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Original Article

Prevalence of accidents and injuries and related factors of fishermen fishing offshore in the North of Vietnam

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ABSTRACT

Introduction: Seafaring, particularly offshore fishing, exposes fishermen to various occupational risks leading to diseases and injuries. This study aimed to determine the prevalence of occupational risks, injury accidents, and contributing factors among offshore fishers in North Vietnam, to develop evidence-based recommendations to enhance their safety and well-being.

Methods: A cross-sectional study was conducted involving 420 fishermen with a minimum of two years of experience. Interviews were conducted between 2018 and 2020.

Results: The findings indicated that there is a 41.7% prevalence of accidents and an average injury rate of 280.2 per person per year. Most incidents occurred at night with 104 cases (59.4%), slips and falls 48 cases (27.4%), broken winch lines 40 cases (22.9%), and ship collisions 14 cases (8.0%) being the primary causes. The most common injuries included soft wounds in 92 cases (52.5%) and sprains/dislocations in 14 cases (8.0%). Fishermen with fewer than 10 years of experience exhibited a higher accident risk (odds ratio = 1.54; 95% confidence interval: 1.05-2.72), as did those in the role of a fisherman (odds ratio: 1.68; CI: 0.97-2.94) and those working without labor protection (odds ratio: 3.68; CI: 1.05-12.93).

Conclusion: Lack of labor protection equipment increased the risk by 3.68 times, and fishermen had a 2.02 times higher risk of injury. Addressing these risks requires adherence to labor protection regulations and safe working procedures.

Keywords: Accidents and Injuries, Fishing Vessels, Fishermen, Occupational Hazard

Introduction

Annually, out of the 4.4 million deaths attributed to injuries, approximately 3.16 million lives are claimed by unintentional injuries, while violence-related injuries account for 1.25 million fatalities.[1] The consequences of accidents and injuries extend beyond the physical harm inflicted upon victims, significantly impacting socioeconomic aspects, and severely compromising their quality of life.[2–5] Seafaring, particularly the fishing industry, entails a demanding and perilous occupation. Fishing vessels serve as both living quarters and workplaces for fishermen during their journeys at sea. Working conditions in these maritime environments are exceedingly challenging, characterized by harsh natural elements such as large waves, high winds, and substandard working conditions (e.g. vibrations, noise) that fail to meet recommended standards. It is worth

noting that fishing trips typically last for two to three weeks, and the workforce endures isolation, loneliness, and detachment from the mainland.[6,7] Working conditions on board fishing vessels often fall short of recommended standards, with factors like vibrations and noise contributing to the overall difficulty and potential risks.[8–10]

In Vietnam, accidents are progressively emerging as leading causes of mortality within healthcare facilities, exhibiting higher rates of fatalities and injuries when compared to infectious and non-communicable diseases.[11] With a vast territorial sea and exclusive economic zone, rich marine resources, and thousands of inhabited islands, Vietnam's fishing industry plays a vital role in the country's economy and food security.[12] The reliance on fishing as a livelihood exposes a large number of Vietnamese fishermen to the hazards and risks associated with seafaring. The statistics further emphasize the significance of the fishing industry in Vietnam, with over 45.3 thousand small-scale fishing vessels and a total of 95.24 thousand motorized marine fishing vessels as of December 2021.[13]

The study aimed to provide insights into various aspects, including the socio-demographic profiles of fishermen, the challenging working conditions they encounter at sea, the prevalent types of accidents they experience, and the characteristics of injuries in terms of their nature and location. By addressing these facets, the study aimed to enhance our understanding of the complexities surrounding accidents and injuries in this occupational setting, ultimately informing strategies and interventions to improve the safety and well-being of fishermen.

Methods

The study used a descriptive cross-sectional design. The research topic obtained approval from the research ethics committee of the Institute of Marine Medicine, Vietnam (Ref. No: 29/2018/QĐ-YHB). All subjects voluntarily participated in the study, and a consent form was obtained from each participant.

The research focused on fishermen working on offshore fishing vessels in the Northern region of Vietnam. The inclusion criteria were fishermen with a minimum working experience of more than 2 years who agreed to participate in the study. Exclusion criteria encompassed those with less than 2 years of fishing experience, those who declined to participate, and those who were primarily engaged in occupations other than fishing, as their experiences and risks may differ significantly from those of full-time fishermen.

The research was conducted in various locations within the Northern region of Vietnam, including Quang Ninh, Hai Phong, Nam Dinh, and Thanh Hoa. These four northern provinces were selected due to their proximity to the sea, making them suitable for studying offshore fishing activities, the associated occupational risks in the region and the study period spanned from 5 June 2018 to 5 June 2020.

The sample size determination employed the formula:

$$n = Z^2 * p(1-p) / \varepsilon^2$$

Where:

n: required sample size

Z: confidence coefficient,

chosen as Z = 1.96 for a 95% confidence level

p: rate of accidents and injuries in the community, set at 50%

ε: margin of error, set at 5%

By substituting the values into the formula, the minimum sample size was determined to be 385. However, to ensure higher reliability, the study included a sample size of 420 participants. The sampling method employed was simple random sampling.

Data were collected through direct interviews with the 420 participants engaged in offshore fishing in the Northern region of Vietnam. Data were collected by trained research assistants using structured questionnaires. The research content encompassed the following aspects:

Outcome variables characteristics related to accidents and injuries in the last two years were collected, such as the rate, timing, and location of accidents and injuries on the ship, causes of

accidents, and the place of injuries on the body.

The study investigated several socio-demographic characteristics of fishermen as independent variables, including age, sex, length of service, educational level, ship's operating range, types of fishing boats utilized, and rank on board. Furthermore, descriptive variables about accidents were examined, such as the location of the body damaged by accidents and the cause of the most recent accident on the boat.

Data entry, cleaning, and processing for preliminary data analysis were performed using Stata version 15. The collected data were summarized through descriptive analysis, presenting frequencies, proportions, and graphs. Bivariate analysis was conducted using either the chi-square test or Fisher's exact test, aiming to examine the associations between study variables. Additionally, binary logistic regression analysis was calculated. The model inclusion criteria were set at a significance level of $p < 0.05$. Adjusted risk ratios (ARRs) with corresponding 95% confidence intervals were calculated. Statistical significance was determined at a p-value < 0.05.

Results

Table 1 provides an overview of the sociodemographic characteristics of the participants. Age distribution showed a substantial representation across various age groups, with a significant proportion falling in the 30-39 years category with 158 participants (37.6%). In terms of occupational experience, a notable number of 187 (44.5%) participants had from 10 to 19 years of experience in the fishing industry. Academic qualifications indicated a range of educational backgrounds, with a significant portion of 174 (41.1%) having completed middle school education. The study also highlighted the prevalence of 319 (76%) individuals in the role of fishermen, comprising the majority of the sample, along with fishing boat captains and mechanics.

Table 1: General characteristics of participants (n=420)

Variable		N (%)
Age (years)	20-29	92 (21.9)
	30-39	158 (37.6)
	40-49	125 (29.8)
	50	45 (10.7)
Occupation (year)	< 10	151 (36.0)
	10-19	187 (44.5)
	20	82 (19.5)
Academic level	Illiteracy	31 (7.4)
	Elementary	169 (40.2)
	Middle School	174 (41.4)
	High school and above	46 (11.0)
Position on the ship	Fishing boat captain	67 (16.0)
	Mechanic	34 (8.0)
	Fishermans	319 (76.0)

Table 2 provides a comprehensive overview of the rate of accidents and injuries among fishermen involved in offshore fishing activities during the study period. A total of 175 participants, constituting 175 cases (41.7%) of the sample, reported experiencing injuries, while 245 participants (58.3%) had not suffered injuries. Among those who experienced accidents, the majority of participants 82(46.9%) reported having been involved in accidents only once, followed by 44 cases (25.1%) who had two accidents, 22 cases (12.6%) with three accidents, and 27 cases (19.4%) experiencing four accidents. Furthermore, the study examined

the time of accidents, with 104 cases (59.4%) occurring during nighttime hours and 71 cases (40.6%) during the daytime. Regarding the location of accidents, the deck was the most common site, accounting for 121 cases (69.1%), followed by the machine tunnel in 21 cases (12.0%), boat side in 14 cases (8.0%), and underwater in 19 cases (10.9%).

Table 2: Characteristics of fisherman's accident and injury

Variable		**N (%)**
Injury	Yes	175 (41.7)
	No	245 (58.3)
Frequency of accidents	1 time	82 (46.9)
	2 times	44 (25.1)
	3 times	22 (12.6)
	4 times	27 (19.4)
Time of accidents	Daytime	71 (40.6)
	Night	104 (59.4)
The location of the accident occurred	Deck	121 (69.1)
	Machine tunnel	21 (12.0)
	Boatside	14 (8.0)
	Underwater	19 (10.9)

Table 3: Causes and nature of injury of accidents and injuries

Variable		**N (%)**
Reason	Complications due to pressure	8 (4.6)
	Ship engine repair	11 (6.3)
	Poisoning	6 (3.4)
	Sea snake bites, fish fins stab	14 (8.0)
	Winch, winch rope broken	40 (22.9)
	Fall	48 ()27.4
	The train collided	14 ()8.0
	Labor tools on board	13 (7.4)
	Burn	12 (6.9)
	Fight	9 (5.1)
The nature of the damage	Software wound	92 (52.5)
	Sprains, dislocations	14 (8.0)
	Fracture	12 (6.9)
	Partial amputation	7 (4.0)
	Joint pain (reduced pressure)	4 (2.3)
	Traumatic brain injury	4 (2.3)
	Falling into the sea	14 (8.0)
	Poisoning	6 (3.4)
	Vascular wound	6 (3.4)
	Paralysis (hypotension)	4 (2.3)
	Burn	12 (6.9)

Table 3 presents a detailed breakdown of the leading causes of accidents and injuries among fishermen involved in offshore fishing activities. Among the reported reasons for injuries, several

factors were identified. The most common cause of injuries was "fall" accounting for 48 cases (27.4%), followed by winch, winch rope broken at 40 cases (22.9%). Additionally, injuries resulting from ship engine repair, sea snake bites, fish fins stabbing, and the train collision were also noted. When examining the nature of the injuries sustained, soft tissue wounds constituted the majority, with 92 cases (52.5%).

Table 4 displays a comprehensive breakdown of the specific locations of injuries resulting from accidents among fishermen. Among the reported locations of injury, the most commonly affected area was the shoulder, forearm, arm, and hand, accounting for 79 cases (45.1%). In addition, thighs, legs, and feet were affected in 43 cases (24.6%), indicating the vulnerability of lower extremities to injuries. Body injuries were 20 cases (11.4%, followed by abdomen, back, and pelvis with 14 cases (8%). While head, eye, and dento-maxillo facial injuries were less common, they underscored the diverse range of injuries experienced by the participants.

Table 4: Injury locations on the body caused by accidents and injuries

Location of injury	N (%)
Body	20 (11.4)
Head	10 (5.7)
Eye	2 (1.2)
Dentomaxillo facial	3 (1.7)
Chest	4 (2.3)
Abdomen, back, pelvis	14 (8.0)
Thighs, legs, feet	43 (24.6)
Shoulder, forearm, arm, hand	79 ()45.1

Table 5 provides valuable insights into the association between various factors and the risk of injury among fishermen. In terms of academic level, participants with high school and above education exhibited a lower percentage of injuries with 13 cases (28.3%) compared to those with below middle school 96 cases (48%) or middle school 66 cases (37.9%). Furthermore, career experience played a role, as participants with less than 10 years of experience had a higher injury percentage with 67 cases (44.4%) than those with 10 or more years of experience 108 cases (40.1%), with a statistically significant OR of 1.54.

Additionally, working position showed associations with injuries, with fishermen participants having a significantly higher injury percentage of 148 cases (46.4%) than the mechanic group with 5 cases (14.7%), accompanied by an OR of 3.87. Ship capacity and the use of labor protection were also significantly associated with injury rates.

Table 5: Multivariate analysis of factors related to injury accidents

Variables	Injuries		95% CI	p-value
	Yes (%)	No (%)		
Academic level				
Below Middle School	96 (48)	104 (52)		
High school and above	13 (28.3)	33 (71.7)	2.47 (1.23-4.95)	0.01
Career age (year)				
<10	67 (44.4)	84 (55.6)		

Variables	Injuries		95% CI	p-value
	Yes (%)	No (%)		
≥10	108 (40.1)	161 (59.9)	1,54 (1,05-2,72)	0.027
Working position				
Fisherman	148 (46.4)	171 (53.6)		
Mechanic Group	5 (14.7)	29 (85.3)	3,87 (1,11-13,55)	0.034
Ship capacity				
< 150 CV	27 (75)	9 (25)		
150-400CV	115 (40.9)	166	5,49 (2,39-12,64)	<0.001
> 400CV	33	70	8,39 (3,37-20,87)	<0.001
Using labor protection				
No	173	228		
Yes	3	15	3,68 (1,05-12,93)	0.03
Rank				
Fisherman	152	186		
Ship owner	23	59	2,02 (1,18-3,39)	0.009

Discussion

The present study provides valuable insights into the factors associated with accidents and injuries among fishermen working on offshore fishing vessels in the North of Vietnam. The analysis of sociodemographic characteristics revealed that the majority of fishermen had a working age of 10-19 years, followed by less than 10 years, while those with a working age of ≥20 years constituted a smaller proportion. This finding is consistent with a study conducted by Amadou Barrow in a different region, indicating similarities in the age distribution of fishermen.[14] Regional differences in the age composition of the fishing workforce can be attributed to various factors, including economic opportunities, cultural traditions, regulatory policies, migration patterns, economic incentives, and technological advancements. These factors collectively influence the number of younger and older individuals engaged in fishing in different regions, highlighting the need for tailored approaches to address the unique challenges faced by fishermen in each area.

Regarding education levels, the present study's findings align with previous research, which emphasized a prevalent low level of education among fishermen, with a significant proportion having only primary or lower secondary education.[15,16] These findings collectively emphasize the need for targeted interventions and educational initiatives to improve the socio-demographic characteristics of fishermen. Enhancing access to education and vocational training programs could potentially contribute to safer working conditions and reduce the risk of accidents and injuries. Furthermore, the findings underscore the importance of considering the unique characteristics of the local fishing workforce when designing preventive measures and safety regulations.

The study also examined the rate of accidents and injuries among the fishermen during the study period, revealing a relatively high overall rate of incidents, with 41.7% of the participants reporting accidents and injuries. The calculated rate of accidents per person per year further emphasizes the significant occupational risks faced by fishermen in this region. The findings regarding the timing and location of accidents and injuries align with previous research by the U.S. Department of Health and Human Services Centers for Disease Control and Prevention, highlighting a substantial number of incidents occurring at night and on deck. This emphasizes the importance of implementing appropriate lighting and safety measures during nighttime

operations and emphasizing safety protocols for deck activities.[17]

Moreover, the leading causes of accidents and injuries identified in this study, such as slip and fall incidents, broken winch lines, sea snake bites, and fish fin stabs, are consistent with findings from previous studies.[18,19] These findings underscore the need for targeted interventions focusing on slip and fall prevention, improving winch line safety, and enhancing first aid and emergency response capabilities to address the specific injury patterns observed.

The analysis of the location of injuries on the body revealed that the upper extremities were the most commonly affected area, followed by lower limb injuries. Systemic damage, such as drowning and poisoning, accounted for a smaller proportion of injuries, while head injuries were relatively infrequent.[20,21] These findings highlight the importance of promoting safety practices that specifically address upper extremity and lower limb protection, such as the use of personal protective equipment and ergonomic measures.

The logistic regression analysis provided valuable insights into the factors associated with the risk of injury among fishermen. It was observed that fishermen with a working age of less than 10 faced a significantly higher risk of injury than those with a working age of ≥10 years (with a p-value of 0.027). This suggests that experience and familiarity with the occupational hazards associated with fishing may play a role in reducing the risk of injuries.[14] Additionally, the group of professional friends, responsible for direct involvement in fishing activities, exhibited a higher risk of injury compared to the boat drivers and engine group. This highlights the importance of training and safety measures targeted specifically at the tasks performed by the group of professional friends.

Furthermore, the analysis revealed that fishermen working on ships with a capacity of <150CV were at a significantly higher risk of injuries compared to those operating ships with higher capacities (with p-value < 0.001). This suggests that vessel characteristics and functionality may contribute to the occurrence of accidents and injuries, with small vessels potentially being more susceptible to adverse sea conditions and other hazards.[22] The study also found that fishermen who did not use labor protection measures or used them infrequently had a higher risk of accidents or injuries. This underscores the significance of promoting and enforcing the use of appropriate safety equipment and practices to reduce the risk of harm.

This study sheds light on the sociodemographic characteristics, rates, causes, and nature of accidents and injuries among fishermen working on offshore fishing vessels in the North of Vietnam. The findings are consistent with global trends. Commercial fishery is a hazardous occupation, with hundreds of fishers injured and more than 80 fishers dying daily while involved in fishing operations.[23] In developing countries, between 20% and 50% of the workforce is exposed to health risks. The fishing industry is reported to be one of the most dangerous occupations with about 120 million accidents and 200,000 fatalities annually at the global level.[24] These data underscore the significant occupational risks faced by fishermen worldwide and highlight the need for targeted interventions and safety measures to reduce accidents and injuries in this sector.

One limitation of this study is that it focused solely on offshore fishing vessels in the North of Vietnam, which may limit the generalizability of the findings to other regions or types of fishing operations. Additionally, the study relied on self-reported data, which could introduce reporting bias and under-reporting of incidents.

Conclusions

The findings highlight the need for targeted interventions and comprehensive safety measures to mitigate the risks faced by fishermen. These results underscore the need for tailored interventions and safety measures that account for the unique characteristics of the local fishing workforce. With a high incidence of accidents and injuries, particularly in the context of occupational

risks faced by fishermen globally, there is an urgent call for comprehensive safety initiatives and targeted interventions. By addressing the specific challenges related to age, education, timing, location, and causes of incidents, policymakers and industry stakeholders can work together to enhance the safety and well-being of fishermen in Vietnam and set an example for safer practices in the fishing industry worldwide.

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