Epidemiology of occupational hazards and injuries among fishermen at Tanji fishing site in The Gambia: an analytical cross-sectional study design

Authors: Barrow, Amadou, Kongira, Amadou, Nget, Musa, Sillah, Saikou Omar, Jatta, Solomon PS, et al.

Source: Environmental Health Insights, 16(1)

Published By: SAGE Publishing

URL: https://doi.org/10.1177/11786302221088699

Epidemiology of occupational hazards and injuries among fishermen at Tanji fishing site in The Gambia: an analytical cross-sectional study design

Environmental Health Insights
Volume 16: 1–10

DOI: 10.1177/11786302221088699

Amadou Barrow[1,2], Amadou Kongira[1], Musa Nget[1], Saikou Omar Sillah[1], Solomon PS Jatta[1], Mansour Badjie[1] and Rex A Kuye[2]

[1]School of Public Health, Gambia College, Brikama, The Gambia. [2]Department of Public and Environmental Health, School of Medicine and Allied Health Sciences, University of The Gambia, Kanifing, The Gambia.

ABSTRACT: Fishing is a well-known industry, and there are certain risks of work-related diseases and accidents, occupational hazards and safety issues. This study aimed at examining the determinants of occupational hazards and injuries among fishermen at Tanji fishing site, a major fish-landing site in the Gambia, West Africa. An analytical cross-sectional design was conducted in August to October 2019. Structured questionnaires were administered to fishermen at Tanji fishing site. A simple random sampling method was used to select fishermen in this study. Data entry and processing for preliminary data analysis was done using Stata version 15. Descriptive and bivariate analysis using chi-square/fisher exact test as well as binary logistics regression analysis were used. The adjusted risk ratios (aRRs) and confidence intervals of 95% were calculated. A *P*-value < .05 was considered for statistical significance. The proportion of occupational hazards were 95%, while reported injuries were 85%. Ergonomics, physical, and environmental/climatic hazards formed the majority at 25%, 23%, and, 21%, while muscle strains and falling formed the majority for types of injuries at 19% and 17%, respectively. Fishermen who used PPE (aRR: 0.12and 95% CI: 0.01-0.99) were less likely to have occupational hazards relative to those who did not use PPE. In terms of injuries, fishermen who were smokers (aRR: 3.18, 95% CI: 1.32-7.66), had chemical hazards (aRR: 3.14, 95% CI: 1.26-7.86) and had no fishing safety rules (aRR: 2.81, 95% CI: 1.15-6.85) were more likely to sustained injuries relative to other categories after controlling for confounders. This research found a high prevalence of OSH hazards and injuries among fishermen, highlighting the critical nature of strengthening safety regulatory services for this workforce.

KEYWORDS: Occupational hazards, injuries, fishermen, The Gambia, Ergonomics

RECEIVED: January 5, 2021. **ACCEPTED:** February 27, 2022.

TYPE: Original Research Article

FUNDING: The author(s) received no financial support for the research, authorship, and/or publication of this article.

DECLARATION OF CONFLICTING INTERESTS: The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

CORRESPONDING AUTHOR: Amadou Barrow, Department of Public and Environmental Health, School of Medicine and Allied Health Sciences, University of The Gambia, Kanifing, The Gambia. Email: abarrow@utg.edu.gm

Background

Fishing is a well-known industry, and there are certain risks of work-related diseases and accidents, occupational hazards and safety issues. Depending on the types of operation, fishermen may be vulnerable to major injuries and occupational hazards, which significantly impact public health. Work-related health risks are attributed to almost 2.78 million deaths worldwide. In developing countries, between 20% and 50% of the workforce is exposed to health risks.[1] According to the International Labor Organization (ILO), due to its vulnerability, the fishing sector has one of the highest mortality rates in the workplace; and in most cases, when a death occurs at sea, there is no emergency care.[2,3] Due to the numerous hazards and health risks recorded from the ancient occupation, the fishing industry is reported to be one of the most dangerous occupations with about 120 million accidents and 200 000 fatalities annually at global level.[4,5] In the developed countries, reports have revealed that countries that accounted for fisheries-related accidents, often show rates higher than 100 fatalities per 100 000 active fishers.[6]

In 2007, substandtial work on Fishing Convention was adopted during the 96th International Labour Conference of ILO. The convention demands that fishers should have acceptable working conditions on boarding fishing vessels related to basic standards, including work health & safety protection, health care, and social security. The Convention entered into force on 16 November 2017. As of 23 March 2020, 18 states have ratified the convention, including Senegal, Gambia's only neighbor.[6] Generally, fisheries play an imperative role in the attainment of the post-2015 United Nations Sustainable Development Goals (SDGs) 1, 2, and 3: poverty mitigation, end starvation, and ensuring healthy lives, respectively as the fish is a source of food and helps the body with essential nutrient for growth.[7] For the past 40 years, the international community including ILO, Food and Agricultural Organization (FAO), and the International Maritime Organization (IMO), have fisheries accidents and fatalities reporting part of their agenda. However, many countries still lack an effective reporting, injury and fatalities analysis system.[6] FAO estimates that more than 15 million people are aboard vessel employed[8] and amended its global estimate for the number of fatalities in the fisheries in 2019 to 32 000 casualties yearly. Worldwide, the number of fishing casualties increased from around 30 million to 40 million between 2000 and 2016 and this was the basis for the amendment.[6]

Common hazards and injuries reported in the fisheries industry include swelling of the eye, sunburns, falls, mechanical, and electrical accidents, etc. Furthermore, noise-induced loss, allergic respiratory conditions and work-related stress issues are predicted to substantially increase over some time without any organized and effective interventions.[4,9] Studies in Africa have reported cuts from sharp knives, eye redness, as well as pricks from fish spines as part of injuries and hazards. In Ghana, ocular disorders among the fisherfolk as a result of smoke and sun rays have been reported.[1] Another study in India reveals that the fisherfolk do not utilize medical services and are reluctant to recuperate and recover from injuries sustained.[10] Some of the distressing factors for fisher folks include exposure to cold, wind, rough seas, substantial involvement of physical effort, frequency of injuries during work, noise, inadequate hygiene, unexpected threats, failure with equipment, and psychological stress and economic stress pressure.[3,11] Slips, trips, falls, and exposure to loud noises are major physical dangers in handling facilities, while chemical mishaps, solvents, vapors, fumes, and unburned hydrocarbons are common chemical hazards.[3] Occupational dangers are produced by mechanical factors influencing the musculoskeletal system, whereas biological hazards are caused by parasite infection, bacteria or viruses, or injuries from animals such as shark or crocodile bites.[3] Fatal accidents constitute an inherent and unsolved problem among fishermen.[12] Fish processing is a series of events that spans the entire process of handling fish and fish products, from harvesting through customer delivery.[13]

The Gambia's industrial fisheries growth has been slow. Industrial fisheries produce only 10% of the total fish consumed in the country and 20% of the fish processed locally.[14] Most fishing vessels lawfully operating in Gambian waters are foreign-owned and land their catch abroad.[14] In The Gambia, a good percentage of the fish consumed comes from captured fisheries. The traditional fishing subsector employs between 25 000 and 30 000 people, while about 2,000 people enjoy the industrial sector employment. Beyond this, an estimated 200 000 people have their livelihoods dependent on fisheries and fisheries-related activities.[14] Artisanal fishing in the Gambia uses small boats, primarily canoes, that ply the sea and rivers.[15] Between 1997 and 2003, artisanal catches averaged 29 000 tons per year, with pelagic making up about 70% of the landings. Artisanal fishing employs between 25 000 and 30 000 people directly and indirectly, with 80% occurring along the Atlantic coast and 20% along the Gambia River.[15] Industrial fishing is smaller than artisanal fishing and generates 1500 to 2000 employment. Nevertheless, fishing and related activities support close to 200 000 people.[15]

Lack of data on occupational risks and fatalities associated with fish processing in Tanji and other coastal fishing areas in The Gambia. Fishers are exposed to health hazards and injuries both on and offshore. While fishing activities are known to attract high occupational fatality rates, the lack of specific information, especially on non-fatal injuries, has contributed to the serious under-reporting of the hazards and injuries registered among the fisherfolk. Hence, a better understanding of the working environment, the injuries and hazards are necessary to create solution-specific safety campaigns and interventions. This aimed at examining the determinants of occupational hazards and injuries among fishermen at Tanji fishing site, a major fish-landing site in the Gambia, West Africa.

Methods

Study area

The study was conducted in Tanji fishing center, Kombo South District, Gambia's West Coast Region. Tanji is a fishing community with a population of 14 531 people located 12 km southwest of Kololi resort.[16,17] The total population has been rising rapidly as a result of socioeconomic migration attracted by the fishing industry and the town's convenient location. Mandinka, Wolof, Jola, and Serer are the major ethnic tribes. Historically, the Serer has been involved in farming, crafts, and petty trading. The main village is approximately 1 km from the primary fishing area.[16] The Tanji community fishing center harbor was refurbished and opened in 2001, and is also one of the nation's seven key coastline artisanal fishing villages.[16] The fishing center's most distinguishing features include its dimly lit smoking huts, lines of stately African pirogues docked ashore, and housewives, boys, and women waiting to catch fish.[16]

Study design, population, and selection of participant

An analytical cross-sectional design was conducted in August to October 2019. The study was focused on exploring the OSH risks and hazards among fishermen in Tanji fishing site of The Gambia. Questionnaires were administered to fishermen at Tanji fishing site regardless of age, nationality, and sex. A simple random sampling method using the list of registered fishermen at Tanji fishing center was used to select participants for the study.

Sample size

A sample size of 240 was estimated using Cochran's formula with a work-related accident annual incidence of 82.6%,[18] z of 1.96 for 95% confidence level, and sampling error at 5%. However, the researchers adjusted the final sample size to 240 fishermen.

$$n_o = \frac{z^2(p)(q)}{e^2}$$

Data collection tools and techniques

Data were collected by trained research assistants using structured questionnaires. The information regarding socio-demographic factors, history of reported hazards and injuries, knowledge,

attitude and practices on OSH-related issues and activities were collected. The questionnaires were developed in English first, then translated into Mandinka and Wolof. The respondents were the fishermen at Tanji fishing site. Face to face interview was done with the Fishermen to collect data.

Study variables

Outcome variables. Reported injuries and hazards among fishermen were considered as outcome variables in this study. Reported hazards was classified into 2 categories: "Yes" recoded as "1" which denotes that the respondent had experienced a form of hazards at work and "No" recoded as "0" which denotes no experience of hazards at work. Reported injuries was classified into 2 categories: "Yes" recoded as "1" which denotes that the respondent had experienced a form of injuries at work and "No" recoded as "0" which denotes no experience of injuries at work.

Independent variable. The socio-demographic characteristics of fishermen include age, sex, length of service, marital status, educational level, smoking status, frequency of fishing daily, types of fishing boats used, family type, caregiver, monthly income of caregiver, etc. The various proximate factors, including duration of fishing activities, distance from clinics, fishing health-related hazards, and injuries, were also explored.

Ethical consideration

The study protocol was reviewed and ethical clearance was issued by the Gambia College's Research Committee (Ref. No: PH08012/2019) for the study. Furthermore, all methods were performed in accordance with GCRC guidelines. Before the commencement of the study, ethical approval was obtained from the community leader of Tanji. The people were informed about the nature of the study in their local languages (Mandinka and Wolof). Participation in the study was entirely voluntary and only those that accept to be part of the study were recruited. A written informed consent form was signed by each participant who accepted to be enrolled in the study.

Data analysis

Data entry, cleaning, and processing for preliminary data analysis was done using Stata version 15. Descriptive analysis was presented in frequencies, proportions, and graphs to summarize the data. Bivariate analysis using chi-square/fisher exact test as well as binary logistics regression analysis, including its Area Under Receiver Operating (ROC) Curve (AUROC), was done to identify the association between study variables. The inclusion criteria for the model was $P < .05$. The adjusted risk ratios (aRRs) and confidence intervals of 95% were calculated. A P-value $< .05$ was considered for statistical significance.

Results

The study recruited 240 fishermen in the coastal communities of Tanji with a 100% response rate.

Characterization of Fishermen in Tanji Coastal Fishing Community, Gambia

The mean age of fishermen was 39 years with a standard deviation of ±9. Majority of the fishermen (42%) were 35 years old and below. More than half of the participants spent 11 to 25 years as Fishermen with a mean years of 20 and SD of ±9. Six in every ten fishermen (60%) were reported as Non-Gambian nationals. About 84% were married, and 33% of the fishermen had never been to school. Sixty percent of the fishermen were smokers, and 71% reported spending more than 5 hours fishing per day with mean hours of 6 and SD ± 2. The mean number of years using the current boat was 5 with an SD of ±3, as shown in Table 1. Planked canoe with outboard engine formed the majority in terms of types of fishing boats used by 94%, and about 41% of the participants played the role of captain/skipper during fishing.

The proportion of occupational hazards were 95%, while reported injuries were 85%, respectively, as shown in Figure 1. In terms of types of occupational hazards reported across fishermen, ergonomics, physical and environmental/climatic hazards formed the majority at 25%, 23%, and 21%, respectively, as shown in Figure 2.

Muscle trains and falling were reported as the two most common types of injuries at 19% and 17%, respectively, as shown in Figure 3.

Characterization of occupational hazards and injuries among Fishermen in Tanji, Gambia

The proportion of occupational hazards was higher among planked canoes with outboard engine and low in paddle and drug-out canoe ($P = .05$), physical hazards ($P = < .001$), chemical hazards ($P = .003$), psychological hazards ($P < .001$), ergonomics ($P < .001$), environmental/climatic hazards ($P < .001$) and respiratory conditions ($P = .021$). In terms of injuries reported, some significant independent variables include smoking status ($p = .02$), physical hazards ($P = .05$), chemical hazards ($P = .004$), use of PPE ($P = .009$), and having no fishing safety rules for the vessel ($P = .006$), as shown in Table 2.

Determinants of occupational hazards and injuries among Fishermen

Fishermen using PPE were 88% (adjusted Risk Ratio (aRR): 0.12, 95% CI: 0.01-0.99) less likely to have hazards relative to those who do not use PPE, as shown in Table 3. The area under the ROC curve of 97.5% for the preferred model with at least 95.8% accuracy rate indicates the model's favorable sensitivity and specificity characteristics, as shown in Figure 4. It also indicates a good predictive potential of the fitted model to predict occupational hazards across fishermen in Tanji.

Table 1. Characteristics of study participants in Tanji, Gambia.

VARIABLES	FREQUENCY (N)	PERCENT
Age of participants in years		
35 and below	100	41.7
36-45	82	34.2
46 & above	58	24.2
Mean (±SD)	39 ± 9	
Length of service in years		
10 and below	41	17.1
11-25	134	55.8
26 & above	65	27.1
Mean (±SD)	20 ± 9	
Participants' nationality		
Gambian	95	39.6
Non-Gambian	145	60.4
Marital status		
Single	36	15
Married	201	83.8
Divorce	3	1.3
Level of education		
Never been to school	78	32.5
Madrassa	82	34.2
Primary school	36	15.0
Junior school	36	15.0
Secondary school	8	3.3
Smoking status		
Smoker	143	59.6
Non-smoker	97	40.4
Number of years using the current boat		
5 and below	137	57.1
6 and above	103	42.9
Mean (±SD)	5 ± 3	
Number of hours spent fishing in a day		
5 and below	70	29.2
6 and above	170	70.8
Mean (±SD)	6 ± 2	
What type of fishing boat do you use		
Planked canoe with outboard engine	225	93.8
Paddle canoe	5	2.1
Dug-out canoe with outboard engine	10	4.2
Roles played by participants during fishing		
Captain /skipper	98	40.8
Deckhand	62	25.8
Mechanic	31	12.9
General assistant	49	20.4

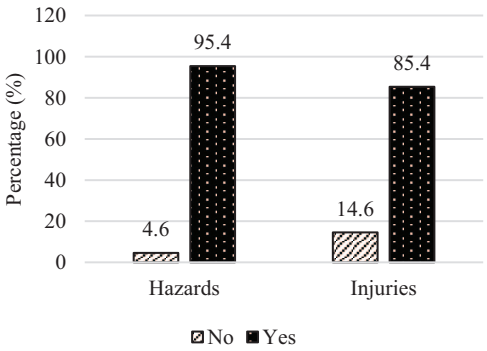

Figure 1. Showing prevalence of any form of hazards and injuries among fishermen in Tanji.

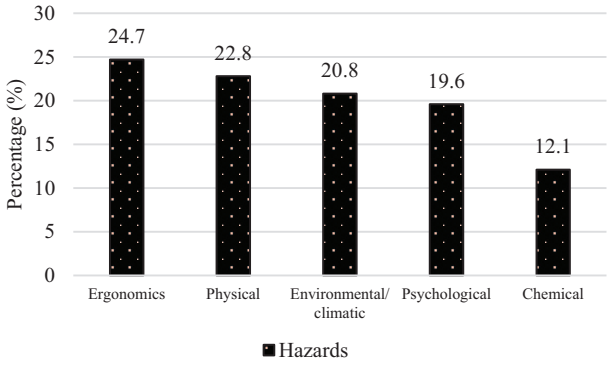

Figure 2. Showing Types of hazards reported among fishermen in Tanji.

As shown in Table 4, smokers' fishermen were 3.18 times (aRR: 3.18, 95% CI: 1.32-7.66) were more likely to have sustained injuries relative to non-smokers. Participants with chemical hazards were 3.14 times (aRR): 3.14, 95% CI: 1.26-7.86) more likely to sustain injuries relative to those without chemical hazards. Fishermen with no fishing safety rules were

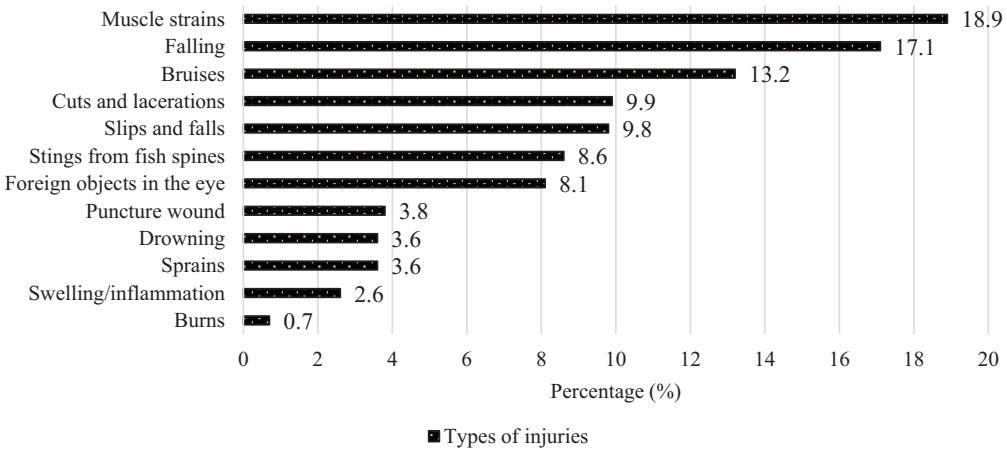

Figure 3. Showing Types of injuries sustained by fishermen in Tanji.

Table 2. Occupational hazards and injuries characteristics of fishermen in Tanji, Gambia.

VARIABLES	HAZARDS		*P*-VALUE	INJURIES		
	NO N (%)	YES N (%)		NO N (%)	YES N (%)	*P*-VALUE
Age of participants in years			.08			.75
35 and below	1 (0.4)	99 (41.2)		16 (6.7)	84 (35.0)	
36-45	6 (2.5)	76 (31.7)		10 (4.2)	72 (30.0)	
46 and above	4 (1.7)	54 (22.5)		9 (3.8)	49 (20.4)	
Length of service in years			.74			.82
10 and below	2 (0.8)	39 (16.2)		6 (2.5)	35 (14.6)	
11-25	5 (2.1)	129 (53.8)		21 (8.8)	113 (47.1)	
26 and above	4 (1.7)	61 (25.4)		8 (3.3)	57 (23.8)	
Participants' nationality			.76			.75
Gambian	5 (2.1)	90 (37.5)		13 (5.4)	82 (34.2)	
Non-Gambian	6 (2.5)	139 (57.9)		22 (9.2)	123 (51.2)	
Marital status			.76			.18
Single	0 (0.0)	36 (15.0)		2 (0.8)	34 (14.2)	
Married	10 (4.2)	191 (79.6)		33 (13.8)	168 (70.0)	
Divorce	1 (0.4)	2 (0.8)		0 (0.0)	3 (1.2)	
Level of education			.94			.72
Never been to school	4 (1.7)	74 (30.8)		13 (5.4)	65 (27.1)	
Madrassa	4 (1.4)	78 (32.5)		12 (5.0)	70 (29.2)	
Primary	2 (0.8)	34 (14.2)		4 (1.7)	32 (13.3)	
Junior	1 (0.4)	35 (14.6)		6 (2.5)	30 (12.5)	
Secondary	0 (0.0)	8 (3.3)		0 (0.0)	8 (3.3)	
Participants' smoking status			.78			.02*
Smoker	7 (2.9)	136 (56.7)		27 (11.2)	116 (48.3)	
Non-smoker	4 (1.7)	93 (38.8)		8 (3.3)	89 (37.1)	

(Continued)

Table 2. (Continued)

VARIABLES	HAZARDS		*P*-VALUE	INJURIES		
	NO N (%)	YES N (%)		NO N (%)	YES N (%)	*P*-VALUE
Number of years using the current boat			.86			.27
5 and below	6 (2.5)	131 (54.6)		17 (7.1)	120 (50.0)	
6 and above	5 (2.1)	98 (40.8)		18 (7.5)	85 (35.4)	
Number of hours spent fishing			.89			.47
5 and below	3 (1.2)	67 (27.9)		12 (5.0)	58 (24.2)	
6 and above	8 (3.3)	162 (67.5)		23 (9.6)	147 (61.2)	
What type of fishing boat do you use			.05*			.34
Planked canoe with outboard engine	9 (3.8)	216 (90.0)		31 (12.9)	194 (80.8)	
Paddle canoe	0 (0.0)	5 (2.1)		1 (0.4)	4 (1.7)	
Dug-out canoe with outboard engine	2 (0.8)	8 (3.3)		3 (1.2)	7 (2.9)	
Roles played by participants during fishing			.30			.26
Captain/skipper	7 (2.9)	91 (37.9)		18 (7.5)	80 (33.3)	
Deckhand	3 (1.2)	59 (24.6)		5 (2.1)	57 (23.8)	
mechanic	0 (0.0)	31 (12.9)		6 (2.5)	25 (10.4)	
General assistant	1 (0.4)	48 (20.0)		6 (2.5)	43 (17.9)	
Physical hazards			<.001*			.05*
No	11 (4.6)	39 (16.2)		3 (1.2)	47 (19.6)	
Yes	0 (0.0)	190 (79.2)		32 (13.3)	158 (65.8)	
Chemical hazards			.003*			.004*
No	11 (4.6)	128 (53.3)		28 (11.7)	111 (46.2)	
Yes	0 (0.0)	101 (42.1)		7 (2.9)	94 (39.2)	
Psychological hazards			<.001*			.63
No	11 (4.6)	66 (27.5)		10 (4.2)	67 (27.9)	
Yes	0 (0.0)	163 (67.9)		25 (10.4)	138 (57.5)	
Ergonomic hazards			<.001*			.43
No	11 (4.6)	23 (9.6)		3 (1.2)	31 (12.9)	
Yes	0 (0.0)	206 (85.8)		32 (13.3)	174 (72.5)	
Environmental/climatic hazards			<.001*			.62
No	11 (4.6)	56 (23.3)		11 (4.6)	56 (23.3)	
Yes	0 (0.0)	173 (72.1)		24 (10.0)	149 (62.1)	
Use of personal protective equipment			.74			.009*
No	7 (2.9)	161 (67.1)		31 (12.9)	137 (57.1)	
Yes	4 (1.7)	68 (28.3)		4 (1.7)	68 (28.3)	
Having no fishing safety rules for the vessel			.08			.006*
No	4 (1.7)	34 (14.2)		11 (4.6)	27 (11.2)	
Yes	7 (2.9)	195 (81.2)		24 (10.0)	178 (74.2)	

(Continued)

Table 2. (Continued)

VARIABLES	HAZARDS		*P*-VALUE	INJURIES		
	NO N (%)	YES N (%)		NO N (%)	YES N (%)	*P*-VALUE
Eye conditions			.50			.51
No	0 (0.0)	9 (3.8)		2 (0.8)	7 (2.9)	
Yes	11 (4.6)	220 (91.7)		33 (13.8)	198 (82.5)	
Respiratory conditions			.021*			.17
No	6 (2.5)	54 (22.5)		12 (5.0)	48 (20.0)	
Yes	5 (2.1)	175 (72.9)		23 (9.6)	157 (65.4)	
Muscular conditions			.70			.38
No	0 (0.0)	3 (1.2)		1 (0.4)	2 (0.8)	
Yes	11 (4.6)	226 (94.2)		34 (14.2)	203 (84.6)	

*Statistically significant

Table 3. Adjusted risk ratios for reported occupational hazards among Fishermen in Tanji, Gambia.

FACTORS	ARR	95% CI OF ARR		*P*-VALUE
		LOWER	UPPER	
Intercept	58.89	0.14	24 709.05	.18
Use of personal protective equipment				
Yes	0.12	0.01	0.99	.05*
No (reference)				
No fishing safety rules				
Yes	3.97	0.58	27.12	.16
No (reference)				

Abbreviations: aRR, adjusted Risk Ratio; CI, confidence interval. Estimates represent the log odds of "Hazard prevalence = Yes" versus *"Hazard prevalence = No"*
*Statistically significant.

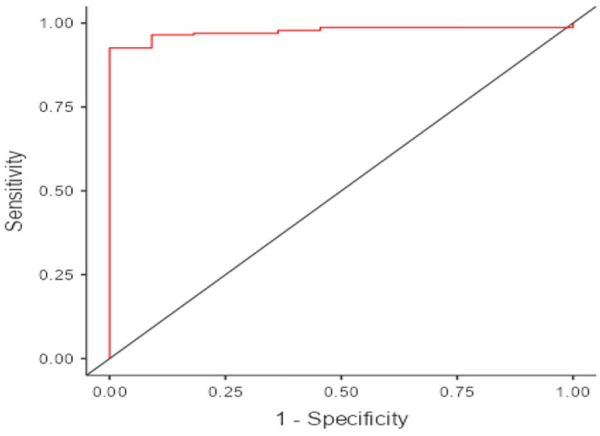

Figure 4. Showing area under receiver operating (ROC) curve (AUROC) of binary logistic models for predicting occupational hazards.

Table 4. Adjusted risk ratios for reported injuries among Fishermen in Tanji.

FACTORS	ARR	95% CI FOR ARR		*P*-VALUE
		LOWER	UPPER	
Intercept	2.77	0.71	10.85	.14
Smoking status				
Non-smoker	3.18	1.32	7.66	.01*
Smoker (Reference)	1			
Physical hazards				
Yes	0.30	0.08	1.08	.07
No (Reference)	1			
Chemical hazards				
Yes	3.14	1.26	7.86	.01*
No (Reference)	1			
Use of PPE				
Yes	3.04	0.98	9.37	.05
No (Reference)	1			
No fishing safety rules				
Yes	2.81	1.15	6.85	.02*
No (Reference)	1			

Abbreviations: aRR, adjusted Risk Ratio;CI, confidence interval. Estimates represent the log odds of "Injury prevalence = Yes" vs. "Injury prevalence = No."
*Statistically significant.

2.81 times (aRR: 2.81, 95% CI: 1.15-6.85) more likely to sustain injuries relative to those who do not have fishing safety rules. The area under the ROC curve of 76% for the preferred model with at least 86.7% accuracy rate indicates the model's

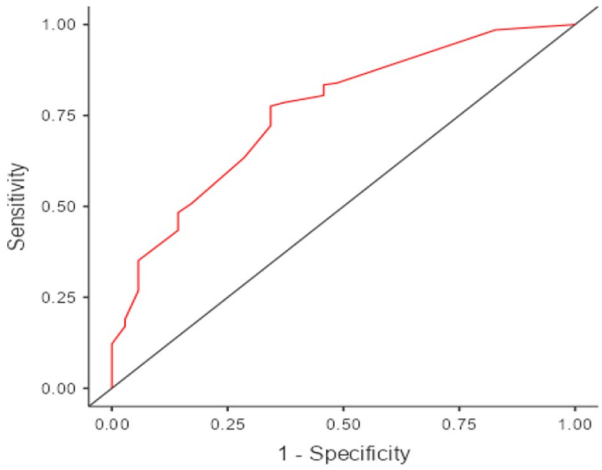

Figure 5. Showing area under receiver operating (ROC) curve (AUROC) of binary logistic models for predicting occupational injuries.

favorable sensitivity and specificity characteristics, as shown in Figure 5. It also indicates a good predictive potential of the fitted model to predict occupational injuries across fishermen in Tanji.

Discussion

This study was meant to explore the characteristics and determinants of occupational hazards and injuries among coastal fishermen in one of the busiest fishing site in the Gambia. The study findings showed that a higher proportion of fishermen were non-Gambians, similar to a study done in Vietnam where the majority were immigrants from South Vietnam.[19] Male fishermen predominate fish harvests because it is perceived as a more risky endeavor held by men.[20] The average age and working experience of fishermen in the Gambia were 39 and 20 years, respectively. This is slightly below the reported mean age for fisherfolk in Brazil at 46 years, with a proportion of males at 94.8% and less the reported mean age of 48 years reported by Camara et al.[21,22] This could be attributed to the fact that fishing is on-the-job training in the Gambia and requires physical and manual strength to perform it. The younger the fisherfolk, the greater the likelihood that they may face workplace hazards and injuries. In Ethiopia, a study found that employees with more work experience had a sixfold increased likelihood of being aware of hazards compared to those with less experienced.[23] Due to their lack of experience, younger workers tend to exaggerate their physical abilities or underestimate the hazards and risks associated with their work.[24] One likely interpretation is that those who have worked for a more extended period may have developed superior knowledge and abilities regarding the equipment and tools in use and have become accustomed to the work environment. Additionally, they may be exposed to various safety training programs, which may increase their awareness.

The majority never attained formal education training and are found to be active smokers of unknown content. Most currently used boats were planked canoe with outboard engine, with 5.2-year-old on average and spent 6 or more hours on fishing services in the sea. These findings were supported by a study done in Morocco where the prevalence of tobacco smoking was 69.9%, with almost three-quarters had consumed more than 10 pack-years.[25] In The Gambia, just like other African countries, physically demanding jobs like fishing are considered for mostly school dropouts as their means for survival. The possible reason fishermen smoke could be due to harsh environmental conditions such as cold weather at sea.

The findings from this study revealed an extremely high proportion of occupational hazards and reported injuries to be 95% and 85%, respectively. Major occupational hazards observed during the study include ergonomics, physical and environment/climate hazards, and muscle strain and falling were the common injuries reported. However, bruises, cut and lacerations, slip and falls, and stings from the fish spine were also reported. Furthermore, the roles that fishermen played exposed them to a variety of occupational hazards and risks.[26,27] The findings revealed that high proportions of hazards were observed among planked canoes with outboard engines and extremely low among dug-out canoes with outboard engines and paddle ones. Higher proportions of hazards within the fishing workspace were found relative to all-hazard categories (Physical, chemical, psychological, ergonomics, and environmental/climate) and respiratory conditions. In terms of injuries reported, findings revealed the outcome of injuries to be common among active smokers, workspace with prevailing physical and chemical hazards, non-active users of PPEs and vessel crew with fragile fishing safety rules and procedures. Pocock et al.[28] reported slightly different findings, stating that common accidents and injuries included severed limbs, injuries from ropes, winches, and jagged fish bones, as well as exposure to noxious fumes from the fish storage area and men inadvertently falling off the boat. The reason for the association between the above variables could be attributed to the irregular use of PPEs to protect themselves and has the potential to accelerate the incidence of workplace hazards, injuries, and accidents. Most of the fishermen believed that the use of PPEs could be strengthened by enforcing existing rules and creating awareness through health education and promotion. The boat's poor design and maintenance conditions put them at risk of accident during operations, and the benefit of having safety rules for their vessels would reduce the rate of workplace incidences.

In this study, only 3.3% of fishers at the Tanji fishing site have completed secondary levels of education. These findings contrast with research conducted in Ghana, which revealed low educational attainment among fishing communities, despite the majority having completed basic and secondary school.[26] Almost a third of the participants in this study had never attended school. These findings corroborate research conducted in Botswana, where more than half of fishermen lacked any level of schooling.[29] This is due to the low

technological level and skill required in local fishing, which does not necessitate an advanced education. Individuals gain awareness through education; thus, the lower the level of education among fishermen, the greater the likelihood of encountering workplace risks and hazards.[30,31]

The study further reveals that the likelihood of fishermen to experience occupational workspace hazards decreased significantly by 88% among proper PPE users relative to non-PPE users. Workspace injury outcome among active smokers was observed 3.18 times more likely to occur compared to non-smokers. Chemical hazard was a significant outcome among all the other hazards categories observed. Therefore, fishermen's exposure to this hazard increased their risk of injury 3.14 times compared to their exposure to other hazards. It was also observed that the injury outcome was determined by the presence or absence of safety rules. Fishing workspace with safety rules predisposed fishermen 2.81 times more likely to sustain injury relative to those without safety rules and procedures within their workspace.

Workers' hazard understanding and exposures were linked with the existence of occupational safety laws in this and other research.[32] It is clear that adequate implementation of occupational safety laws can monitor workers' behavior and ensure that they follow safety protocols. This effectively mitigates safety culture bottlenecks and increases worker awareness of workplace hazards when properly integrated with other safety programs.

Strength and Limitation

This is among the few studies done in Gambia to assess the prevalence and determinants of OSH hazards and injuries among fishermen in local context. This study established merely a relationship, not causality. Social desirability bias is a major downside of self-reported surveys such as this one, as individuals may report more socially approved answers than their true day-to-day conduct. Since this is a cross-sectional study, the limitations inherent in this methodology must be taken into account when interpreting the results.

Conclusion

This study revealed that the prevalence of OSH hazards and injuries among fishermen was high. This would mean that there is a dire need to formulate and strengthen safety measures and trainings that are adaptable to local context as significant proportion of the fishermen have never been to school and others with only primary education. Programs aimed at increasing worker knowledge of occupational hazards and injuries should concentrate on issues such as safety training, safety promotion, and implementation of relevant workplace safety regulations.

Acknowledgements

We would like to extend our heartfelt appreciation to participants who took part in the study. We would like to express our appreciation to the village head (Alkalos) and youth leaders for their assistance in mobilizing the participants. Finally, the authors wish to thank students from the School of Public Health for their diligence during fieldwork and study participants for their cooperation throughout the study.

Authors' Contributions

AB & AK conceptualized the study and prepared the study design. AB, AK, MN, SOS, RAK reviewed literature. AB, AK, MN, SOS, SPSJ, and MB, undertook fieldwork. AK performed data input. AB performed data analysis, wrote the results, discussed the findings, and wrote the initial draft of the manuscript. All authors critically reviewed the manuscript for its intellectual content. All authors read and approved the final manuscript. AB had the final responsibility to submit for publication.

Availability of Data and Materials

The data used to support the findings of this study are available upon reasonable request from the corresponding author.

Ethics Approval and Consent to Participate

The study protocol was reviewed and ethical clearance was issued by the Gambia College's Research Committee (Ref. No: PH08012/2019) for the study. All methods were carried out in accordance with relevant guidelines and regulations. The people were sensitized about the nature of the study in their local languages (Mandinka and Wolof). Participation in the study was entirely voluntary and only those that accepted to be part of the study were recruited. A written informed consent form was signed by each participant who accepted to be enrolled in the study.

ORCID iD

Amadou Barrow https://orcid.org/0000-0002-6006-9355

REFERENCES

1. Ngaruiya FW, Ogendi GM, Mokua MA. Occupational Health Risks and hazards among the Fisherfolk in Kampi Samaki, Lake Baringo, Kenya. *Environ Health Insights*. 2019;13:1178630219881463.
2. Mansi F, Cannone ESS, Caputi A, et al. Occupational exposure on board fishing vessels: Risk Assessments of biomechanical overload, noise and vibrations among worker on fishing vessels in southern Italy. *Environments*. 2019;6:127.
3. Alabi O, Olaoye JO, Odebiyi OC. Occupational hazards and injuries associated with fish processing in Nigeria. *J Aquat Sci*. 2015;3:1-5.
4. Olapade OJ, Kpundeh MD, Quinn PG, Nyuma GJY. Occupational hazards, risk and injuries of fish processors in tombo a coastal fish landing site, Sierra Leone, West Africa. *Int J Fish Aquac*. 2021;13:27-39.
5. World Health Organization. *Global Strategy on Occupational Health for All: The Way to Health at Work*. World Health Organization; 1995:3-62. Accessed January 28, 2022. https://www.who.int/occupational_health/en/oehstrategy.pdf?ua=1
6. FAO. *Safety at Sea and Decent Work in Fisheries and Aquaculture*. Food and Agriculture Organization of the United Nations, Rome; 2021:2-9.
7. World Health Organization. *World Health Statistics 2016*. World Health Organization; 2016. Accessed August 5, 2021. http://www.myilibrary.com?id=987917
8. National Institute for Occupational Safety and Health. *Proceedings of the International Fishing Industry Safety and Health Conference*. CDC; 2020:5-28. Accessed October 3, 2021. https://www.cdc.gov/niosh/docs/2003-102/default.html
9. Haile LM, Kamenov K, Briant PS, et al. Hearing loss prevalence and years lived with disability, 1990–2019: findings from the Global Burden of Disease Study 2019. *Lancet*. 2021;397:996-1009.

10. Neethiselvan R, Gayathri S, Shanmughapriya P, S G, P S. Assessment of health seeking behaviour among fishermen community in Puducherry. *Int J Community Med Public Health*. 2021;8:732.
11. Jeżewska M, Grubman-Nowak M, Leszczyñska I, Jaremin B. Occupational hazards for fishermen in the workplace in Polish coastal and beach fishing—a point of view. *Int Marit Health*. 2012;63:40-48.
12. Jensen OC. Work related injuries in Danish fishermen. *Occup Med*. 1996; 46:414-420.
13. Julius OO, Didlyn KM, George QP, Yawa NGJ. Occupational hazards, risk and injuries of fish processors in tombo a coastal fish landing site, Sierra Leone, West Africa. *Int J Fish Aquac*. 2021;13:27-39.
14. United Nations Conference on Trade and Development. The fisheries sector in the Gambia: Trade value addition and social inclusiveness, with a focus on women. 2014:3-28.
15. Gambia | Spcsrp | Sub regional Fisheries Commission. Accessed August 7, 2021. https://spcsrp.org/en/gambia
16. Access Gambia. Tanji Fishing Village, Gambia. Published 2021. Accessed October 3, 2021. https://www.accessgambia.com/information/tanje-fishing-village.html
17. Gambia Bureau of Statistics. *Gambia Population Census 2013*.; 2013.
18. Garrone Neto D, Cordeiro RC, Haddad Jr V. Acidentes do trabalho em pescadores artesanais da região do Médio Rio Araguaia, Tocantins, Brasil. *Cad Saúde Pública*. 2005;21:795-803.
19. Carruth AK, Levin JL, Gilmore K, et al. Cultural influences on safety and health education among Vietnamese fishermen. *J Agromedicine*. 2010;15: 375-385.
20. Food and Agriculture Organization of the United Nations, World Fish Center. *Small-Scale Capture Fisheries: A Global Overview With Emphasis on Developing Countries*. World Bank; 2008:2-57. Accessed October 6, 2021 https://openknowledge.worldbank.org/bitstream/handle/10986/16752/831830WP0Small00Box379886B00PUBLIC0.pdf?sequence=1&isAllowed=y
21. Filho FB, Alves ADO, Towersey L, et al. Tropical medicine rounds: the skin health of fishermen in Guanabara Bay, Rio de. *Int J Dermat*. 2019;58(4):1-8. doi:10.1111/ijd.14382
22. Camara S, Kuye RA, Sridhar M. Environmental and occupational hazards exposures faced by coastal fishermen in Tanji, the Gambia. *Afr J Environ Health Sci*. 2018;5:103-112.
23. Tadesse S, Bezabih K, Destaw B, Assefa Y. Awareness of occupational hazards and associated factors among welders in Lideta Sub-City, Addis Ababa, Ethiopia. *J Occup Med Toxicol*. 2016;11:15.
24. Belin A, Zamparutti T, Tull K, et al. *Occupational Health and Safety Risks for the Most Vulnerable Workers*. European Parliament; 2011:135. Accessed October 7, 2021 https://eige.europa.eu/docs/2024_IPOL-EMPL_ET(2011)464436_EN.pdf
25. Laraqui O, Hammouda R, Laraqui S, et al. Prevalence of chronic obstructive respiratory diseases amongst fishermen. *Int Marit Health*. 2018;69:13-21. doi:10.5603/IMH.2018.0003
26. Kyei S, Owusu-Ansah A, Boadi-Kusi SB, Abbey DN, Abu EK. Occupational hazards correlates of ocular disorders in Ghanaian fisheries. *Healthc Low Resour Settings*. 2016;4(2):29-34. doi:10.4081/hls.2016.5482
27. Mandal S, Hasan I, Hawlader NH, Sultana I, Rahman MM, Majumder MSI. Occupational Health Hazard and safety assessment of fishermen community in coastal zone of Bangladesh. *Int J Health Econ Policy*. 2017;2:63.
28. Pocock NS, Tadee R, Tharawan K, et al. Because if we talk about health issues first, it is easier to talk about human trafficking"; findings from a mixed methods study on health needs and service provision among migrant and trafficked fishermen in the Mekong. *Global Health*. 2018;14:1-19.
29. Mosepele K, Ngwenya BN, University of Botswana. *Harry Oppenheimer Okavango Research Centre. Socio-Economic Survey of Commercial Fishing in the Okavango Delta, Botswana*. Bay Publishing; 2010.
30. Faremi F, Ogunfowokan A, Mbada C, Olatubi M, Ogungbemi A. Occupational hazard awareness and safety practices among Nigerian sawmill workers. *Int J Med Sci Public Health*. 2014;3:1244.
31. Percin F, Akyol O, Davas A, Saygi H. Occupational health of Turkish Aegean small-scale fishermen. *Occup Med*. 2012;62:148-151.
32. Kumar SG, Dharanipriya A, Kar SS. Awareness of occupational injuries and utilization of safety measures among welders in coastal South India. *Int J Occup Env Med IJOEM*. 2013;4:252-172-177. PMID: 24141865. Accessed October 7, 2021. https://pubmed.ncbi.nlm.nih.gov/24141865/