more common in developed countries, where regulatory frameworks and healthcare systems are more advanced [20]. This enhanced infrastructure not only supports better documentation of occupational injuries but also improves survival rates from severe injuries, although often with significant disabilities. However, this framework does not fully explain the high morbidity rates in middle SDI countries, suggesting the presence of additional factors aBecting these outcomes, which require

further exploration to understand the complex dynamics at play [21].

Results may be influenced by the 'healthy worker' eBect. This suggests that the working population generally appears healthier than the general population [22]. The eBect arises because seriously ill or disabled individuals are less likely to be employed. Improved healthcare has enabled more individuals with disabilities to work, potentially increasing recorded YLDs in occupational settings. This study focuses on individuals who returned to work after a disability, excluding those who couldn't return and lived with the disability outside the workforce. Therefore, while the healthy worker eBect might suggest an underestimation of disabilities within the employed population, this analysis does not encompass those who have left the workforce permanently. This limitation means the data might underestimate disabilities in the employed population. Policymakers must consider this when interpreting occupational health data and planning interventions to support disabled workers [23-26].

The categorisation of countries into diBerent SDI groups is useful for broad comparisons but may mask important variations within these groups. These intra-group diBerences can provide critical insights into occupational health outcomes. Generalising SDI categories without recognising these diBerences may limit the ability to fully understand and address specific occupational health challenges within similar economic contexts. While SDI oBers a valuable framework for analysis, it also introduces complexity in data interpretation. Additionally, the 2018 annual report by the ILO reinforced these findings, pointing out that in regions with low SDI, informal workers, who are frequently omitted from traditional occupational health surveillance systems encounter substantially higher risks. These workers, often engaged in unregulated sectors, lack formal employment protections and access to health and safety resources, placing them at increased vulnerability to occupational injuries [27]. This lack of inclusion in safety programs and health monitoring means that the actual rate of injuries in these populations may be underreported, and the severity of occupational health issues underestimated. The findings from the ILO report underline the critical need for tailored interventions that address the unique challenges faced by workers in low SDI regions. Enhanced safety measures, better regulatory oversight, and increased training opportunities are essential to mitigate the disparities in occupational health outcomes observed across diBerent regional and economic contexts [28].

The longitudinal dynamics of occupational injuries, as analysed by Baidwan NK et al. (2018), indicate that improvements in a country's SDI generally correlate with a reduction in the rate of severe occupational injuries, though the relationship is not linear [29]. The study highlights that as countries transition from low to middle SDI, often spurred by industrialisation, there is an initial surge in occupational injury risks. This increase can be attributed to rapid workforce changes and industrial practices that outpace the development of safety regulations and worker training. During these transitional phases, emerging industries may not yet have adequate safety protocols in place, and the enforcement of existing standards can be inconsistent or insuBicient, thereby elevating the risk of injuries. This dynamic could explain the higher rates of YLD and mortality observed in the middle SDI group. Another contributing factor might be the middle SDI countries' intermediate capacity in health documentation and reporting. These countries likely possess better resources to record and report injuries and mortality compared to low SDI countries but may lack the more advanced medical infrastructure of high SDI countries to eBectively treat injuries. This intermediate capability might paradoxically result in higher observed rates of mortality and morbidity than seen in both high and low SDI groups, highlighting a complex interplay between healthcare development and injury outcomes in middle SDI countries [30].

Future research should focus on reducing the burden of falls from occupational injuries and improving workplace safety. Longitudinal studies are needed to understand the longterm eBects of occupational falls, including chronic health conditions, disability, and quality of life impacts. These studies will oBer insights into the progression and management of fall-related conditions [31].

Developing and implementing preventive strategies is crucial. Enhancing engineering controls, strengthening administrative protocols, and promoting personal protective equipment can significantly reduce fall risks. Targeted interventions for high-risk industries and vulnerable groups, such as older workers or those in hazardous conditions, are essential for improving occupational health outcomes. Increased investment in educational and training programs is also needed to raise awareness of fall hazards and encourage safe practices. Empowering workers with knowledge and tools to address risks proactively will enhance their safety and well-being [32].

Addressing these research priorities and implementing eBective strategies can reduce the frequency and severity of occupational falls, creating safer work environments globally. This research aims to contribute to the body of knowledge in occupational health by providing evidence-based insights into the impact of falls on worker health. The findings are expected to inform policy decisions and interventions to improve workplace safety and reduce the burden of falls [7].

4.1. Limitations

This study has limitations, primarily relying on data from the GBD study. While comprehensive, GBD data's accuracy varies by country. High-income countries often have better health data systems than low-income ones, potentially leading to overrepresentation of certain health outcomes. Reporting and classification methods for occupational injuries diBer by region and over time, introducing bias that could aBect trends and skew results. There may be delays in GBD data reporting, meaning it might not reflect the most current trends or intervention impacts. Despite these issues, the GBD study is a robust, widely used dataset with a systematic approach to quantifying global health burdens. It is trusted and cited in high-profile studies, including

articles in The Lancet and The New England Journal of Medicine, underscoring its critical role in global health research and policy [33- 35].

5. Conclusion

This study assessed the impact of occupational falls on disability across diBerent SDI categories using GBD data from 2010 to 2019. The findings show that lower SDI regions consistently have higher YLD rates due to occupational falls. Regression analysis confirmed a significant relationship between SDI groups and YLD rates, highlighting the role of socio-demographic factors in disability outcomes. These results align with existing literature on the vulnerability of lower-income regions to occupational injuries due to poor safety measures and healthcare access. The study calls for targeted interventions, improved safety standards, and enhanced health surveillance to address these disparities, advocating for global policy reforms and increased investment in occupational health to improve worker well-being.

Declerations

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Ethics Approval

No ethics approval was required for this study. Not applicable.

Consent for Publication

Consent for publication given by both authors.

Availability of Data

Not applicable

Competing Interests

The authors declare that they have no competing interests

Author's Contribution

Dr Christine Vella was responsible for the study design and write up of the manuscript.

Mr Zammit Meample coordinated revisions of the manuscript.

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