SYSTEMATIC REVIEW

The health and safety of being fishermen: A Systematic Review

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Abstract

Objective: To explore the occupational safety and health of fishermen in coastal areas, and the causes and health problems experienced by them.

Method: The systematic review was conducted in February 2021, and comprised search on Google Cendekia, ScienceDirect, ProQuest, PubMed and **BioMed Central** databases for relevant studies published in English or Indonesian from 2016 to February 2021. The key words used were fisheries, fishermen, occupational, safety and health. The studies identified were assessed using population-intervention-control-outcomes-study framework.

Results: Of the 24,271 studies initially identified, 23(0.09%) were reviewed in detail. Findings showed that fishing accidents occurred every year, causing traumatic injuries. The cause of such accidents had both internal and external factors. Health problems experienced by the fishermen included physical and mental health disorders.

Conclusion: The occupational safety and health of fishermen need to be paid attention to.

Keywords: Global warming, Temperature, Occupational health, Accidental falls, Hunting, Mental health.

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Introduction

Occupational safety and health (OSH) is about creating a safe and comfortable work environment by improving and maintaining employees' physical and spiritual health as well as social condition. It specifically aims at preventing or decreasing incidents and their causes.[1] OSH is a right of the employees who work in both formal and informal sectors.[2]

The International Labour Organization (ILO) in 2013 stated that every 15 seconds, an employee died due to an occupational accident or suffered from occupation-related diseases.[3] In 2012, the ILO recorded that the mortality rate due to occupation-related incidents and diseases was around 2 million cases annually, and musculoskeletal disorders (MSDs) increased in many countries.[3]

A fisherman's occupation carries significant health risks due to their behaviours, occupational hazards, and unhealthy and unsafe work environment.[4] Health problems among fishermen include hypertension, hypothermia and heat stress. Working as a fisherman can cause occupational accidents because the profession has 3D characteristics; Dangerous, Dirty and Difficult.[5]

According to a study conducted on fishermen in Hative Besar village, the complaints reported by fishermen were back pain and headache due to long stay offshore and insufficient time for taking rest. They could not focus on the job, which triggered from minor accidents, such as slipping to being infected with poisonous fish that can cause death, and to the possibility of a sunken fishing vessel.[6]

A report by the Census of Fatal Occupational Injuries (CFOI) conducted by the Bureau of Labour Statistics (BLS) mentioned that the risk of occupational accidents in fishermen was 20-30 times higher than other occupations. The main factor is work environment, like most fishing boats being without personal protective equipment (PPE), and low education level which increases the risk because of poor knowledge and questionable attitudes.[7]

The current systematic review was planned to illustrate OSH level among fishermen, the factors causing occupational incidents, and the health problems suffered by the fishermen.

Materials and Methods

The literature review was conducted in February 2021 and comprised search on Google Cendekia, ScienceDirect, ProQuest, PubMed and BioMed Central (BMC) databases for relevant studies published in English or Indonesian from 2016 to February 2021. The key words used in the search included fisheries, fishermen, occupational, safety, and health. The search was conducted in line with the Preferred reporting items for Systematic Reviews and Meta-Analyses (PRISMA) guideline[8], and studies were included or excluded according to the Population-intervention-control-outcomes-study (PICOS) approach[8] (Table 1).

Studies were included only if complete text was available in either English or Bahasa Indonesia. Systematic reviews were excluded. The variables of interest were occupational

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accidents, health problems, factors of occupational accidents, and factors of health problems in fishermen.

The search was conducted by two researchers independently, and data was extracted using the PICOS format.[8]

Results

Of the 24,271 studies initially identified, 23 (0.09%) were reviewed in Figure. The review showed that the occupational accidents experienced by the fishermen were slipping/falling, getting cut/punctured, being hit by falling objects, and other incidents, such as having burn injuries/being injured due to explosion or being injured by the boat engines, and the accidents led to fatal and non-fatal injuries.[9] Most fishermen suffered from a single injury.[10] while others had multiple injuries in such accidents.[11] The types of injuries frequently suffered by the fishermen were fractures, minor injuries, upper extremity injuries, sprains, burn injuries, amputations and even intracranial injuries (Table 2).

Table-1: Population-intervention-control-outcomes-study (PICOS) criteria for inclusion and exclusion of studies.8

Parameter	Inclusion Criteria	Exclusion Criteria
Populations	Fishermen	Not a fisherman
Intervention	n/a	
Comparator	How the OSH in fishermen around the world	
Outcomes	Occupational accidents, physical health problems, and mental health	problems
Study design	Observational research	Not include any review article(scoping, systematic etc.) and RCT

OSH: Occupational safety and health, RCT: Randomised controlled trial.

The occupational accidents were caused by both internal and external factors. High workload, poor concentration and lack of experience were some of the internal factors.[10] Fatigue, decreased alertness, lack of skills and knowledge, low awareness of dangers also caused occupational accidents.[12] Fishermen were more focussed on financial matters even if they had to take a higher risk of accidents.[13] The external factors included broken or insufficient equipment and facilities, improper PPEs, and natural factors.[12,13]

Fishermen were found to have both physical and mental health problems in addition to occupational hazards. Physical problems included MSDs, skin disorders, allergy, respiratory disorders, hearing loss, fatigue, fever, diarrhoea, hepatitis and cardiovascular diseases.[14-17] Mental health problems included work stress, depression, post-traumatic stress disorder (PTSD), anxiety disorder, mental health disorder (MHD), self-harm, suicide attempts, and having abstract thoughts about ending their lives.[17,18]

The factors causing MSDs were employment period, age, type of occupation, abnormal body mass index (BMI), monotonous jobs and workload.[19-22] The skin disorders were due to fungal, bacterial and viral infections as well as because of contact with mud, animals and marine plants.[14,23] Some fishermen also experienced fatigue because of lengthy employment period, having pulse rate above the normal range, and sunlight exposure.[24] Hearing loss was associated with employment period[25]. Cardiovascular diseases were significantly caused by sex, employment period, diet and depression.[16] Mental health problems were also caused by conflict, poor relationship with co-workers, non-supportive work environment, and having multiple assigned roles on the job.[18]

Table-2: Extracted data from the studies reviewed.

Author	Objective	Study Design	Sample	Result (s)
Pillai S, et.al[11]	This study aims to describe fishermen's perspectives on the factors that contribute to injury and staying safe while fishing	Cross-Sectional	426 commercial fishermen	About 1 in 5 fishermen reported experiencing at least one injury in the last year. About half reported experiencing at least one injury in their fishing career. Respondents experienced heavy workloads, poor mental focus, and lack of experience as the most common causes of injury to commercial fishing.
Zytoon MA, Basahel AM[25]	This study aims to review reported injuries, discuss risk factors, and identify data to inform future FLIPP research.	Qualitative	19 respondents	28 fatal injuries and 45 non-fatal injuries were reported to coast guard from 2002 to 2014. Nearly half of non-fatal injuries occurred while fishers were hauling fishing gear (47%), upper limb injuries (48%), and fractures (40%).
Syron LN, et.al [36]	This study aims to determine the usefulness of related data to conduct surveillance, and patterns of injury/disease during 2012-2016	Secondary Data Analysis	153 cases from the Alaska Trauma Registry (ATR), 2,403 cases from the Fishermen's Fund (FF), and 514 cases from the US Coast Guard (USCG)	In the ATR data (153 cases), all cases were traumatic injuries, as expected. Most fractures (40%), crushes (12%), wounds (10%), amputations (7%), and intracranial injuries (7%). In USCG data (514 cases), the most cases were traumatic injuries (92%). Most injuries were fractures (15%), cuts (10%), surface wounds/bruises (10%), and sprains/tearings (9%). In the FF data (2,403 cases), the most cases were traumatic injuries (93%). The majority of injuries were sprains/tearings (32%), cuts (16%), surface injuries/bruises (10%), fractures (9%), and punctures (5%).

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Table-2: *continued from previous page*

Author	Objective	Study Design	Sample	Result (s)
Marvasti A.[14]	This study aims to determine the determinants of fatalities (fatal and non-fatal injuries and missing) including commercial fishermen who chase all fish species in the Gulf of Mexico.	Time Series	7,305 commercial fishermen	Fishermen are willing to accept financial rewards for accepting a greater risk of accidents. Bad weather conditions as measured by wave height and lack of job opportunities in the market increase the risk of accidents to fishermen. The number of fishermen on a boat helps reduce the chances of casualties in dangerous situations at sea.
Kincl L., et.al[10]	This study aims to review reported injuries, discuss risk factors, and identify data to inform future FLIPP research.	Qualitative	19 respondents	28 fatal injuries and 45 non-fatal injuries were reported to coast guard from 2002 to 2014. Nearly half of non-fatal injuries occurred while fishers were hauling fishing gear (47%), upper limb injuries (48%), and fractures (40%).
Bovbjerg VE., et.al[12]	This study aimed to characterize the pattern of non-fatal injury in the West Coast Dungeness Crab Fleet; to identify the highest risk of injury hazard by the work process of job duties); and to test injury risk reduction interventions	Mixed-Methods	426 fishermen	A total of 102 injuries were reported in 89 injury incidents, nine incidents (10.1%) reported multiple injuries (seven incidents with two injuries, one incident with three injuries, and one incident with five injuries). Of the 102 injuries, nearly two thirds were sprains (22.5%), surface wounds/bruises (15.0%), cuts (17.6%), or punctures (10.8%).
Asumeng MA, Folitse BY.[13]	This study investigates occupational hazards, safety culture and safety behaviour of fishermen at Jamestown Landing Beach, Accra.	Cross-Sectional	155 fishermen	Factors causing high accidents are fatigue and decreased alertness, boat overload (too many catches), inadequate training, orientation and supervision, unsafe or damaged equipment and facilities, underestimation of the situation, and lack of skills and knowledge. Factors causing moderate accidents are lack of awareness of danger, loss of concentration, lack of proper protective equipment and equipment.
Chauvin C, Le Bouar G, Lardjane S.[37]	The purpose of this study was to analyze accidents in terms of two main characteristics of the vessels involved: type of fishery and fishing activity.	Case studies	8,286 reports	712 coastal fishermen had work accidents in 2002-2012. 415 of the 712 injured coastal fishermen were active fishermen while the other 297 were passive fishermen. Work accidents that occurred were falling (11 cases), hitting permanent buildings (10 cases); hit (26 cases); cut or stabbed (15 cases); overwork or an uncomfortable position (18 cases); and other work accidents (17 cases).
Fulmer S, Buchholz B, Scribani M, Jenkins P.[18]	The aim of this study was to report the prevalence of musculoskeletal pain in lobster fishermen in the northeastern US.	Cohort	395 lobster fishermen	In the last 3 months, lobster fishermen who had complaints of pain due to work in the head area were 1 person, neck was 31 people, shoulders were 113 people, elbows were 47 people, hands/wrist were 117 people, back was 174 people, and legs were as many as 138 people. In the last 7 months, 2 lobster fishermen had complaints of head pain, 29 necks, 96 shoulders, 40 elbows, 64 hands/wrist, 145 back and 134 feet. The pain experienced by lobster fishermen in the last 3 months is influenced by the period of work and age of the fisherman.
Junior VH. [31]	This study aims to identify the main skin diseases in fishing communities on the north coast of Sao Paulo	Cross-Sectional, Prospective	75 fishermen	Skin diseases found in 75 fishermen included psoriasis, vitiligo, eczema, seborrheic dermatitis, lichenoid amyloidosis, folliculitis, bacterial infections, larva migrans, mucocutaneous leishmaniasis, superficial mycoses (tineas), superficial mycoses (candidiasis), wounds from fish venom, actinic keratoses, seborrheic keratoses, solar melanosis, and fibrous papules of the nose.
Laraqui O., et.al[20]	The aims of this study were to evaluate the prevalence of skin disease among fishermen, to determine its distinct clinical form, its most frequent location, and to identify potential etiologic factors.	Cross-Sectional	1,102 fishermen	The most frequent traumatic skin disorder, with palmar hyperkeratosis found in 67.1% of fishermen, plantar hyperkeratosis 59.4%, scars (due to equipment, fish spines, etc.) 52.2%, facial wrinkles 32%, and creature stings sea 11.2%. The skin infections obtained were from fungal (44.4%), bacterial (8.3%), viral (5.5%) and scabies (1%). Only 192 (17.4%) fishermen did not have skin disease. 43% of fishermen have one type of skin disease, 27.2% of fishermen have two types of skin disease, 9.5% of fishermen have three types of skin disease, and 2.5% of fishermen have four types of skin disease.
Lovreglio P., et.al[15]	The purpose of this survey was to evaluate the application of the Nordic Occupational Skin Questionnaire (NOSQ) for marine fishermen as an initial assessment tool to screen for contact dermatological disorders.	Cross-Sectional	143 fishermen	Fishermen who have allergy symptoms in the nose as many as 6 people, allergy symptoms in the eyes as many as 11 people, asthma as many as 8 people, dry skin as many as 17 people, eczema as many as 12 people, itching bites as many as 71 people, and who experienced itchy bites in the last 12 months as many as 41 people. The cause of 71 fishermen experiencing itching bites was due to algae/water plants as much as 49.3%, due to mud as much as 25.3%, fish, crustaceans, mollusks, cephalopods, jellyfish as much as 16.9%, and other causes related to work as much as 15.5%.

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Table-2: *continued from previous page*

Author	Objective	Study Design	Sample	Result (s)
Dienye PO., et.al [38]	This study aims to assess the prevalence of LBP and the severity of the condition of fishermen in Nigeria, to explore the potential factors associated with LBP, and to elucidate the strategies used by fishermen to cope with LBP.	Cross-Sectional	384 fishermen	There were 86 fishermen who experienced mild Low Back Pain (LBP), 64 people, and 112 people who were heavy. Age, marital status, educational status, and Body Mass Index (BMI) showed a significant relationship with the severity of LBP. The group with the frequency of severe LBP are fishermen who are 35 to 44 years old, have an abnormal BMI, have basic education and are married. LBP is less common in fishermen who have worked for 21 years and use motorboats.
Eckert C, Baker T, Cherry D.[39]	The purpose of this study was to evaluate chronic health risks before and during the fishing season in commercial fishermen.	Cross-Sectional	66 fishermen	6 fishermen experienced hearing loss due to work. Many fishermen have evidence of upper extremity injuries. From 20 physical examinations, 8 fishermen had symptoms of inflammation in the shoulder muscles, 4 had symptoms of carpal tunnel syndrome, 3 had injuries to the flexor and extensor tendons in the wrist, 3 had injuries to their fingers, and 2 had thickened tissue between the tendons of the fingers and palms. in hand.
Putra IS., et.al[40]	This study aims to determine the relationship between tenure and type of work with musculoskeletal disease in fishermen.	Cross-Sectional	56 fishermen	27 fishermen experienced musculoskeletal disease. Musculoskeletal disease in fishermen is related to the period of work and the type of work. Working period has an influence on musculoskeletal disease in fishermen. Fishermen who have a long working period are more at risk of developing musculoskeletal diseases.
Levin JL., et.al[22]	The study aimed to link hearing loss among commercial fishermen with their level of noise exposure on board fishing vessels	Cross-Sectional	227 fishermen	There are 117 fishermen who have hearing loss. 60 people had mild hearing loss (26-40 dB), 37 people had moderate hearing loss (41-55 dB), 16 people had moderate-severe hearing loss (56-70 dB), 3 people had severe hearing loss (71 90 dB), and 1 person had very severe hearing loss (>90 dB). The hearing loss is influenced by the fishermen's tenure. Fishermen who work 15 years are more at risk of hearing loss.
Souza VVD, Ak M.[17]	This study aims to measure the level of work stress of fishermen and to find a relationship between fishermen's demographics and work stress	Cross-Sectional	100 fishermen	Fishermen experienced moderate work stress as many as 23 people, heavy work stress as many as 75 people, and very high work stress as many as 2 people. This could be due to their role overload, role ambiguity, conflict at work, an inadequate work environment, and having poor relationships with coworkers.
Thamrin Y., et.al[21]	This study aims to explore the determinants of occupational safety and health problems in seaweed workers in Takalar Regency, South Sulawesi, Indonesia.	Cross-Sectional	105 fishermen	81 fishermen who suffered injuries, 70 people who experienced fatigue, and 58 people who experienced Low Back Pain (LBP). Work fatigue is related to pulse rate above average, working period > 1 year and length of sun exposure. Work accidents are related to female gender, working period > 1 year and working > 8 hours. Types of work such as maintenance, processing and all types of work are associated with LBP.
Sandsund M., et.al[41]	The aim of this study was to study the symptoms of musculoskeletal disease among working fishermen in Norwegian fishing using three different research methods.	Mix-Method	153 fishermen	Of the 102 fishermen, 57% and 60% had experienced stiffness/pain in the neck/shoulder and lower back. All respondents attributed their complaints to monotonous movements (39%), heavy lifting (37%), working at high speeds (22%) and working with hands above or above shoulder height (22%).
Noman MA Al., et.al[42]	The main purpose of this study was to determine the health problems and behaviour of fishermen seeking care.	Cross-Sectional	300 fishermen	208 fishermen had suffered from illness in the last 3-6 months. 95 fishermen had skin diseases, 26 fishermen had respiratory problems, 49 fishermen were injured, 73 fishermen had fever, 53 fishermen had diarrhoea, 14 fishermen were stabbed, 5 fishermen had hepatitis, 89 fishermen had musculoskeletal disorders, 11 fishermen had allergies, and 11 fishermen experienced dizziness.
Frantzeskou E, Jensen OC, Linos A.[23]	The aim of this study was to investigate the health status and health risk factors present in Greek fishing workers, by exploring their working environment, thereby providing a baseline for documentation of the need for prevention and promotion of Health.	Cross-Sectional	161 fishermen	Fishermen aged < 50 years experienced hearing loss as many as 9 people, 7 people had skin disease, 11 people had respiratory problems, 46 people had musculoskeletal disorders, and 14 people had cardiological disorders. Fishermen aged 50 years experienced hearing loss as many as 23 people, experienced skin disease as many as 13 people, experienced respiratory problems as many as 28 people, experienced musculoskeletal disorders as many as 77 people, and experienced cardiological disorders as many as 59 people. Cardiovascular disease in Greek fishermen was influenced by age, sex, years of service, diet and level of depression. The risk of cardiovascular disease in male fishermen is higher than that of women of the same age.
Pocock NS., et.al[16]	This study aims to explain violations, occupational hazards, post-trafficking physical and mental health	Mixed Method	275 respondents	Physical health problems experienced by fishermen include dizziness, headache, toothache, indigestion, back pain, skin disease, fatigue, fainting, drastic weight loss, memory impairment, chronic cough, and pain in more than three places. Mental health disorders that have been experienced include symptoms of depression, symptoms of Post Traumatic Stress Disorder (PTSD), anxiety disorders, Mental Health Disorder (MHD), self-harm, attempted suicide, and thoughts of ending one's life.

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Author	Objective	Study Design	Sample	Result (s)
Berg-Beckhoff G., et.al[19]	The aim of this study was to estimate the prevalence and predictors of musculoskeletal pain among Danish fishermen.	Cross-Sectional	270 fishermen	Lower back and shoulder pain is the most common and experienced by 4/5 fishermen over the past year. Hand and neck pain is the second most common with a prevalence of about 2/3. Lower back pain, shoulder and hand pain are also common and present in about 1/3 of fishermen. Fishermen with medium workloads have a 32% risk of experiencing musculoskeletal disorders. Fishermen with a high workload have a 60% risk of experiencing musculoskeletal disorders. The risk of musculoskeletal disorders is reduced by 15% in fishermen who have side jobs.

Identification of studies via databases and registers

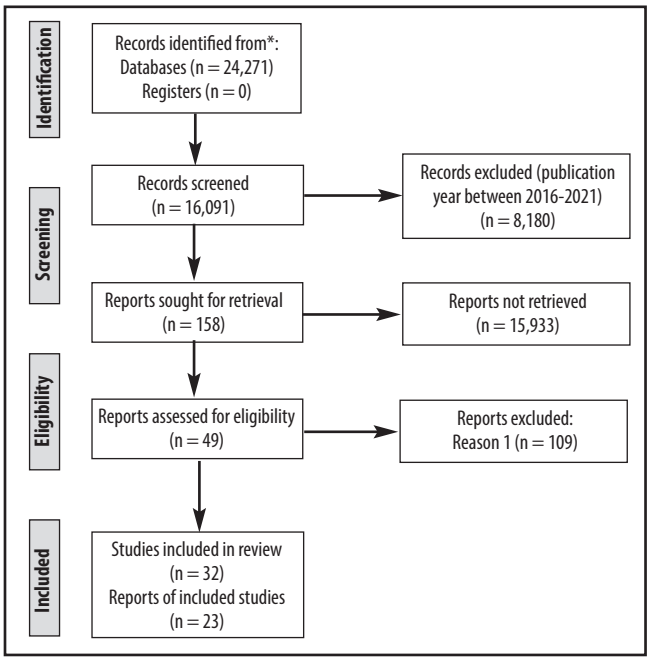

Figure: Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart.

Discussion

Based on the findings, it is clear that occupational accidents still happen on a regular basis, and they need to be controlled so that the fishermen's productivity level may increase by way of avoiding lost worktime[26].

The kinds of occupational accidents experienced by fishermen were falling, slipping, stumbling/tripping, being hit, and being squeezed/pinched[27].

Such accidents frequently happen because the fishermen work in slippery and damp surfaces, especially in the area for storing the catch[28]. A fishing vessel not equipped for the job and fishermen not wearing the correct shoes increase the risk of falling/slipping[29].

The types of occupational accidents experienced by fishermen were sprain, minor injuries, bruise, fractures, puncture wounds, lacerated wounds, amputation and even intracranial injury. Upper extremity injuries and fractures were also common. A study mentioned that the fishermen had a higher risk of experiencing occupational accidents compared to office-based employees because 60% of fishermen's time was used for hard physical labour, leaving them with little time to take rest.[30]

The factors causing occupational accidents identified in the current review show that fishermen still are not fully aware of the risk of accidents they face while working. Fishermen with poor OSH knowledge have a higher risk than those with good OSH knowledge.[2]

A study in Tambala village stated that unsafe actions were correlated with occupational accidents.[31]

Besides occupational accidents, the fishermen also suffered from physical and mental health problems. The physical problems, among other issues, included MSDs, like pain in the head, neck, shoulders, elbows, wrists, back and feet.[20] MSDs are often associated with physical labour and uncomfortable postures.[32]

Another common ailment was skin disorder, and some fishermen had multiple skin disorders at the same time.[23] The types of skin disorders included psoriasis, vitiligo, eczema, seborrhoeic dermatitis, lichen amyloidosis, folliculitis, bacterial infection, cutaneous larva migrans, mucocutaneous leishmaniasis, superficial mycoses (tinea), superficial mycoses (candidiasis), actinic keratosis, seborrheic keratosis, and solar melanosis, and fibrous papule (a spot on the nose).[33] These skin disorders were frequently suffered by the fishermen because their work environment is wet and exposed to sunlight. The condition of a wet work environment makes the skin dry and potentially damages the dermal membrane, which increases the risk of skin disorders.[34]

Another common physical health problem was hearing loss, with fishermen having mild (26-40dB), moderate (41-55dB), moderate-severe (56-70dB), severe (71-90dB), and extremely severe (>90dB) hearing loss[25]. Other than the

routine exposure to the noise of the boat engine, some fishermen dived into the sea for a traditional swim who were more likely to have hearing loss because of Inner Ear Decompression Sickness (IEDCS) in which the blood flow that supplies oxygen to the inner ear gets blocked and leads to hearing loss.[35]

Physical health problems have various causative factors. However, the length of employment period was a critical factor. An employment period is associated with the workers' exposure duration to the sources of the disease. The longer a worker is exposed to the sources of disease, the risk of suffering from health problems becomes higher.[36]

Several mental health problems were also identified.[17,18] The factors behind such problems were conflicts with co-workers as well as conflicts within. Poor mental health is a possibility if someone does not have good self-adaptation skills or cannot solve a conflict inside or outside of one's own self.[37]

The current systematic review has some limitations, like it did not calculate the risk of bias in the studies reviewed. The studies were included only on the basis of PICOS framework, which means there is a possibility that some recent and important findings published in languages other than English and Bahasa Indonesia and published outside the 2016-21 time zone may have been left out.

Conclusions

The OSH levels among fishermen need to be paid attention to because they continue to suffer from occupational accidents owing to both internal and external factors, leading physical and mental health problems.

Limitation: The systematic review was not registered with the international prospective register of systematic reviews (PROSPERO).

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