

Original Article

Injuries and diseases among commercial fishermen in the Northeast Atlantic and Barents Sea. Data from the Royal Norwegian Coast Guard

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Received: 11 March 2002 / **Accepted:** 11 October 2002 / **Published online:**

No grant sponsor

Abstract

Objectives. The working conditions in the Northeast Atlantic may be hazardous, and accidents are frequent. The objective of this study was to clarify the situation as viewed by the Royal Norwegian Coast Guard (RNCG).

Methods. Consecutive reports on medical assistance given by the three major RNCG vessels from October 1995 and March 2001 were analysed.

Results. There were 117 reports. Men constituted 96%, and 54% were Norwegians. The median age was 38 years. Seriousness was classified as low (46 cases), moderate (43 cases), serious (22 cases) and life threatening [five cases (two died)]. Infection caused 27 visits. Fifty-five cases were due to trauma, and hand injuries constituted 19 cases. Fishermen over 40 years of age were more severely injured ($P<0.04$). In 52 cases, the RNCG personnel requested further medical advice. Sixty-one patients were hospitalised and 48 transported by helicopter.

Conclusions. The RNCG offers an important medical service, but there is frequently a need for consulting medical advisors. Telemedicine should be investigated in this setting.

Keywords. Injuries - Diseases - Fishery - Atlantic - Telemedicine

Introduction

The working conditions in fishery in the Northeast Atlantic and Barents Sea may be hazardous, compounded by isolated fishing grounds, seasonable darkness, cold water, strong winds and icing. In 1995, the occupational death rate among Norwegian commercial fishermen was reported to be 100/100,000/year (Meeting: Stortinget, Oslo, 8 October 1995). This is ten times the value of that on the Norwegian mainland. Several countries have reported similar values. Lincoln and Conway (1999) revealed 116/100,000 worker deaths/year in Alaska in between 1991 and 1998. Iceland (Rafnsson and Gunnarsdottir 1992) experienced a fishing-related death rate of 89.4/100,000/year during 1966-1986, and Jaremin et al. (1997) registered 67.8 fatal accidents per 100,000 employees among Polish seamen and deep-sea fishermen during 1985-1994. Besides the fatal incidents, it is well known that there is a high number of non-fatal occupational injuries among commercial fishermen. A Danish study (Jensen 1996) reported the risk of non-fatal injuries in fishing as being twice as high as in agriculture.

The Northeast Atlantic and the Barents Sea have one of the richest fisheries worldwide. In 1998, a total of more than 2.8 million tons of fish was landed in Norway, and northeast arctic cod constituted approximately 320,000 tons (Statistics Norway 1999). Between 200 and 400 vessels and up to 10,000 fishermen operate in the area (Haagensen et al. 2001). This has made the fishing industry, next to oil, Norway's most important export industry. Of Norway's fishery resources, 80% are managed jointly with other nations. The control of this sea territory is by the Royal Norwegian Coast Guard (RNCG). Its officers perform inspections of vessels and catches in the area. They also offer medical assistance to all nationalities represented in the fishing fleet as well as to the personnel situated at different arctic locations, such as Bear Island, Svalbard, Jan Mayen and Hopen. Other medical assistance resources in the region are the search and rescue helicopters of the Royal Norwegian Air Force situated in Banak and Bodø, the local hospitals at Kirkenes, Hammerfest and Longyearbyen, and the University Hospital of North Norway. However, when an injury occurs the distance to the nearest medical service may be tremendous. In this setting, the possibilities related to the use of electronic communication in healthcare (e-health) may be of great interest.

The purpose of this study was to illuminate the injuries and diseases among commercial fishermen in this area based on the reports of the RNCG. In addition, it was to discuss aspects of e-health in relation to the fishing fleet.

Material and methods

In 1995, the chief medical officer at the RNCG base at Sortland established a reporting system for all medical assistance performed by the three major vessels. These vessels, of the north-cape class, were KV Andenes, KV Nordkapp and KV Senja. They frequently operate with a ship's doctor on military service and carry a Lynx helicopter on board. This helicopter is employed for control and military as well as medical operations. To improve its capacity, a fuel depot is located on Bear Island. All consecutive reports from October 1995 to March 2001 (65 months) were analysed in April 2001.

The coastguard medical-report scheme registered the following data: the name of the coastguard vessel, date of incident, position, patient's name and address, date of birth, name of patient's vessel, citizenship, method of support (radio and/or visit), case history in free text, treatment, further actions (i.e. helicopter transport), time spent on transporting the patient, admittance to hospital, diagnosis, name and position of the person offering medical assistance, time spent on treatment, and the seriousness of the situation (low, moderate, serious, life threatening). Medical variables when an injury

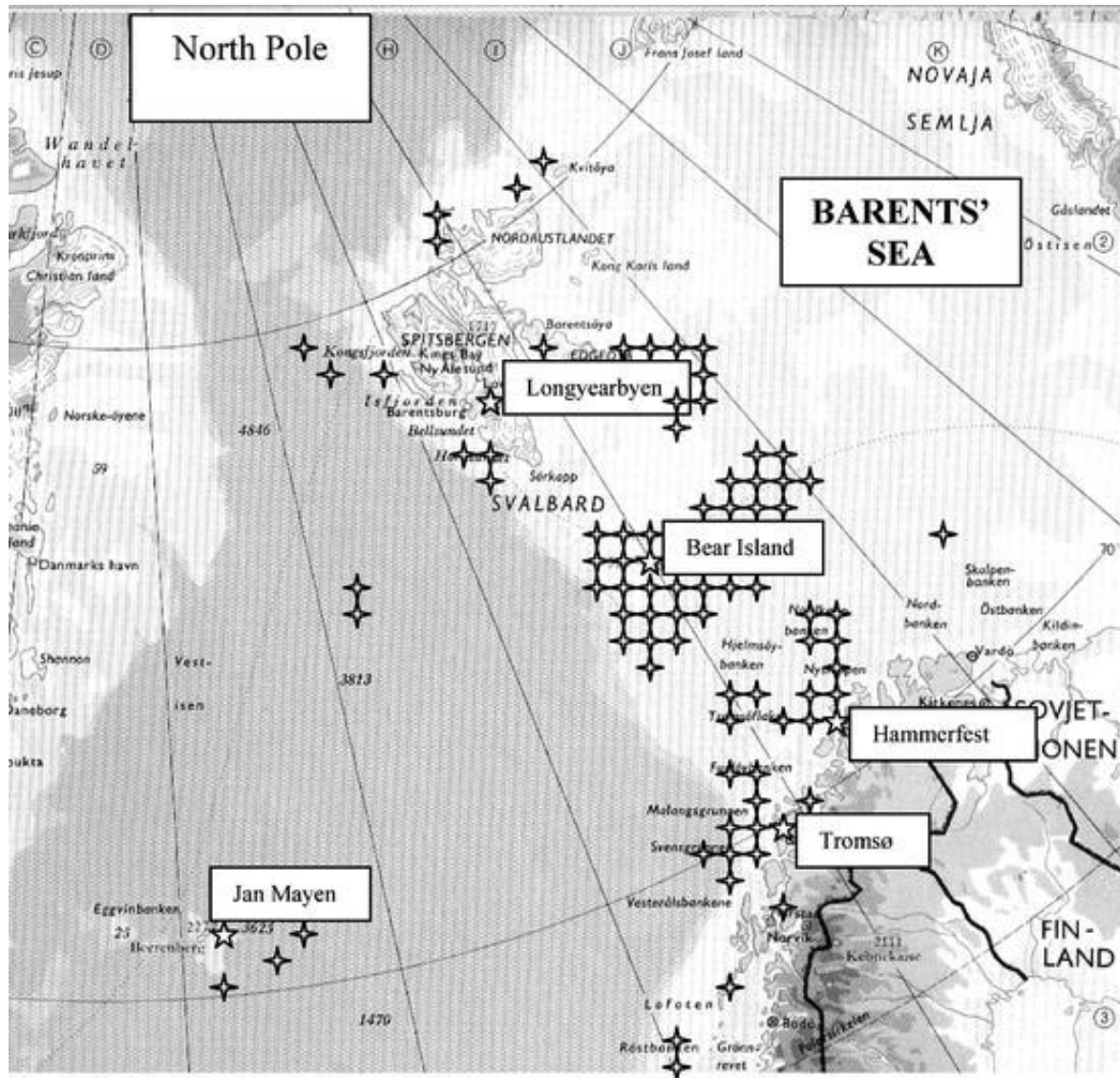
was reported were: injury type, injury mechanism, body part injured, and severity of the injury. The latter was coded according to the abbreviated injury scale (AIS) (American Association for Automobile Medicine 1976).

Statistics

Microsoft Excel 2000 for personal computers was used for the final database, and the Statistical Package for Social Science (SPSS) version 11.0 for statistical calculations. Statistical comparisons between the different groups were by one-way ANOVA. All *P* values are two-tailed and considered statistically significant when $P < 0.05$.

Results

From 1995 to 2001 (65 months), there were 117 reports of medical assistance to 117 patients registered by the north-cape-class vessels (KV Andenes: 48 cases, KV Nordkapp: 34 cases, and KV Senja: 35 cases). Most of the incidents occurred in the Bear Island region. However, several incidents happened in the Svalbard zone. Details are shown in Fig. 1. Whereas the coastguard was staffed with a ship's doctor taking care of the medical operation in 51 cases (44%), the situation had to be handled by the rescuer in the majority (56%) of incidents. One hundred and eight patients were visited by the ship's doctor or the rescuer. In nine cases, medical advice through radio communication was the only support given. Only one of these cases was due to bad weather conditions. The cases were classified by the medical personnel, according to seriousness, as little - 46 cases, some - 43 cases, serious - 22 cases and life threatening - five cases. One case was not classified. The five cases classified as life threatening were due to abdominal trauma causing unconsciousness, multiple injuries and unconsciousness due to a fall, poisoning (ethylene glycol), bilateral lung tuberculosis, and cardiac infarction. Two of these patients died (the first and last ones listed).



- ✦ - One or more vessels assisted by the Norwegian coast guard
- ☆ - This marks a Norwegian hospital or a Norwegian island in the Northeast Atlantic.

Fig. 1. Positions of the vessels assisted by the Norwegian coast guard

The mean time spent per patient was 2 (range 0.1-24) h. An increasing number of medical operations was observed during the study period (1996: 16 operations, 2000: 29 operations). Details are shown in Fig. 2. The great majority of patients was male (96%) and the median age was 38.2 (range 17.2-62.5) years. Half (53.8%) were Norwegians. Further details are shown in Table 1. Norwegians were significantly younger than the foreigners ($P=0.01$). The median age was 33.8 (range 17.2-62.5) and 41.2 (range 18.4-60.2) years, respectively. Looking at the period from January 1996 to December 2000, we observed that July and August had the highest figures (34/117 cases). Details can be seen in Fig. 3.

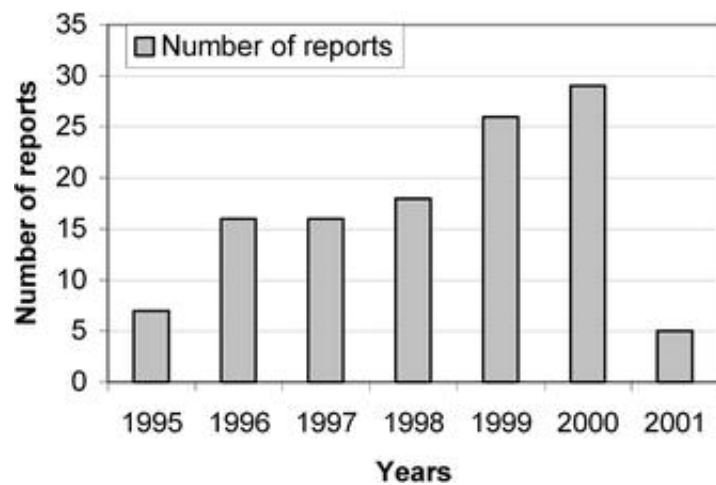


Fig. 2. Number of reports of medical assistance performed by three major Norwegian coastguard vessels

Table 1. Overview of the 117 medical reports from three major Norwegian Coast Guard vessels from 1995 to 2001

Parameter	Cases
Nationality	
Norwegian	63
Russian	27
Spanish	10
British	6
Faroese	3
Portuguese	3
Other ^a	5
Gender	
Female	4
Male	96
Unknown	17
Hospital	
Longyearbyen	21
Hammerfest	19
University Hospital of Tromsø	11
Unknown	5
Other ^b	5
Medical personnel	
Doctor	51
Rescuer	66

^a Icelanders, French and German

^b Barentsburg, Harstad, Sandnessjøen, Central Hospital of Rogaland

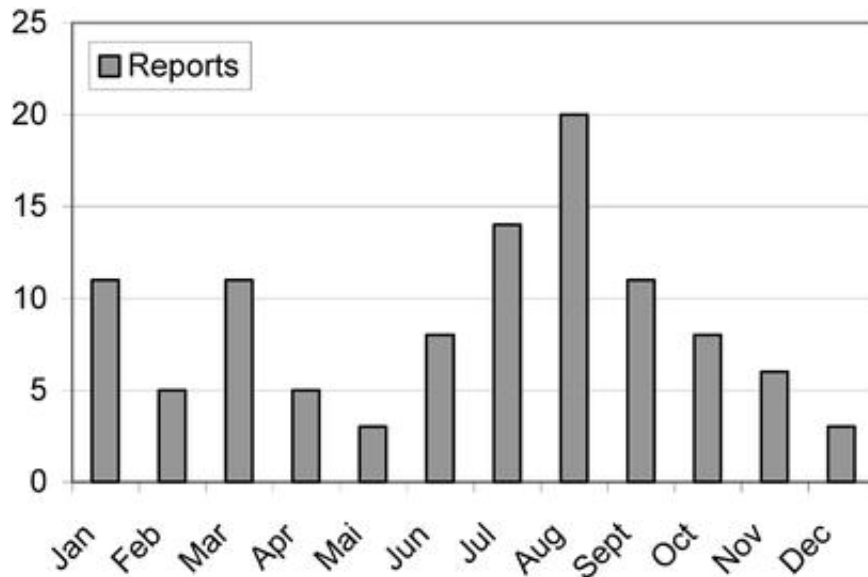


Fig. 3. Number of reports of medical assistance from Jan 1996 to Dec 2000

Fifty-five cases were due to occupational injuries, and 27 cases due to infections. An overview is shown in Table 2. Gumboil, pneumonia, bronchitis and eye infections constituted approximately half of the infections. Looking at traumas, we found that hand injury (35%) was the dominating one. There were 12 cases of fractures. The traumas, according to the AIS, were: grade 1, 25 patients; grade 2, 23 patients; grade 3, five patients; grade 4, two patients. One patient died from multiple injuries due to a fall down a ladder. Fishermen above the age of 40 years tended to be more severely damaged when injured ($P < 0.01$). The mean AIS score was 1.4 (range 1-3) and 1.9 (range 1-4) among those below and above 40 years, respectively. Injuries most frequently occurred in March (nine cases), July (eight cases) or August (seven cases). Between January 1996 and December 2000, 24 out of 51 injuries occurred within these months. In cases of little severity, Norwegians dominated the numbers of contacts. The mean AIS scores were 1.5 (range 1-4) and 1.9 (range 1-4) among the Norwegians and foreigners, respectively ($P < 0.04$).

Table 2. Overview of injuries and diseases

Reason	Total	Injury or disease	<i>n</i>
Infections	27	Gumboil	5
		Pneumonia/bronchitis	4
		Eye	4
		Genito-urinary	3
		Infected wounds	3
		Appendicitis	2
		Otolaryngeal	2
		Other	4
Trauma	55	Hand injury	19
		Fracture	12
		Head, neck, face injury	9
		Ankle, calf, foot injury	8
		Eye injury	7
		Soft tissue damage	6
		Hand/finger torn off	2
		Luxated shoulder	2
		Hypothermia	1
		Diving accident	1

Not surprising, there was a correlation between the seriousness of the injury/disease and the coastguard personnel's search for further medical advice ($P=0.05$). In 52 cases, further medical advice was obtained from the medical emergency service at the University Hospital of North Norway (15 cases), Hammerfest hospital (ten cases), Longyearbyen hospital (nine cases) and the University Hospital of Bergen (two cases). Medical doctors in the army or navy (five cases) and general practitioners in Norway (four cases) also gave the coastguard medical advice. In four cases the supporting doctor's position was not registered.

Sixty-one patients were admitted to different hospitals and 21 of them were hospitalised at the Longyearbyen hospital. Further details are shown in Table 1. The following means of transport were employed for hospitalisation: patient's ship (six cases), coastguard vessel (seven patients) and helicopter (48 patients). In 38 cases, the Lynx helicopter on board the coastguard vessel was used, in six cases a Sea King helicopter from Banak in Northern Norway, in two cases the Puma helicopter of the District governor of Svalbard, and in two cases the combined use of helicopters as they met on Bear Island. The mean one-way flying time of the Lynx helicopter was 1.9 (range 0.33-3.25) h.

Discussion

In this study, we have documented a need for medical support among the commercial fishermen operating in the Northeast Atlantic and the Barents Sea. Their working conditions may be hazardous, and occupational injuries are frequent. Hand injuries, especially, are common. Hand and finger injuries accounted for 35% of all injuries in this survey. These values are similar to findings by Jensen and co-workers (1995) from the Bornholm Central Hospital in Ronne, and from some general practices. They reported finger injuries as constituting 33% and hand and wrist injuries 17% of all injuries in the fishing industry. The trawler scoop and the winches were responsible for 18% and 11% of the accidents, respectively. This indicates that prophylactic efforts concerning safety in work with trawler scoops, winches and steering systems should be made.

In this study, there was one case of fatal injury. The risk of fatal injuries in commercial fishing is significant. Figures from Alaska (NOISH 1994) indicated a fatal injury risk almost 30 times greater than in other industries in the USA. Danish Maritime Authority reports for 1991-1995 (Hansen and Jensen 1997) state that 29.6% of injuries resulting in death involved falls overboard or being dragged away by fishing gear. In this study the great majority of vessels were trawlers fishing for northeast arctic cod, and any differences between various types of vessels could not be focused. In Alaska, the death rates among fishermen have been reported as varying considerably by type of fishery (Lincoln and Conway 1999). Fishing for shellfish had the highest death rates, then herring, halibut, salmon and ground fish. Differences have also been observed for Baltic fishermen. Tomaszunas (1992) concluded that the non-fatal and fatal injuries in Baltic fishermen occurred much more frequently than in deep-sea fishermen employed on large ocean-going trawler-factory ships.

In this study, a significant number of injuries happened during summer time (July and August). Whereas the wintertime has seasonable darkness and snow and icing that cause rough conditions, most incidents occur when the midnight sun is shining. This may be due to at least two factors. During the summer, inexperienced young men, who are substitutes for fishermen on holiday, might be less careful than their colleagues. Secondly, fishermen signing on after their holiday might be less cautious. This indicates that prophylactic efforts should be focused on improved training of fishermen acting as substitutes during summer holidays and an update on safety on board when the others return from their vacation. In a Danish study (Jensen 2000), the numbers of fall injuries in November, December, May and August were significantly greater than in the other months. However, a recently published report from the ambulance, search and rescue operations in the Barents Sea, performed by the Royal Norwegian Air Force, did not show a similar pattern (Haagensen et al. 2001).

The patients in this survey were young (median age 38 years), and the great majority were male (96%). This material is in accordance with the findings of Haagensen and co-workers (2001) at the Royal Norwegian Air Force base at Banak, who reported a mean age of 35 years and a 96% male prevalence among patients rescued by helicopters from the Barents Sea in 1994-1999.

We observed that the elderly were more severely damaged when injured. This could be caused by the fact that foreigners were older than the Norwegians and less likely to contact the coastguard when minor injuries occurred. However, age might be related to risk of injury. Jensen (2000) observed that the proportion of fall injuries in relation to age showed a U-shaped pattern. The age group below 20 years and above 50 years had the highest proportion of fall injuries. The findings among older fishermen corresponded to the pattern of fall injuries in the Danish population.

This survey does not reflect the overall values of accidents, injuries or diseases among fishermen in the Barents Sea. We have focused only on the incidents taken care of by the RNCG as there were no available national data indicating the total situation in the area. However, there are reasons to believe

the numbers handled by others (local hospitals, general practitioners, Royal Norwegian Air Force, Norwegian Society for Sea Rescue) are significant. Fishing means also work on board ship both at sea and in a harbour. Whereas the coastguards offer service at sea, injuries among fishermen, suffered while they leave or board, and injuries during loading, unloading, repairing and making other preparations on the quay, are taken care of by the local health service on land. Several minor accidents may also happen without any information being given to the coastguard. Medical assistance might have been offered by other coastguard vessels. However, in the annual report of the Norwegian Coast Guard for 1998 and 1999 (1998, 1999) medical assistance was needed for 30 and 25 cases, respectively. Our study included 44 cases (80% of all cases) during the time period. This indicates that the majority of cases are taken care of by the three north-cape-class vessels.

The need for medical assistance in the Northeast Atlantic and Barents Sea may be reported to the coastal radio stations in Norway, directly to the Joint Rescue Co-ordination Centre North Norway Bodø or by direct contact with Norwegian hospitals, general practitioners or the Norwegian coast guard. As more and more communications are by satellite telephones, the coastal radio stations have become less important in this setting. These radio stations have guidelines on how to handle medical situations. However, the new situation due to satellite telephones has given the captains of the vessels the possibility of contacting almost anyone anywhere; thus there is obviously a need for a system to handle this. Employing telemedicine services, the Longyearbyen hospital at Svalbard could act as a casualty clinic for the fishermen in this region. It receives at present the majority of patients admitted to hospital. The majority of today's trawlers are equipped with satellite communication systems such as the Inmarsat A, B, M and mini-M systems. These satellites' orbits are 35,700 km above the earth's surface. The four satellites located above the Pacific Ocean, the Western Atlantic, the Eastern Atlantic and the Indian Sea offer communication possibilities all over the world except for the polar areas. In the north, the limit is between the 80th and 81st degrees of latitude. Further north, the Iridium system is employed. Whereas the Inmarsat C only offers written communication (telefax), the other systems offer the possibility of sending e-mails, with pictures attached, to hospitals, rescue co-ordination centres, medical doctors or the coastguard vessels. This may open a new area of telemedicine possibilities to fisheries in these regions. Pictures and electrocardiograms (ECG) of injured patients may be communicated to a medical resource centre, and advice and treatment guidelines may be returned. An improved level of information may give the distant medical advisor a better overview of the injured or diseased patient. A proper use of the limited resources (vessels, helicopters, hospitals, etc.) available can be obtained. Today we experience a steadily rising pressure on limited healthcare budgets worldwide. In the Northeast Atlantic and Barents Sea tremendous distance introduces significant costs per patient admitted to hospital by helicopter. Our data are too limited for us to perform model-based cost-effectiveness or cost-utility analyses. For example, the time between the request for medical help and its actual arrival was not registered. However, there are reasons to believe that this type of analysis will be requested in the future. The healthcare owners as well as the shipping companies want to know the effect of their investments.

In conclusion, fishermen in the Northeast Atlantic and the Barents Sea may need medical assistance. The RNCG is an important resource in this setting. Today's improving technology, with the use of satellite communication systems in fishery, may introduce better medical assistance. Prophylactic efforts should include safety in work with trawler scoops, winches and steering systems as well as improved training of persons acting as substitutes during summer holidays and an update on safety on board when fishermen return from their vacation.

Acknowledgement. The authors are thankful to Stein Gunnar Moksnes at the Norwegian Centre for Telemedicine for sharing his experience in maritime telemedicine. We are also grateful to Børge Ytterstad at the Institute of Community Medicine, University of North Norway, who introduced us to the field of injury prevention.

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