VIA MEDICA

ORIGINAL PAPER

Int Marit Health
2012; 63, 1: 7–16
www.intmarhealth.pl

ISSN 1641–9251

Surveillance of maritime deaths on board Danish merchant ships, 1986–2009

Daniel F. Borch, Henrik L. Hansen, Hermann Burr, Jørgen R. Jepsen

Centre of Maritime Health and Safety, University of Southern Denmark, Esbjerg, Denmark

ABSTRACT

Background. A previous study demonstrated a high death rate among seafarers signed on Danish ships during the years 1986–1993. This study aimed to examine and analyse the subsequent development until 2009.

Material and methods. A total of 356 fatalities were identified from data supplied from the Danish Maritime Authority, an insurance company, and other sources. Maritime deaths among seafarers signed on Danish ships comprise deaths from 1) accidents, suicides and homicides; and 2) disease on board. Deaths due to 2) occurring ashore within 30 days after signing off were included. The overall and mode-specific death rates were calculated for three eight-year observation periods. The rates for work-related fatal accidents were compared with the rates for land-based trades.

Results. All categories of maritime deaths were significantly reduced from 1986 to 2009 — in particular during the last eight-year period (Accidents 1986-1993: 66.6 per 100,000 person years, 2002–2009: 27.0 per 100,000 person years, diseases 49.5–26.1, suicides 14.4–7.8). In spite of the remarkable improvement since 1986, seafarers remain in 2002–2009 more than six times more likely to die from occupational accidents (including shipwrecks) than do workers ashore.

Conclusions. The favourable trend of maritime deaths in the Danish merchant fleet may be due to 1) preventive measures — e.g. interventions relating to vessel safety, work environment, and improved medical care on board — and to 2) technological and organizational changes — e.g. newer and larger vessels in the Danish merchant fleet, changed composition of the workforce, and reduced shore leaves. The persisting excess risk warrants further preventive actions.

(Int Marit Health 2012; 63, 1: 7–16)

Key words: seafarers, maritime deaths, maritime medicine

BACKGROUND

Historically, work at sea is dangerous. The seafarer remains exposed to hazards of a magnitude or in combinations that are rarely encountered in other fields of work. Risk exposures include extreme weather, toxic emissions from cargo, failure of heavy mechanical equipment, infections from global travelling, and psychosocial factors such as fatigue and isolation. Seafarers' health is also challenged by medical emergencies being managed by lay people.

The increased death toll among merchant seafarers has been shown repeatedly [1–5]. Out of 147 deaths among Danish merchant seafarers during 1986–1993, 23 and 26 were caused by shipwrecks and occupational accidents, respectively. Alcohol played a major role in 2/3 of the fatal injuries during

Jørgen Riis Jepsen, Centre of Maritime Health and Safety, University of Southern Denmark, Niels Bohrs vej 9-10, DK-6700 Esbjerg, Denmark, Tel.: (+45) 6550 4264, fax: (+45) 6550 1091, e-mail: jriis@cmss.sdu.dk

off-duty hours. The risk of fatal accidents was 11.5 times higher than among male workers ashore. Rough weather, inadequate safety awareness, failure to use personal protective devices, and inexperience characterized many accidents [3].

Following this study, the Danish Maritime Authority extended its inspection practice from the previous main focus on vessel safety to increasingly cover work environment issues [6]. Furthermore, the Authority's Division for Investigation of Maritime Accidents has studied thoroughly an increasing number of accidents and fatalities with the aim to learn from each event, and to introduce and communicate new preventive measures to the trade.

At the same time, attempts were made to improve the maritime working environment. Following the introduction of a mandatory safety organization in 1975 on large ships with more than 10 ratings, the requirements for the safety organization and its function were further strengthened. A Maritime Occupational Health Service was established in 1993, and regular workplace risk assessments became compulsory in 1996.

The concept of training officers in charge of medical care onboard to act as the hands, ears, and eyes of the radio medical doctor [7] led to the establishment of a new and coherent maritime health care system in the mid 1990s, whereby the radio medical service carried out by four hospitals was also replaced by one specialized unit. Since then officers have been trained by the Centre for Maritime Health Services to manage health problems on board in cooperation with Radio Medical Denmark and with common reference to the content of the ships medical chest and the Maritime Medical Manual [8].

Many Danish shipping companies adopted alcohol policies in the 1990s in the aftermath of the Exxon Valdez catastrophe, and in 2007 the legal blood alcohol limit during work on board was set to 0.5 per mille.

The Danish merchant fleet and the tasks onboard underwent major changes in the same period of time. In spite of a rather stable number of vessels in the Danish merchant fleet (between 500 and 600), the gross deadweight tonnage increased from 6.9 million in 1986 [9] to 10.1 million in 2009 [10]. The number of dry cargo ships (ships transporting dry cargo except container ships, bulk carriers, reefers, and supply ships) was reduced by 58% from 246 in 1989 [9] to 104 in 2009 [10]. Most of these vessels are coasters, which have accounted for the majority of fatal accidents [11] and shipwrecks [12] in the Danish merchant fleet during the last four decades. Concurrent to the reduced number of coasters, the container and tanker fleets have increased considerably. Constant renewal during recent decades has resulted in a significantly younger Danish than global fleet (in 2009 an average age of 6.9 years vs. 11.4 years, respectively) [13]. On-board cargo operations that caused a high proportion of accidents [11] have also been significantly reduced.

The altered conditions in global shipping may have influenced the rate of fatal accidents outside work. High economic pressures combined with technological developments in the maritime trade have drastically reduced the crews' options for leisure activities ashore during port calls, and consequently the associated risks [14–16].

The composition of the crew in terms of nationality has undergone substantial changes. The share of seafarers of foreign nationality in the Danish merchant fleet was about 10% in the 1980s but exceeded 50% in 2009 [10]. Foreigners dominate among ratings, while most officers remain Danish. All these factors would tend to improve the health and safety situation in the Danish shipping industry.

This study aims to examine and analyse the trend of maritime deaths in the Danish merchant fleet from 1986 to the end of 2009 and to compare the rate of fatal occupational accidents with that of the Danish working population.

MATERIALS AND METHODS

DATA

In order to study the incidence rate of maritime deaths we need information about their number (numerator) as well as about the people at risk in the study period (denominator).

In this paper, maritime deaths consisted of fatal occupational accidents (including fatalities related to an incident involving the ship), fatal accidents involving seafarers who are signed on but off duty, and deaths from disease, suicide, and homicide occurring on board. As the surviving seafarer may be evacuated from the ship or sent ashore for treatment, we also include deaths following acute disease on board that happened up to 30 days after signing off. This definition is identical to the one applied in a previous article [3].

To compare the one-year incidence rate of maritime fatal occupational accidents to the one-year incidence rate among workers onshore, the number of onshore fatal occupational accidents was related to the number of male workers in land-based occupations in the same time-period.

NUMERATOR DATA

The numbers and the modes of maritime deaths that occurred during each calendar year 1986–2009 represent the key variables for this study. In order to compare the one-year incidence rates of maritime fatalities from accidents with the fatal occupational accidents ashore in the same observation periods, we have additionally sought data on the latter.

Information on the maritime deaths was collected from two sources (Table 1). The Danish Maritime Authority receives the captain's notification of the death of all seafarers signed-on on Danish merchant vessels. In addition, the Authority covers medical and funeral expenses for seafarers in international trade. It may therefore be assumed that the authority becomes aware of the deaths, and that all applicable deaths that occurred during the study period have been identified. Further information about the circumstances leading to compensable deaths was additionally collected from the Danish Shipowners' Accident Insurance Association. Both sets of data on deaths were independent of the seafarers' nationality and country of residence.

Out of a total of 837 maritime deaths that occurred in the study period, 481 concerned either fishermen or seafarers who at the time of death were either not signed-on or were employed on vessels of another flag nation. The remaining 356 seafarers (all except ten males) died while employed on ships in the Danish merchant fleet. Data from these files were entered into the Research Register of Maritime Deaths (Table 1).

Further details about each case were collected from a variety of sources (files of the maritime authorities – e.g. maritime inquiries and investigations, log books, telex and e-mail communications, death certificates, necropsy reports, police reports, bills from medical treatment overseas, captains' reports, newspaper articles, etc.). This information permitted, with a high degree of certainty, the definition of the mode of death for all cases (Table 2).

For comparison, the Danish Working Environment Authority, which caters for the work environment ashore, registered 1468 fatal occupational accidents among males during the study period. Traffic fatalities relating to work were included in this figure while

Table 1. Data sources for the quantitative calculations. The research register of maritime deaths developed for this study is based on data from the Danish Maritime Authority and the Danish Shipowners' Accident Insurance association

	Maritime databases	Land-based databases
Numerator	Research register of maritime deaths 1986–2009 (N = 356) among men (Danish Work Environment	The Danish National Register of Work Injury. The number of fatal occupational accidents Service) (N = 1468)
Denominator	The number of insured positions on board Danish ships (Danish Shipowners' Accident Insurance Association) (N = 170.923)	Employment classification module for registering jobs ashore among men (Statistics Denmark) (N = 35.089.682)

Table 2. Definitions of mode of death [3]

Mode of death	Definition
1: Homicide	Unlawful killing with intent
2: Occupational fatal accident	An external, sudden, unexpected, unintended, and violent event, during the execution of work or arising out of it, which causes death
3: Non-occupational fatal accident	An accident outside working hours onboard the ship or ashore involving a signed on seafarer
4: Shipwreck	A casualty related to an incident involving the ship, such as sinking, foundering, collision, explosions, and fire.
5: Fatal disease on board — recognized by others	Death from an illness that started on board and was noticed by others
6: Fatal disease — found dead on board	A seafarer found dead from illness without previous notice by others of any signs of illness
7: Death from disease ashore	The seafarer presented initial symptoms onboard and was evacuated or signed off to eventually die ashore within 30 days
8: Suicide	The act of causing one's own death. Disappearance in open sea without any indications of an accident is included under suicide

fatalities occurring while commuting to/from work, and fatal accidents on ships were excluded.

DENOMINATOR DATA

The corresponding two sets of denominator variables are the person-years in risk of the two background populations onboard and ashore, respectively (Table 1).

The Danish Shipowners' Accident Insurance Association provided for each year in the study period the number of insured positions for seafarers (Table 1). In a practical context and provided that all ships are in full-time operation, one position on board corresponds to about two full-time seafarers. In this study we have estimated the number of person-years at risk by adding up the number of positions on board for each year and multiplying with a factor two. Consequently, for the seafarers 341,846 person-years were at risk during the whole study period. The number of person-years at risk for each of the three eight-year study periods is indicated in Table 3.

For the control group of the onshore male workforce, the corresponding total number of person-years at risk (35,089,682) was supplied from Statistics Denmark. The number of person-years at risk for each of the three eight-year study periods is indicated in Table 4.

VARIABLES

Deaths. The Research register of maritime deaths from January 1st 1986 to December 31st 2009 contains for each year all deaths of seafarers signed on commercial and publicly owned Danish flagged merchant ships except fishing vessels. Seafarers who died ashore within 30 days after signing off a ship due to an acute disease that started on board were also included. Deaths of seafarers that were formally signed on but on leave, and of passengers and stowaways, were excluded from the study. Ten maritime deaths, out of which five were fatal occupational accidents, involved females. Still, for practical purposes, the rates for occupational accidents were calculated as if all were males, and using the male land-based workforce as the reference. The previous study of maritime deaths on board Danish merchant vessels from 1986 to 1993 applied identical inclusion and exclusion criteria [3] except that publicly owned vessels were not included.

ANALYSES

Due to an unknown age-composition of one of the denominator populations, namely that of the seafarers, we calculated the crude (non age-standardized) incidence rates for each eight-year period for all deaths and for mode-specific deaths. Comparison of the rates for each period was done in a logistic regression with death as the dependent variable. As the independent variable, the period (i.e. calendar year divided into three eight-year periods) was used as a categorical variable. A trend test permitted the assessment of the development of the incidence rates

Table 3. The number and incidence rates of deaths distributed on modes of death and time intervals. N = number of deaths. IR = incidence rate (deaths pr. 100,000 person-years)

Person-years at risk	1986–1993 111.152		1994–2001 115.908		2002–2009 114.786		
	N	IR	N	IR	N	IR	p*
1: Homicides	2	1.8	4	3.5	0	0.0	0.148
2: Occupational accidents	27	24.3	28	24.2	12	10.5	0.029
3: Non-occupational accidents	23	20.7	12	10.4	7	6.1	0.001
4: Shipwrecks	24	21.6	24	20.7	12	10.5	0.101
All accidental fatalities	74	66.6	64	55.2	31	27.0	0.006
5: Diseases on board – recognized by others	24	21.6	23	19.8	8	7.0	0.006
6: Diseases – found dead on board	19	17.1	15	12.9	15	13.1	0.619
All disease-related fatalities on board	43	38.7	38	32.8	23	20.0	0.017
7: Diseases ashore	12	10.8	19	16.4	7	6.1	0.280
8: Suicides	16	14.4	14	12.1	9	7.8	0.074
Total deaths	147	132.3	139	119.9	70	61.0	0.000

*p for trend with calendar year as a continuous variable

Table 4. Number (N) and incidence rates (IR = deaths pr. 100,000 person-years) of fatal occupational accidents among seamen signed on a Danish merchant vessel with Danish men in all occupations ashore as the standard for comparison (IRR = incidence rate ratio)

Person-years of risk	1986–1993 111,152			1994–2001 115,908			2002–2009 114,786			
Occupational accidents	**N**	**IR**	**IRR**	**N**	**IR**	**IRR**	**N**	**IR**	**IRR**	**p***
Seafaring except shipwrecks	27	24.3	5.24	28	24.2	5.18	12	10.5	3.21	0.015
Male workers ashore	541	4.6	1	542	4.7	1	385	3.3	1	
Seafaring including shipwrecks	51	45.9	9.91	52	44.9	9.63	24	20.9	6.41	0.001
Male workers ashore	541	4.6	1	542	4.7	1	385	3.3	1	

*p for change in incidence rate ratio between 1986–1993 and 2002–2009

over time in a logistic regression with death as the dependent variable and, as the independent variable, the calendar year as a continuous variable. The relative risks were also compared for each eight-year observation period and for each mode of death.

RESULTS

Out of the 356 fatalities studied, 59% occurred at sea, 6% during mooring or port manoeuvres, and 31% while the ship was docked. Only 4% of the deaths occurred ashore. 45% of the fatal non-occupational accidents involved a coaster crew and 17% a tanker crew (Table not shown).

Table 3 shows the numbers and incidence rates of the deaths in three eight-year observation periods, subdivided into modes of death. The overall death rate declined significantly during the 24 years of observation. This is in particular due to the reduction of occupational and non-occupational fatal accidents, and of fatal recognized disease on board. A similar trend was observed for the remaining categories. While there were almost constant incidence rates for all deaths and for each mode of death between the first eight-year period 1986–1993 and the second eight-year period 1994–2001, the incidence rates were significantly lower in the last eight-year period.

During the observation period, the incidence rates for deaths from recognized disease, for accidents whether or not related to work, and for shipwrecks were all at least 50% reduced from the first to the third eight-year period. The largest reduction of deaths (70%) was observed for recognized fatal diseases, and for fatal accidents happening outside work. Fatalities due to occupational accidents and shipwreck, disease-related deaths ashore, and suicides were all reduced to about 50% of the initial rate. A less pronounced reduction of 23% was found for fatal disease that was unrecognized before death.

The relative distribution of modes of death in the three eight-year periods is illustrated in Figure 1. In 2002–2009, the most frequent modes of death were death from previously unrecognized disease (21%) followed by fatalities from occupational accidents and shipwreck (both 17%), and suicides (13%).

The yearly decline from 1986 to 2009 in the incidence rates of fatal accidents (Figure 2) and diseases (Figure 3) were both highly significant (p = 0.006 and 0.017, respectively).

In the two first observation periods, fatal occupational accidents were more than five-fold increased among seafarers compared to male workers onshore. The inclusion of shipwrecks raised the relative risk to almost ten-fold. In the last observation period in the new millennium, however, the excess risk was reduced to just over three and six times, respectively, for the two categories (Table 4).

Table 5 illustrates the more specific causes behind the fatal work-related accidents in the three time intervals. The reduction happened across all types of accidents except fatalities related to falls overboard.

For deaths related to diseases that were acknowledged by other crewmembers prior to death, the information from the files permitted categorization into the assumed main groups of disease for the majority of seafarers. All categories of diseases were reduced in the three eight-year study periods. The reduction was less evident for heart diseases, which also represented the most frequent category of conditions across all study periods.

DISCUSSION

This study has demonstrated a substantially reduced total death incidence rate among seafarers signed on Danish merchant ships from 1986 to 2009. From the first to the last eight-year period, the reduc-

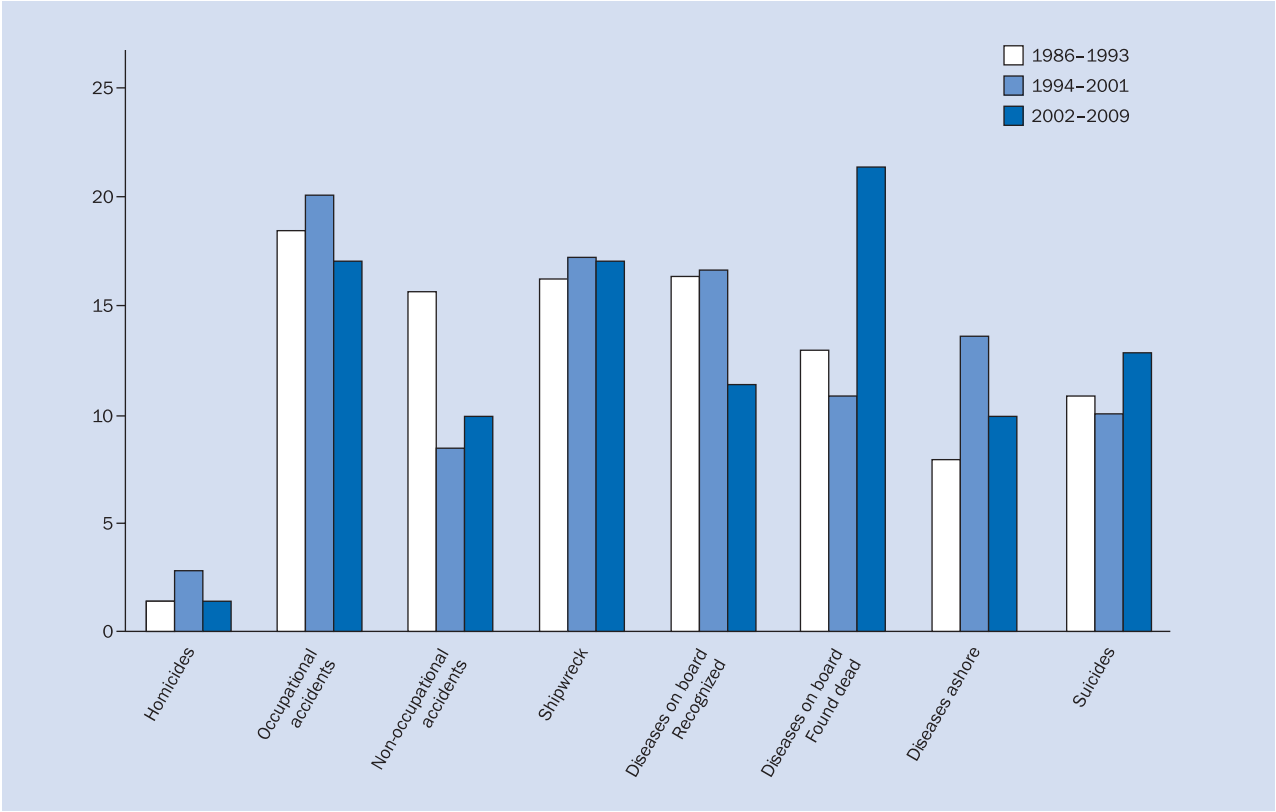

Figure 1. Relative distribution of modes of death (%) in the three eight-year periods

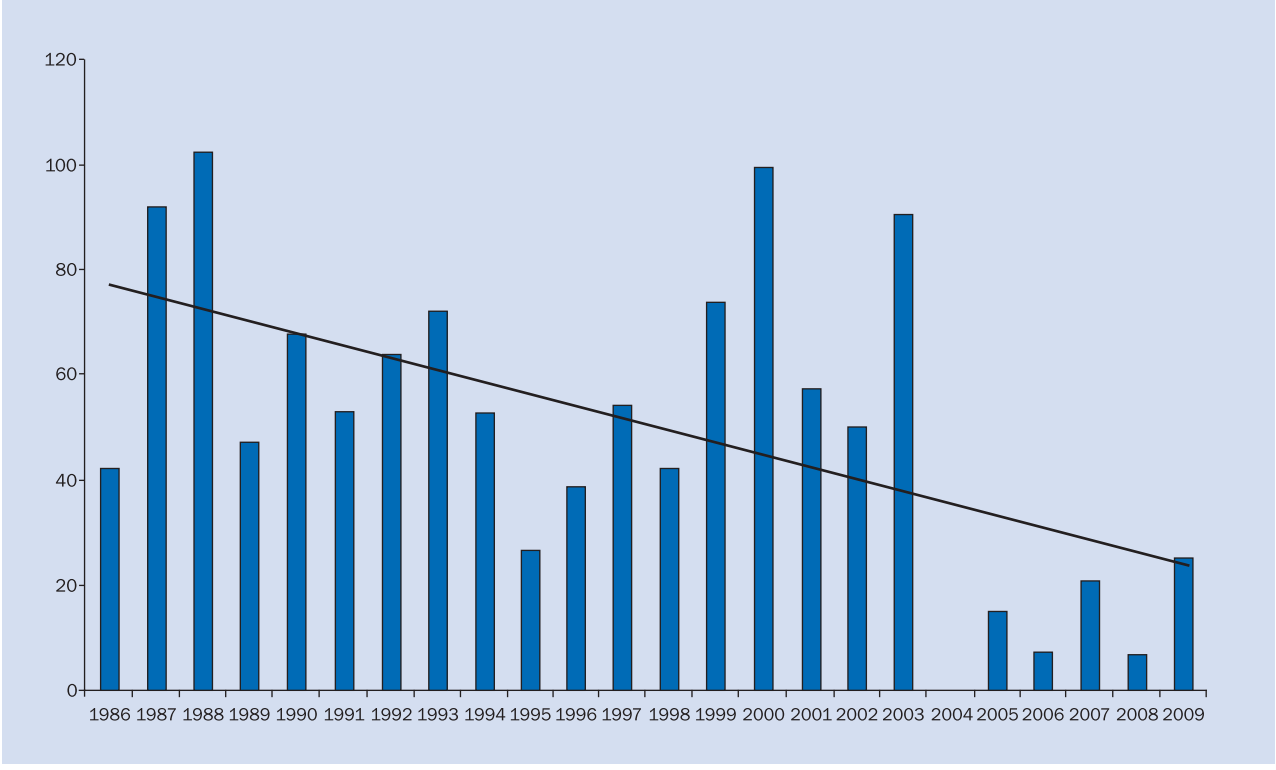

Figure 2. Crude rates of all fatal accidents (occupational accidents including shipwrecks and accidents occurring while signed on but unrelated to work) per 100,000 person-years. The slope of the trend line is significant (p = 0.006)

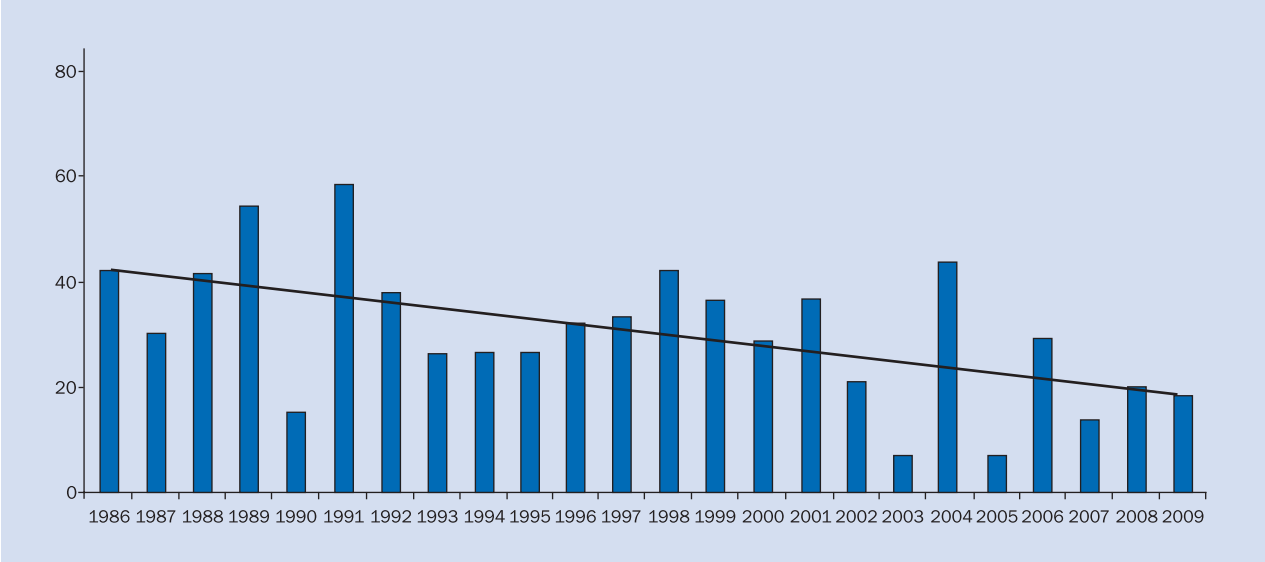

Figure 3. Crude rates of fatal disease onboard (disease recognized by others and found dead) per 100,000 person-years. The slope of the trend line is significant (p = 0.017)

Table 5. Types of occupational accidents according to information in files 1986–2009

Occupational fatal accidents	1986–1993	1994–2001	2002–2009	Total
Falls on board	5	4	2	11
Swept overboard	5	2	0	7
Falls overboard	4	4	6	14
Mooring operations	3	2	1	6
Suffocation in holds and tanks	3	1	0	4
Accidents in engine rooms	1	0	0	1
Other accidents	6	15	3	24
Total	27	28	12	67

tion accounted to almost 54% (132.3 and 61.0 per 100,000 person-years, respectively) with the most significant reduction occurring from the second to the last eight-year observation period in the current millennium (Table 2). All modes of death were reduced, but particularly those linked to the maritime environment in terms of vessel security and work environment, to the risks associated with shore leaves, and to recognized and treatable diseases on board.

In spite of the significant improvements, the current rate of maritime deaths remains worrying — not least with respect to the fatal accidents. Compared to onshore, the incidence rate of fatal occupational maritime accidents (including shipwrecks) was increased by a factor of ten during the two first observation periods. The elevated risk remained, but dropped to about a six-times increase during the last observation period in the current millennium (Table 3). Only fishermen with an almost four-fold higher fatality rate of 100 fatalities per 100,000 person-years during 1989-2005 [17] have a higher rate of fatal accidents. These figures demonstrate that in spite of a significantly improved safety over the last 24 years, the Danish merchant fleet remains a high-risk trade. Further interventions are clearly required. The breakdown of types of occupational accidents (Table 5) suggests that an intervention towards falls overboard would be particularly justified although it is acknowledged that conclusions must be made with caution due to the small numbers.

The reduced overall number of deaths has caused an increase over time of the relative fractions of seafarers that were found dead, and of suicides (Figure 1). In spite of passing a medical examination both groups may have suffered poor somatic — in particu-

lar cardiovascular — or mental health prior to embarkation, or a new acute condition on board may have caused death. Both challenges are difficult to handle. Additional requirements for medical fitness would be likely to cause the loss of licence of many seafarers without necessarily improving safety. The influence on these deaths of environmental factors cannot be determined, but psychosocial exposures on board may have contributed to suicides.

STRENGTHS AND WEAKNESSES

The design of this study is strong because the dataset includes all crewmembers in the Danish merchant fleet regardless of their nationality, and reflects the proportion of the mortality that is "acutely" related to the work. Consequently, this design may suggest areas where a direct preventive intervention in the occupational setting could make a difference.

Occupational mortality studies that are based on national mortality registers may permit a comparison of the total or disease-specific mortality between occupational groups and may also identify fatal accidents. However, these studies cannot identify 1) the proportion of fatal accidents that occurred at sea, 2) whether they occurred while carrying out work on-board or during leisure time, or 3) the proportion of deaths from illness at sea that may have had a more favourable course if occurring ashore. When it comes to death from preventable disease, national mortality registers tend to reflect past exposures. While in the context of occupational health, past exposures may be relevant for assessing, e.g. exposure-effect relations; preventive activities targeting disease cannot solely be based on such historical outcomes because many responsible exposures may have changed over time or may even have disappeared. In addition, preventive interventions should not only be of a primary character. In a maritime context the prevailing onboard treatment options are of equal importance. Most importantly, an occupational mortality study based on national registers would only include national citizens. Missing the more than five-fold increased share of seafarers of foreign nationality in the Danish merchant fleet (from around 10% in the 1980s to more than 50% in 2009 [10]) would bias any assessment. Not only would the majority of seafarers be ignored, but those ignored may also represent the crew at highest risk.

The unique register developed for this study has overcome these constraints because we have managed to update the "acute" share of the maritime mortality in the Danish merchant fleet, taking into account the composition of the crew with regard to nationality. This has been possible because the data sources permitted access to numerator as well as denominator data. The risk has been calculated for all ships in the merchant fleet in spite of the multinational crews.

The weaknesses of this study should also be mentioned. The presented data have not explained the observed highly reduced rate of deaths. The favourable achievements may be related to the previously mentioned preventive interventions during the observation period that aimed to target factors relating to vessel safety, work environment, and health care on board. However, none of these interventions in themselves can with certainty explain the observed trend. The reduced number of deaths may as well be related to concurrent technological and organizational developments that have not *per se* intended to improve the health and safety of seafarers (e.g. the composition and age of the fleet, the work functions onboard, and the current, more intensive shipping with shorter port calls). In addition, the tendency towards generally improved health in the labour force is also likely to favour seafarers on Danish vessels, where a certain selection may have reduced the number of chronic conditions.

However, the differentiated trend for reduced death rate incidences in between the various modes of deaths does indicate potential explanations. The smaller reduction of fatal occupational accidents including shipwrecks than of non-occupational fatalities suggests the positive influence of shorter port calls (which, however, may also have less desirable consequences such as increased isolation on board). Cardiovascular conditions account for most of the disease-related deaths onboard (Table 6). The substantial fall in deaths from acknowledged diseases compared to the largely stable number of situations where the seafarer was found dead suggests the influence of improved health care and facilities for treatment on board and better options for evacuating sick or injured seafarers for care ashore. Evidently, whether on board a ship or elsewhere, a medical intervention would not be feasible when, e.g. an acute cardiovascular event causes the immediate death of a person who is alone.

Prevention of both would rely on healthy seafarers onboard and may be influenced by 1) the pre-employment health examination, which, however, has not changed in the observation period and by 2) general health promotion that targets lifestyle factors such as smoking and the various metabolic risk

Table 6. Distribution of categories of disease-related deaths according to information in files 1986–2009

Fatal disease onboard recognized by others	1986–1993	1994–2001	2002–2009	Total
Infectious diseases	5	4	0	9
Gastrointestinal diseases	5	1	0	6
Heart diseases	10	9	7	26
Cerebrovascular diseases	2	1	0	3
Other diseases	2	6	1	9
Total	24	21*	8	53

*2 cases could not be determined

factors. The general Danish trend towards a healthier population and a reduced prevalence of cardiovascular disease may be assumed to also eventually affect seafarers onboard Danish ships and consequently to reduce the likeliness of fatal cardiovascular events on board.

The number of seafarers that were found dead on board ships in the observation period was largely unchanged (Table 2). This may reflect that the general positive trend for cardiovascular health in the Danish population does not yet apply for seafarers to the same extent. Compared to the non-maritime population, many indices and a few studies [18, 19] suggest that seafarers smoke more than average although the current smoking regulations on board Danish vessels are comparable to those ashore. Cheap untaxed cigarettes are mostly available on board ships in international trade. Obesity is also more prevalent among seafarers and there is a trend towards a further increase of this problem [20, 21]. Health promotion among Danish seafarers is still in its infancy and therefore can also hardly have influenced the findings.

The suicide rate has declined in the general Danish population on land and among signed-on seafarers in the observation period although this is not statistically significant for the latter (Table 3). The seemingly low suicide rate for seafarers, however, merely reflects suicides among currently signed on seafarers and therefore not those among those on home leave or unemployed. It has previously been demonstrated that in the first observation period only 1/3 of seafarers' suicides happened during active service. The remaining majority of suicides took place during home periods or among unemployed seafarers[2]. For that reason and because suicide accounts for a significant share of current maritime deaths (Figure 1), the demonstrated suicide rate during active service is still a matter of concern. It should, however, be noted that especially since the beginning of this millennium, the increased employment of crew from nationalities other than Danish reduces the value of comparison with suicides occurring in the Danish male population.

To fully understand what has happened in the observation period and to devise the options for prevention one has 1) to look deeper into the circumstances that characterize each mode of death and each individual death and 2) control in the analyses performed in this paper for the age and nationality of the seafarers, and for the type of vessel. To do this, additional data that are not readily available are needed. Consequently, no definite conclusions can be drawn with regard to the contribution to the observed trend of the already instituted preventive measures that have been summarized in the introduction, or whether the reduction of maritime deaths is rather related to other factors.

COMPARISON WITH OTHER STUDIES

Studies based on national mortality registers [1, 2, 4] have shown an elevated mortality for all occupational groups of seafarers in between which, however, the magnitude and the causes of death has differed. The rate of fatal occupational accidents in a recent British study was of the same magnitude but slightly lower (7.9 per 10,000 person-years during 1996–2005) than in the current study (10.5 per 100,000 person-years during 2002-2009) [22]. The difference may be related to differences in designs and calculations, and to the composition of the two fleets, e.g. the higher proportion of passenger vessels in the British fleet.

In spite of the global character of shipping and the efforts by international bodies such as the ILO [23] to establish a more uniform level of health and safety internationally, the favourable development of maritime deaths demonstrated for Danish shipping

in this study cannot be generalized to other flag nations that may be subject to conditions that are very different from those applicable in the Danish merchant fleet.

CONCLUSIONS

The Danish merchant fleet has become a considerably safer place to work during recent decades. Still, however, the on-going high risk of fatal occupational accidents demands further improvement. Further analyses of each individual mode of death are required to determine the character of the required interventions. The trend of maritime deaths should be continuously monitored.

REFERENCES

1. Vuksanovic P, Goethe WHG. Mortality and lethality among seamen. Bull Inst Mar Trop Med Gdynia 1986; 37: 201–217.
2. Hansen HL, Pedersen G. Influence of occupational accidents and deaths related to lifestyle on mortality among merchant seafarers. Int J Epidemiol 1996; 25: 1237–1243.
3. Hansen HL. Surveillance of deaths on board Danish merchant ships, 1986–93: implications for prevention. Occup Environ Med 1996; 53: 269–275.
4. Brandt LP, Kirk NU, Jensen OC et al. Mortality among Danish merchant seamen from 1970 to 1985. Am J Ind Med 1994; 25: 867–876.
5. Lynge E. Occupational mortality. Scand J Public Health 2011; 39 (7 Suppl): 153–157.
6. Hansen HL, Vinter M. Søfarende i danske skibe omkring årtusindskiftet — om arbejdsmiljø og arbejdsvilkår i handelsflåden. Handels- og Søfartsmuseet på Kronborg. Årbog 2004. Helsingør 2004: 59–86.
7. Kirk U, Duus L. Health training programmes for skippers in the fishing fleet and officers in the merchant fleet in Denmark, the implementation of EU Directive 92/29/EEC. Esbjerg: South Jutland University Centre, 1996.
8. Kirk U, Duus L, Brandt L. The maritime medical manual. Copenhagen: Iver C. Weilbach & Co. A/S, 1998.
9. Skibsfartsberetning 1985/86. København: Danmarks Rederiforening, 1986: 31.
10. http://www.sofartsstyrelsen.dk/SiteCollectionDocuments/Publikationer/Fakta%20om%20sofart/FOS%20DK%202009%20til%20hjemmeside.pdf.
11. Hansen HL, Nielsen D, Frydenberg M. Occupational accidents aboard merchant ships. Occup Environm Med 2002; 59: 85–91.
12. Hansen HL. Beretninger om Danske skibsforlis siden 1970. Marstal: Marstal Søfartsmuseum, 2009.
13. http://www.shipowners.dk/danskskibsfartogoffshore/noegletal/handelsflaadensgennemsnitsalder/.
14. Oldenburg M, Jensen HJ, Latza U et al. Coronary risks among seafarers aboard German-flagged ships. Int Arch Occup Environ Health 2008; 81: 735–741.
15. Roberts SE, Williams JC. Update of mortality for workers in the UK merchant shipping and fishing sectors: The Maritime and Coastguard Agency and the Department for Transport 2007.
16. Kahveci E. Fast turnaround ships and their impact on crews. Cardiff: Seafarers International Research Centre 1999.
17. Laursen LH, Hansen HL, Jensen OC. Fatal occupational accidents in Danish fishing vessels 1989–2005. Int J Inj Contr Saf Promot 2008; 15: 109–117.
18. Tomaszunas S. Smoking habit in fishermen and seafarers. Bull Inst Mar Trop Med Gdynia 1989; 40: 13–20.
19. Oldenburg M, Baur X, Schlaich C. Occupational risks and challenges of seafaring. J Occup Health 2010; 52: 249–256.
20. Hoeyer JL, Hansen HL. Obesity among Danish seafarers. Int Marit Health 2005; 56: 48–55.
21. Hansen HL, Hjarnoe L, Jepsen JR. Obesity continues to be a major health risk for Danish seafarers and fishermen. Int Marit Health 2011; 62: 98–103.
22. Roberts SE. Mortality from disease among seafarers in British merchant shipping (1976–1995). Int Marit Health 2002; 53: 43–58.
23. Maritime Labour Convention, 2006: International Labour Conference, 2006.