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RISK FACTORS ASSOCIATED WITH SEVERE OCCUPATIONAL INJURIES AMONG EMPLOYEES IN SONGKHLA PROVINCE, THAILAND: A RETROSPECTIVE STUDY (2023)

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Abstract: Occupational injuries remain a major safety and health concern in Thailand. In 2023, over 80,000 cases were reported, with Songkhla province having the highest proportion of severe cases (4.42%) in the southern region. Although laws and preventive measures are in place, occupational injuries still occur frequently. This study aimed to assess the prevalence and factors associated with severe occupational injuries among employees in Songkhla. This retrospective study used secondary data from the Occupational Safety and Health Center Region 9, Ministry of Labour. The sample included 1,920 employees from 769 companies in 2023, collected using a standardized form. Descriptive statistics summarized the characteristics of injury cases. Logistic regression was used to identify factors associated with severe injuries, using adjusted odds ratios (AOR) and 95%CI. Model precision was evaluated with the Hosmer–Lemeshow test and ROC curve. Among 1,920 employees, 1,020 (53.1%) sustained severe injuries. Most occurred in February (AOR=1.8; CI 1.1–2.9), March (AOR=1.9; CI 1.2–3.0), and November (AOR=2.1; CI 1.3–3.4). Higher odds were found in agriculture/fishery sectors (AOR=3.2; CI 1.0–10.1), deep lacerations (AOR=2.2; CI 1.7–2.8), and fractures/dislocations (AOR=3.9; CI 2.9–5.1). Lower odds were found for injuries to the head/face/neck (AOR=0.1; CI 0.01–0.6) and hip/waist/torso (AOR=0.1; CI 0.01–0.9). Leading causes included falling objects (AOR=1.5; CI 1.0–2.3), falls from height (AOR=1.7; CI 1.0–3.1), and transport-related accidents (AOR=4.0; CI 1.8–9.0). Workplaces with ≥500 employees had higher odds (AOR=1.5; CI 1.0–2.1). The model showed good fit (χ^2=5.59, p=0.232) and fair discrimination (AUC=0.705). Severe injuries were significantly associated with month, industry type, nature and location of injury, accident cause, and company size. These findings underscore the need for targeted interventions in high-risk sectors, Strengthened enforcement at key times, and sector-specific prevention programs.

Keywords: occupational injuries, severe injuries, risk factors, Thailand, Songkhla

1. Introduction

Occupational injuries represent a critical issue that significantly impacts the health and safety of workers, as well as the economy and competitiveness of industries in Thailand. Despite the presence of safety measures, the Social Security Office reports that over 80,000 workers are injured annually, with 31.68% of these injuries being severe (Office of the Workmen's Compensation Fund, Social Security Office, Thailand, 2023). This issue is particularly pronounced in southern Thailand, where Songkhla

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Province, home to more than 40,000 manufacturing establishments, plays a key role in the production sector (National Statistical Office of Thailand, 2022). Severe injuries in the workplace are often linked to heavy machinery, hazardous chemicals, and high-risk activities such as lifting heavy objects, falling, and working at heights (Gomes et al., 2023). These injuries not only impact worker health but also create significant economic burdens, including increased production costs, lost productivity, medical expenses, compensation, and potentially disruption of operations (Cholrit Luangjinda et al., 2020). Thailand has implemented stringent work safety laws and measures, but the rate of occupational injuries in southern Thailand remains high. Songkhla Province, in particular, has the highest rate of severe occupational injuries. This study aims to analyze the prevalence and factors associated with severe occupational injuries among workers in Songkhla Province in 2023. It aims to provide insights for improving worker safety measures and reducing the rate of severe occupational injuries in workplaces in the region.

2. Materials and Methods

2.1 Study Design

This retrospective study analyzed the prevalence and risk factors associated with severe occupational injuries among employees in Songkhla Province, southern Thailand, in 2023.

2.2 Data Collection Procedures

2.2.1. This study received human research approval from the Human Research Ethics Committee of Thaksin University, under the Exemption Certificate No. TSU 2024_109, on July 10, 2024.

2.2.2. Data Collection: A formal request was submitted to the Occupational Safety Center, Region 9, Department of Labor Protection and Welfare, Ministry of Labor, Thailand, to obtain statistical data on occupational injuries. The dataset included records of workplace accidents that occurred in Songkhla Province in 2023. Relevant data were systematically extracted based on the inclusion criteria using a standardized data extraction form.

2.3 Study Population

The study population included 1,920 employees in Songkhla Province who sustained occupational injuries in 2023, as recorded in the Occupational Safety Center, Region 9 database. All cases of occupational injuries among employees in Songkhla Province during 2023 were included in the study based on the established inclusion criteria.

2.4 Instruments

The data extraction form was designed to collect key variables, which included the date of injury (day, month, and year), the province where the injury occurred, the number of employees involved, the cause of the accident, contributing hazards, the nature of the injury, the affected body part, and the severity of the injury (classified as severe or non-severe).

2.5 Data Analysis

2.5.1. Data Quality Control: The dataset underwent verification by two independent reviewers (the primary researcher and a research advisor) using EpiData software to ensure accuracy and completeness. Inconsistencies were identified, reviewed, and corrected through consensus.

2.5.2. Statistical Analysis: This study applied both descriptive and inferential statistics. Descriptive statistics summarized occupational injury prevalence through frequencies and percentages. For inferential analysis, logistic regression examined risk factors for severe injuries. Initially, univariate logistic regression identified significant variables ($p < 0.05$) for further analysis. Then, multivariate logistic regression using the Backward Selection method estimated Adjusted Odds Ratios (aOR) with 95% Confidence Intervals (95% CI), adjusting for confounders. Model fit was assessed using the Hosmer-Lemeshow Test ($p > 0.05$ indicated good fit), and multicollinearity was checked via the Variance Inflation Factor (VIF < 5). Finally, the model's classification performance was evaluated through ROC Curve Analysis, with the Area Under the Curve (AUC) measuring its accuracy.

2.6 Ethical Considerations

This study received ethical approval from the Human Research Ethics Committee of Thaksin University, and an Exemption Certificate (TSU 2024_109) was issued on July 10, 2024. The secondary data used in this study were obtained with official permission from the Occupational Safety Center, Region 9. To ensure privacy and confidentiality, no personally identifiable information was included in the dataset. Strict measures were taken to protect confidentiality, and the data were used exclusively for academic research purposes.

3. Results and Discussion

The study found no significant relationship between the day of the week and injury severity ($p = 0.779$), though severe injuries peaked on Tuesdays (17.44%), while non-severe injuries were most common on Thursdays (16.96%). However, injury severity varied significantly by month ($p = 0.011$), with March having the highest proportion of severe injuries (11.47%) and August the highest for non-severe injuries (10.78%). Industry type significantly influenced injury severity ($p = 0.003$), with manufacturing reporting the highest proportions of both severe (58.92%) and non-severe injuries (49.44%). Injury type was also significantly associated with severity ($p < 0.001$), with fractures or dislocations accounting for 37.75% of severe injuries, whereas superficial wounds were the most common non-severe injuries (44.89%). Body parts affected differed by severity ($p < 0.001$), with severe injuries most commonly involving hands, arms, and shoulders (51.47%). Causes of injury also varied significantly ($p < 0.001$), with being struck by objects the leading cause in both groups (48.82% severe, 50.78% non-severe), though falls and vehicle-related accidents were more likely to result in severe injuries. Factors contributing to injuries showed significant variation ($p < 0.001$), with tools and materials being the primary cause for both severe (65.29%) and non-severe injuries (71.67%). Business size was also significantly related to injury severity ($p = 0.001$), with large businesses (500+ employees) having the highest proportion of severe injuries (25.20%), whereas small businesses (1-19 employees) had the highest proportion of non-severe injuries (22.78%).

3.1 Prevalence

The study on the prevalence of occupational injuries in Songkhla Province in 2023 revealed several factors influencing the occurrence of workplace injuries, including time-related factors, business size, industry type, and injury characteristics. These factors are crucial for analyzing and developing strategies to prevent workplace accidents in the future. Regarding the day of the week, the study found no significant difference in the distribution of severe and non-severe injuries across the days, with Tuesday and Monday showing the highest proportion of severe injuries, while Sunday had the lowest. This may reflect the nature of work these days, where Monday and Tuesday are typically the beginning of the workweek, and workers may still be adjusting from the weekend break, leading to what is referred to as the "Monday Effect." This phenomenon, where fatigue from the weekend leads to reduced focus, can increase the risk of accidents. Conversely, Sunday, often a holiday in many industries, experiences fewer workplace injuries due to a reduced workforce. The results of this study are consistent with other studies. Many studies have found that serious occupational injuries tend to occur on Mondays, which is linked to the "Monday Effect." March and February have the highest rates of severe injuries, as these months coincide with Thailand's summer season. This may result in workers experiencing fatigue and exhaustion while on the job, increasing the risk of severe injuries. (Baraza et al., 2023; Baraza & Cugueró-Escofet, 2021; Fuentes-Bargues et al., 2023a; Shao et al., 2019). This indicates that specific characteristics of the work environment are associated with seasonality, as Gomes et al. (2023) found that fatal injuries in the United States occur more frequently during the summer months. Work involving heavy machinery, hazardous materials, and complex equipment poses a significant risk of serious work-related injuries (Gomes et al., 2023). When considering injury types, superficial wounds, burns, and bruises were common, both severe and non-severe injuries, and were often caused by working with tools or machinery. Hand, arm, shoulder, and neck injuries were the most common, consistent with work environments that often involve repetitive physical activities, such as heavy lifting or poor posture. Fuentes-Bargues et al. (2023) and Onder (2013) found that the hands and arms were the most frequently affected areas in restaurants. Workplace injuries also reported higher rates of injury in large establishments (with more than 500 employees) having a higher risk of severe injuries, while smaller company were more likely to experience minor injuries (Fuentes-Bargues et al., 2023; Onder, 2013). This is likely due to the challenges in managing safety standards in larger establishments without effective oversight. Park et al. (2024) found similar patterns, noting that workplace accidents were most frequent in small businesses with fewer than 50 employees and those with 100-499 employees(Park et al., 2024).

Table 1: *Prevalence of Occupational Injuries Classified by Severity: Severe Injuries and Non-Severe Injuries*

Factor	Severe Injuries (n =1,020)		Non-Severe Injuries (n = 900)	
	n	%	n	%
Day of the Week				
Sunday	61	6.78	64	6.27
Monday	153	17.00	164	16.08
Tuesday	157	17.44	162	15.88
Wednesday	119	13.22	144	14.12

Factor	Severe Injuries (n =1,020)		Non-Severe Injuries (n = 900)	
	n	**%**	**n**	**%**
Thursday	131	14.56	173	16.96
Friday	147	16.33	168	16.47
Saturday	132	14.67	145	14.22
Chi-Square (χ^2) = 3.23				
p-value = 0.779				
Cramer's V = 0.04				
Month				
January	48	4.71	50	5.56
February	105	10.29	68	7.56
March	117	11.47	76	8.44
April	56	5.49	73	8.11
May	74	7.25	72	8.00
June	76	7.45	93	10.33
July	97	9.51	71	7.89
August	93	9.12	97	10.78
September	96	9.41	90	10.00
October	89	8.73	81	9.00
November	99	9.71	67	7.44
December	70	6.86	62	6.89
Chi-Square (χ^2) = 24.57				
p-value = 0.011				
Cramer's V = 0.11				
Industry Type				
Other Public Services	29	2.84	38	4.22
Agriculture & Fisheries	14	1.37	6	0.67
Technology & Communication	9	0.88	13	1.44
Finance, Insurance, and Support Services	2	0.20	4	0.44
Construction & Engineering	121	11.86	125	13.89
Transport & Logistics	37	3.63	53	5.89
Trade & Wholesale/Retail Sales	127	12.45	132	14.67
Services & Tourism	65	6.37	71	7.89
Energy & Utilities	15	1.47	13	1.44
Manufacturing Industry	601	58.92	445	49.44
Chi-Square (χ^2) = 25.08				
p-value = 0.003				
Cramer's V = 0.11				
Nature of Injury				
Superficial Wounds, Burns, Bruises	237	23.24	404	44.89
Deep Wounds	382	37.45	306	34.00
Bone and Joint Fractures or Dislocations	385	37.75	162	18.00
Asphyxiation, Poisoning, Chemicals	16	1.57	28	3.11

Factor	Severe Injuries (n =1,020)		Non-Severe Injuries (n = 900)	
	n	**%**	**n**	**%**
Chi-Square (χ^2) = 14.60 **p-value < 0.001** **Cramer's V = 0.27**				
Injured Body Part				
Other Body Parts	10	0.98	1	0.11
Hands, Arms, Shoulders	525	51.47	404	44.89
Head, Face, Neck	124	12.16	228	25.33
Hips, Waist, Torso	96	9.41	80	8.89
Feet, Ankles, Legs, Knees	265	25.98	187	20.78
Chi-Square (χ^2) = 61.50 **p-value < 0.001** **Cramer's V = 0.18**				
Cause of Injury				
Lifting, Carrying, and Work Postures	91	8.92	81	9.00
Objects or Materials Striking, Cutting, Piercing	498	48.82	457	50.78
Collapsing Objects or Falling Debris	234	22.94	142	15.78
High Heat Exposure, Contact with Hot Surfaces	16	1.57	21	2.33
Exposure to Toxic Substances, Chemicals	66	6.47	128	14.22
Electric Shock	13	1.27	12	1.33
Falling from Heights	62	6.08	36	4.00
Vehicle Accidents	36	3.53	12	1.33
Other Causes	4	0.39	11	1.22
Chi-Square (χ^2) = 56.43 **p-value < 0.001** **Cramer's V = 0.17**				
Contributing Hazard				
Lifting and Work Posture	73	7.16	65	7.22
Machinery, Boilers, Pressure Vessels	109	10.69	46	5.11
Work Environment Conditions	49	4.80	49	5.44
Gas, Toxic Substances, Chemicals	18	1.76	37	4.11
Tools, Objects, or Materials	666	65.29	645	71.67
Electricity and Electrical Equipment	13	1.27	13	1.44
Vehicles	59	5.78	27	3.00
Buildings or Structures	33	3.24	18	2.00
Chi-Square (χ^2) = 41.95 **p-value < 0.001** **Cramer's V = 0.15**				
Size of Companies				
1-19 Employees	189	18.53	205	22.78
20-49 Employees	143	14.02	142	15.78

Factor	Severe Injuries (n =1,020)		Non-Severe Injuries (n = 900)	
	n	%	n	%
50-99 Employees	133	13.04	134	14.89
100-199 Employees	169	16.57	120	13.33
200-499 Employees	129	12.65	133	14.78
>500 Employees	257	25.20	166	18.44
Chi-Square (χ^2) = 21.19				
p-value = 0.001				
Cramer's V = 0.11				

The study analyzed the factors associated with severe occupational injuries among employees in Songkhla Province in 2023. The results revealed no statistically significant relationship between the day of the week and severe occupational injuries when compared to Sunday. The adjusted odds ratio (AOR) for the other days ranged from 1.04 to 1.46, with Thursday having the highest AOR at 1.46 (95% CI = 0.92 - 2.30), followed by Wednesday with an AOR of 1.30 (95% CI = 0.82 - 2.07). In terms of months, severe occupational injuries varied, with February (AOR = 1.87, 95% CI = 1.19 - 2.96, p = 0.007), March (AOR = 1.93, 95% CI = 1.24 - 3.02, p = 0.004), July (AOR = 1.88, 95% CI = 1.19 - 2.98, p = 0.007), November (AOR = 2.14, 95% CI = 1.35 - 3.40, p = 0.001), and December (AOR = 1.70, 95% CI = 1.04 - 2.79, p = 0.036) showing significant statistical associations with severe injuries compared to January. Regarding the type of business, agriculture and fisheries (AOR = 3.21, 95% CI = 1.01 - 10.16, p = 0.047) were found to have a significantly higher risk (3.21 times higher) of severe injuries compared to other public service sectors. The severity of injuries was also linked to specific injury types. Deep wounds (AOR = 2.23, 95% CI = 1.74 - 2.86, p < 0.001) and fractures or dislocations of bones and joints (AOR = 3.90, 95% CI = 2.93 - 5.18, p < 0.001) had significantly higher risks of severe injuries compared to superficial cuts, burns, or bruises. Specifically, deep wounds had a 2.23 times higher risk of severe injury compared to superficial cuts, while fractures or joint dislocations had a 3.90 times higher risk. Injuries to the head, face, or neck (AOR = 0.07, 95% CI = 0.01 - 0.62, p = 0.017) and to the hips, waist, or torso (AOR = 0.11, 95% CI = 0.01 - 0.98, p = 0.048) were associated with significantly lower risks of severe injury compared to injuries to other body parts, with reductions of 93% and 89%, respectively. Concerning the causes of injury, accidents involving collapsing objects or materials falling (AOR = 1.58, 95% CI = 1.05 - 2.39, p = 0.030), falls from heights (AOR = 1.78, 95% CI = 1.02 - 3.10, p = 0.041), and vehicle-related accidents (AOR = 4.07, 95% CI = 1.83 - 9.06, p = 0.001) were significantly associated with an increased risk of severe occupational injuries. Vehicle-related accidents had the highest risk, with a 4.07 times greater likelihood of resulting in severe injuries compared to heavy lifting incidents. Factors related to machinery, boilers, and pressure vessels (AOR = 1.52, 95% CI = 0.75 - 3.07, p = 0.240), the work environment (AOR = 0.91, 95% CI = 0.50 - 1.68, p = 0.766), exposure to gases, toxic substances, or chemicals (AOR = 0.62, 95% CI = 0.23 - 1.65, p = 0.335), tools or objects (AOR = 0.77, 95% CI = 0.42 - 1.41, p = 0.397), electrical equipment (AOR = 0.61, 95% CI = 0.05 - 7.83, p = 0.706), vehicles (AOR = 1.24, 95% CI = 0.54 - 2.81, p = 0.611), and buildings or structures (AOR = 1.30, 95% CI = 0.61 - 2.77, p = 0.499) were not significantly associated with severe occupational injuries. Finally, regarding the size of the workplace, establishments with 500 or more employees had a significantly higher risk of severe injuries (AOR = 1.54, 95% CI = 1.09 - 2.19, p = 0.015) compared to those with 1-19 employees.

3.2 Factors Associated with Severe Occupational Injuries

The study found no statistically significant relationship between the day of the week and severe injuries when compared to Sunday, suggesting that there are no specific work-related factors that heighten injury risks on certain weekdays. However, Sunday had the lowest injury frequency due to it being a common rest day, consistent with findings by Gomes et al. (2023), which indicated that weekdays have a higher occurrence of severe injuries than weekends(Gomes et al., 2023). The increase in severe injuries in February, March, July, November, and December may be related to seasonal weather conditions, such as working outdoors during the summer or rainy season, which may increase the chance of being injured. In addition, the increase in accidents in November may be related to work pressures at the end of the year, which may lead to increased stress and fatigue. This is consistent with the study by Gomes et al. (2023) who found seasonal variation in severe injury rates, with more severe injuries reported during the summer season (Gomes et al., 2023; Lyu & Song, 2024; Morabito et al., 2006).

The agriculture and fishing industries are significantly more susceptible to severe injuries than other sectors due to the nature of these jobs, the use of heavy equipment, hazardous outdoor environments, and the prevalence of marine fishing activities in Songkhla Province. Fuentes-Bargues et al. (2023) indicated that the agriculture sector accounted for 4.7% of all serious occupational injuries (Fuentes-Bargues et al., 2023b).

Deep wounds, fractures, or dislocations are significantly more likely to cause serious injury than superficial wounds or bruises, possibly due to the nature of the work involved, including the use of heavy machinery or working at height, which increase the likelihood of serious injury. Baraza et al. (2023) found that bone and joint injuries were the most common in the industrial sector, accounting for 55.9% of all occupational accidents(Baraza et al., 2023; Mohammadfam et al., 2014). Occupational injuries to the head, neck, torso, and hips have been found to be both preventable and risky, depending on the context of the injury and the work conditions. Personal protective equipment (PPE), such as hard hats, can reduce the severity of injuries in these areas. However, head injuries, especially traumatic brain injuries or skull fractures, often result in long recovery times and may lead to extended work absences, aligning with Onder's (2013) findings on the impact of head injuries on work stoppage(Onder, 2013). Vehicle accidents were found to be a significant risk factor for severe injuries, with a 4.07 times higher likelihood of severe injury compared to heavy lifting and postural issues. This aligns with the high frequency of vehicle-related workplace accidents in Thailand (Masinaei et al., 2022; Office of the Workmen's Compensation Fund, Social Security Office, Thailand, 2023; Park et al., 2024). Additionally, falls from heights and being struck by falling objects were also identified as significant injury risks, consistent with Farahbod et al. (2021), who found that falls from height accounted for 52.4% of all workplace accidents (Farahbod et al., 2021). Lastly, larger enterprises with over 500 employees had a higher risk of accidents (AOR = 1.54), potentially due to complex operations and challenges in managing safety standards effectively without proper oversight. Baraza et al. (2023) also reported that large companies had the highest accident rates compared to smaller enterprises(Baraza et al., 2023).

Table 2: *Factors Associated with Severe Occupational Injuries*

Factor	COR	AOR	95%CI	p-value
Month				
January	Ref.			
February	1.89	1.87	1.19 - 2.96	0.007*
March	1.88	1.93	1.24 - 3.02	0.004*
July	1.67	1.88	1.19 - 2.98	0.007*
November	1.81	2.14	1.35 - 3.40	0.001*
December	1.38	1.70	1.04 - 2.79	0.036*
Industry Type				
Other Public Services	Ref.			
Agriculture & Fisheries	3.06	3.21	1.01 - 10.16	0.047*
Nature of Injury				
Superficial Wounds, Burns, Bruises	Ref.			
Deep Wounds	2.13	2.23	1.74 - 2.86	<0.001*
Bone and Joint Fractures or Dislocations	4.05	3.90	2.93 - 5.18	<0.001*
Injured Body Part				
Other Body Parts	Ref.			
Head, Face, Neck	0.05	0.07	0.01 - 0.62	0.017*
Hips, Waist, Torso	0.12	0.11	0.01 - 0.98	0.048*
Cause of Injury				
Lifting, Carrying, and Work Postures	Ref.			
Collapsing Objects or Falling Debris	1.47	1.58	1.05 - 2.39	0.030*
Falling from Heights	1.53	1.78	1.02 - 3.10	0.041*
Vehicle Accidents	2.67	4.07	1.83 - 9.06	0.001*
Size of Companies (Employees)				
1-19	Ref.			
>500	1.68	1.54	1.09 - 2.19	0.015*

3.3 Model performance

To further assess the discriminatory ability of the model between severe and non-severe injuries, the Receiver Operating Characteristic (ROC) curve was applied, as presented below.

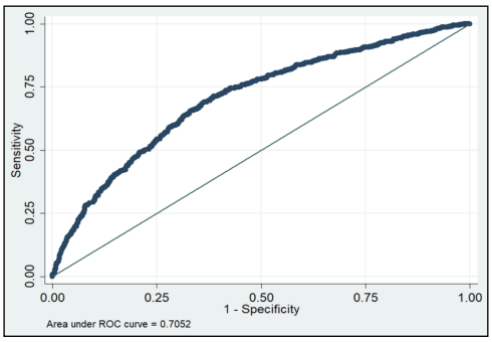

Figure 1. *ROC Curve of Model Performance.*

The goodness-of-fit of the logistic model used to assess occupational injury severity was tested by the Hosmer-Lemeshow method with 1,920 observations and 6 groups. The test statistic was chi2 = 5.59 and the corresponding p-value was 0.2322, indicating that the model fit the data very well., as the p-value is greater than the conventional threshold of 0.05, suggesting no significant deviation from the expected values. The model performance evaluation using the ROC curve in analyzing the relationship between factors and occupational injuries with the logistic model, as shown in Figure 1, revealed that the Area Under the Curve (AUC) is 0.7052. This indicates that the model has moderate to good discrimination ability between severe and non-severe injuries, as the AUC value falls within the range of 0.7 to 0.8, which is considered a satisfactory performance.

Potential Implications for Prevention and Policy

Beyond identifying risk factors, the findings of this study provide important implications for targeted prevention strategies and workplace safety policies. The observed seasonal variation, particularly the higher risk of severe injuries during February, March, July, and November, suggests the need for season-specific safety interventions, such as intensified safety inspections, heat stress management programs, and fatigue prevention measures during high-risk months. Employers and regulatory authorities could consider reinforcing safety communication and supervision during periods associated with increased workload or adverse weather conditions.

The significantly higher risk observed in the agriculture and fisheries sector highlights the importance of sector-specific safety regulations and tailored training programs. These industries often involve hazardous outdoor environments, heavy machinery, and limited regulatory oversight, indicating a need for strengthened enforcement of occupational safety standards, improved access to personal protective equipment, and practical safety training adapted to local working conditions.

In addition, injuries caused by falling objects, falls from heights, and vehicle-related accidents were strongly associated with injury severity. These findings support the implementation of engineering controls and administrative measures, such as improved machine guarding, fall protection systems, traffic management plans within worksites, and stricter compliance with safety procedures for high-risk tasks. Vehicle-related accidents, which showed the highest odds of severe injury, emphasize the importance of road safety policies, driver training, and vehicle maintenance programs in occupational settings.

The increased risk observed in large enterprises with more than 500 employees suggests that organizational complexity may challenge effective safety management. Large workplaces may benefit from strengthening safety management systems, including regular risk assessments, safety audits, and clear accountability structures to ensure consistent enforcement of safety practices across departments and work units.

Overall, these findings underscore the need for integrated prevention strategies combining regulatory enforcement, organizational safety management, and worker-focused interventions, particularly in high-risk sectors and during peak injury periods. Such targeted approaches could contribute to reducing the burden of severe occupational injuries in Songkhla Province and similar industrial contexts.

4. Conclusion

This study identified key factors associated with severe occupational injuries in Songkhla Province, Thailand, including seasonal variation, industry type, injury characteristics, accident causes, and company size. Higher risks were observed during specific months, in agriculture and fisheries sectors, for injuries involving deep wounds and fractures, and for accidents related to falling objects, falls from height, and vehicles. These findings highlight the presence of distinct high-risk periods, sectors, and mechanisms of injury that warrant focused preventive attention.

From a policy and practice perspective, the results underscore the importance of targeted occupational safety interventions, particularly in high-risk industries and during peak injury months. Strengthening regulatory enforcement, enhancing sector-specific safety training, improving supervision for high-risk tasks, and reinforcing safety management systems in large enterprises may contribute to reducing the severity of occupational injuries. Integrating these measures into provincial and organizational safety strategies could improve the effectiveness of injury prevention efforts.

This study has several limitations, including reliance on secondary administrative data, which may lack detailed information on individual behaviors, safety culture, and workplace environmental conditions. As a result, causal relationships could not be fully established.

Future research should incorporate primary data collection, such as workplace observations, worker surveys, or qualitative approaches, to better understand behavioral, organizational, and environmental determinants of injury severity. Longitudinal studies and evaluations of specific safety interventions or policy implementations would also be valuable in assessing their effectiveness and informing evidence-based occupational safety policies in Thailand and similar settings.

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Declaration of Interest Statement

The authors declare that there are no conflicts of interest regarding the publication of this article. This research did not receive any financial support or benefits from commercial or non-profit sectors that could be perceived as a potential conflict of interest.

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