Risk of fatal accidents occurring other than at sea among Icelandic seamen

Vilhjálmur Rafnsson, Hólmfríður Gunnarsdóttir

Abstract

Objective—To study mortality among seamen, particularly from fatal accidents that occurred other than at sea.

Design—Cohort study.

Setting—Iceland.

Subjects—27 884 seamen, both fishermen and sailors from the merchant fleet, who had been members of a pension fund from 1958 to 1986.

Main outcome measures—Cause of death (ICD seventh revision), standardised mortality ratio.

Results—Most standardised mortality ratios were greater than 1, being 1.26 for all causes and 1.83 for all external causes. There was no healthy worker effect. The excess of deaths from all external causes included all subcategories of death from accidents, poisonings, and violence and not just accidents at sea (water transport accidents, ICD codes E850-E858). A significant trend was found for length of employment and mortality from all accidents at sea, drowning at sea, accidental poisoning, other accidents, and accidental drowning; correlation coefficients for all causes, all accidents, suicide, and injuries undetermined whether accidentally or purposely inflicted were 0.7-0.8. Compared with seamen who started work during 1968-77, those who started work in 1978 or later had higher mortality from all causes, road traffic accidents, poisoning, other accidents, homicide, and injuries unknown whether accidentally or purposely inflicted, but not from all accidents at sea and accidental drowning.

Conclusion—Seamen seem to be a special group with a high risk of fatal accidents occurring not only at sea. The association between fatal accidents other than at sea and length of employment as seamen indicates that seamen are modified by their occupation towards hazardous behaviour or a risky lifestyle.

Introduction

Fishermen are considered to have one of the most risky working environments because fatal accidents are common¹⁻⁵ and have been so for some time.⁶ Fishing has long been assumed to be an extremely demanding occupation, exerting both physical and mental strain on the men thus employed.³

The Nordic countries (Denmark, Sweden, Norway, Finland, and Iceland) all have similar patterns of morbidity and mortality. Fish products were 71% of the total exports of Iceland in 1989, and fishing occupies more than 5% of the total labour force.⁷ In a recent anthropological monograph on fishing economies and cultural constructs in Iceland Pálsson gave some interesting views on fishermen's society and occupation.⁸ In Iceland the type of fishing emphasises not only that fishing is too dangerous for women but also that it is an occupation only for the bravest and physically strongest men.⁸ Among other factors mentioned by Pálsson is the relation between fishing and lifestyle: "The art of fishing . . . cannot be dissociated from its larger context, the art of living"⁸ Different aspects of fishing and the related sociocultural factors in Iceland have been discussed before.^{9 10}

Our aim was to see whether, in addition to the documented risk of fatal accidents at sea, seamen were also at risk of other fatal accidents.

Subjects and methods

We obtained data on a cohort of Icelandic seamen from the Seamen's Pension Fund.⁶ The cohort comprised 27 884 men, including seamen from the merchant fleet and fishermen, who accounted for the majority of the members. Most of the seamen were young: 56% of the active seamen were under 35 and only 5% were 55 or older.⁶ The majority of the seamen had been employed for a short time: 9254 for one year or less. The pension fund did not differentiate between fishermen and others and had no information on the kind of job men performed or the ship they had served on. Its members comprise about 70% of all Icelandic seamen and fishermen. The number of men in the general population in Iceland was 125 000 in 1990.

The subjects were included in the study from the time they were first listed in the membership files of the fund. Each year that a person was listed in the membership files was registered as a whole year of employment. Records were linked through the identification numbers of each seaman to the national register and the registers of deaths and of cause of death, all of which are kept by the Statistical Bureau of Iceland, to establish the fate of each seaman. Record linkage was possible through the permission of the data inspection committee. The pension fund was established in 1958 and computerised in 1965-6. Follow up began in 1966, when the registers of deaths and cause of death were computerised, and ended on 1 December 1989.

The register of cause of death records the information listed on death certificates throughout the country. From this register the underlying cause of death was obtained. Different revisions of the International Classification of Diseases (ICD) were used during the study period, so the cause of death was reclassified for the purpose of standardisation.¹¹ The seventh revision was chosen because it is used by the cancer register in Iceland and has been used in previous mortality studies.^{6 12 13} At the end of the study we were able to establish the fate of all the seamen.

Person years were calculated for each man starting with his first year in the fund and ending with his date of death or 1 December 1989.¹⁴ The number of expected deaths was calculated on the basis of the total number of person years for each five year age category during the respective calendar years of the study period, multiplied by the specific mortality for cause and calendar year in Icelandic men.

The ratio between the observed and the expected numbers of deaths, or the standardised mortality ratio, was calculated with the 95% confidence interval assuming a Poisson distribution.¹⁵ If the observed number was 100 or more we assumed that the distribution was normal.

Separate analyses were performed according to accumulated years of employment. To eliminate the effect of selection of the subjects into different exposure groups, person years were calculated 10 years

Department of Occupational Medicine, Administration of Occupational Safety and Health, Bildshoefdi 16, 112 Reykjavik, Iceland
Vilhjálmur Rafnsson, chief medical director
Hólmfríður Gunnarsdóttir, research assistant

Correspondence to:
Dr Rafnsson.

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after the subjects were first listed in the file.^{16 17} Spearman's rank correlation coefficients and one tailed p values¹⁸ were calculated as we hypothesised that the risk would increase with longer employment.

Results

Table I shows the observed and expected numbers of deaths in the total cohort. The standardised mortality ratio was raised for all causes and all external causes. A high risk of several categories of accidents was found: in addition to an increased risk of accidents involving water transport, the risk was high for poisonings and violent deaths, including suicide and homicide. Only one of the homicides was committed using a firearm or explosives (ICD (seventh revision), code E981). After 1970 we were able to use a new category defined in the eighth revision of the International Classification of Diseases—that is, injury undetermined whether accidentally or purposely inflicted. This cause of death was in excess 30 v 15.92; 1.88 (1.27 to 2.69)).

Table II shows the relation between the standardised mortality ratio for selected causes of death and length of employment. Many of the standardised mortality ratios were high, and for many categories there was a positive gradient with respect to longer duration of employment, although only some of the correlation coefficients were significant. The trend, however, was significant for all accidents at sea, drowning at sea, accidental poisoning, other accidents, and accidental drowning. The correlation coefficients for all causes, all accidents, suicide, and injuries undetermined whether accidentally or purposely inflicted were 0.7, 0.8, 0.7, and 0.8 respectively.

Table III shows the results when dividing the cohort according to when men were first listed in the pension fund. Those who started working between 1968 and 1977 were followed up till 1979 and those who started

in 1978 or later were followed up till 1989. From 1978 to 1989 standardised mortality ratios were higher for death from all causes, traffic accidents, poisoning, poisoning by alcohol, other accidents, homicide, and injuries undetermined whether suicide or accident. Those who started working in 1978 or later had a lower standardised mortality ratio for all accidents at sea and drowning at sea.

Discussion

We found a substantial excess of deaths from all causes and all external causes in this cohort of Icelandic seamen, but no healthy worker effect on total mortality, which contrasts with what has been found in studies of mortality in other occupational groups in Iceland.^{12 16} Our findings may also contradict the myth that fishing attracts the bravest and strongest men.⁸

We are well aware of the weakness of comparing an occupational group with the general population.¹⁹ This procedure usually introduces a negative bias, the employed population having a better outcome than others. In our study mortality from all causes was increased mainly by the increased mortality from accidents. This cohort of seamen represents a sizable proportion of the total male population in Iceland, so its experience will strongly influence the death rates in the population that were used to calculate the standardised mortality ratios. This means that the stated standardised mortality ratio is further underestimated in comparison with what would be found if we had had the opportunity to compare seamen with non-seamen. No such data—for example, mortality in the economically active general population of Iceland—are currently available.

In the light of our potential negative bias, the fact that a healthy worker effect was found in Canadian fishermen after a follow up of eight years,²⁰ in Swedish fishermen,²¹ and in Italian fishermen²² is interesting. Among the Canadian fishermen the high standardised mortality ratio for all accidents was not solely explained by high mortality from accidents at sea as road traffic accidents were also in excess.²⁰

We found that length of employment was associated with higher risk of accidents unrelated to work, indicating that seamen may have riskier life styles. The high rate for accidental poisoning by alcohol supports this. However, liver cirrhosis is rare in Iceland^{23 24} and none of the seamen in our study died from it.

The fact that more experienced than inexperienced seamen died in accidents and drowned at sea is interesting. Workers might be expected to benefit from experience and age and reduce their risk of having accidents at work. In our study, however, the likelihood of escaping from a fatal accident at work diminished the longer the exposure to the hazards at sea. Drown-

TABLE I—Observed and expected numbers of deaths by cause with standardised mortality ratios (95% confidence intervals) in 27 884 seamen* followed up from 1966 to 1989

Cause of death (ICD (seventh revision) code)	No of deaths		Standardised mortality ratio (95% confidence interval)
	Observed	Expected	
All causes (001-E999)	2226	1768.79	1.26 (1.21 to 1.31)
Accidents, poisonings, and violence (E800-E999)	771	422.30	1.83 (1.71 to 1.96)
Motor vehicle accidents (E810-E841)	106	64.27	1.65 (1.37 to 1.99)
Water transport accidents (E850-E858)	256	93.25	2.75 (2.44 to 3.09)
Water transport accidents, drowning (E850, E851)	216	81.09	2.66 (2.34 to 3.02)
Accidental poisoning (E870-E895)	41	24.77	1.66 (1.19 to 2.25)
Accidental poisoning by alcohol (E880)	22	11.55	1.90 (1.19 to 2.88)
Accidental falls (E900-E904)	38	23.76	1.60 (1.13 to 2.20)
Other accidents (E910-E936)	108	62.13	1.74 (1.44 to 2.10)
Accidental drowning (E929)	33	18.28	1.81 (1.24 to 2.54)
Suicide (E963, E970-E979)	144	103.82	1.39 (1.18 to 1.64)
Homicide (E964, E980-E985)	21	8.43	2.49 (1.54 to 3.81)
Injury undetermined whether accidentally or purposely inflicted (E980-E989)†	30	15.92	1.88 (1.27 to 2.69)

*417 502 Person years.

†ICD eighth revision.

TABLE II—Standardised mortality ratios (95% confidence intervals) according to length of employment and cause of death in 21 867 seamen followed up from 1966 to 1989

Cause of death (ICD (seventh revision) code)	Length of employment					Spearman correlation coefficient	p Value (one tailed)
	< 2 Years (n = 6300)	2-4 Years (n = 4262)	5-7 Years (n = 2735)	8-10 Years (n = 2691)	> 10 Years (n = 5874)		
All causes (001-E999)	1.19 (1.08 to 1.31)	1.22 (1.09 to 1.37)	1.62 (1.41 to 1.86)	1.87 (1.62 to 2.16)	1.42 (1.30 to 1.55)	0.7	NS
Accidents, poisonings and violence (E800-E999)	1.20 (0.93 to 1.52)	1.17 (0.85 to 1.58)	2.62 (1.93 to 3.48)	3.63 (2.74 to 4.71)	2.96 (2.57 to 3.41)	0.8	NS
Motor vehicle accidents (E810-E841)	0.94 (0.35 to 2.05)	1.87 (0.81 to 3.69)	4.46 (2.14 to 8.21)	3.96 (1.71 to 7.80)	2.21 (1.23 to 3.64)	0.6	NS
Water transport accidents (E850-E858)	1.34 (0.75 to 2.21)	0.98 (0.39 to 2.01)	2.84 (1.36 to 5.22)	4.81 (2.63 to 8.07)	6.74 (5.31 to 8.45)	0.9	< 0.05
Water transport accidents, drowning (E850, E851)	1.53 (0.86 to 2.52)	0.96 (0.35 to 2.09)	2.92 (1.34 to 5.55)	5.16 (2.75 to 8.82)	6.59 (5.08 to 8.42)	0.9	< 0.05
Accidental poisoning (E870-E895)	1.09 (0.36 to 2.55)	0.35 (0.01 to 1.97)	1.46 (0.18 to 5.27)	2.63 (0.54 to 7.69)	3.76 (2.19 to 6.02)	0.9	< 0.05
Accidental poisoning by alcohol (E880)	1.18 (0.24 to 3.45)		1.32 (0.03 to 7.33)	3.08 (0.37 to 11.11)	4.09 (2.04 to 7.32)	0.9†	NS
Accidental falls (E900-E904)	1.37 (0.45 to 3.21)	0.40 (0.01 to 2.22)	2.99 (0.81 to 7.64)	2.86 (0.59 to 8.35)	1.90 (0.76 to 3.92)	0.5	NS
Other accidents (E910-E936)	0.86 (0.35 to 1.78)	1.28 (0.52 to 2.65)	2.55 (1.03 to 5.26)	3.04 (1.22 to 6.27)	2.56 (1.58 to 3.91)	0.9	< 0.05
Accidental drowning (E929)	1.30 (0.27 to 3.80)	0.65 (0.02 to 3.64)	1.32 (0.03 to 7.33)	1.67 (0.04 to 9.29)	4.41 (2.11 to 8.10)	0.9	< 0.05
Suicide (E963, E970-E979)	0.93 (0.51 to 1.56)	1.36 (0.72 to 2.32)	2.31 (1.15 to 4.13)	2.72 (1.36 to 4.87)	1.42 (0.89 to 2.14)	0.7	NS
Homicide (E964, E980-E985)	5.08 (1.87 to 11.07)	1.32 (0.03 to 7.33)	2.70 (0.07 to 15.06)	6.45 (0.78 to 23.30)	4.24 (1.38 to 9.89)	0.2	NS
Injury undetermined whether accidentally or purposely inflicted (E980-E989)*	0.37 (0.01 to 2.07)	2.38 (0.65 to 6.10)	1.20 (0.03 to 6.71)	7.46 (2.42 to 17.41)	2.57 (1.03 to 5.30)	0.8	NS

*ICD eighth revision.

†Calculated for four groups.

TABLE III—Observed numbers of deaths by cause with standardised mortality ratios (95% confidence intervals) in 21 069 seamen according to their year of starting work

Cause of death (ICD (seventh revision) code)	1968-77 (followed up till 1979) (n = 12 338)*		1978 onwards (followed up till 1989) (n = 8731)†	
	Observed No of deaths	Standardised mortality ratio (95% confidence interval)	Observed No of deaths	Standardised mortality ratio (95% confidence interval)
All causes (001-E999)	316	1.21 (1.08 to 1.35)	184	1.32 (1.14 to 1.52)
Accidents, poisonings, and violence (E800-E999)	176	1.86 (1.61 to 2.15)	109	1.83 (1.52 to 2.20)
Motor vehicle accidents (E810-E841)	26	1.62 (1.06 to 2.34)	28	2.12 (1.41 to 3.07)
Water transport accidents (E850-E858)	68	3.10 (2.41 to 3.93)	26	2.16 (1.41 to 3.16)
Water transport accidents, drowning (E850, E851)	55	2.79 (2.10 to 3.63)	20	2.02 (1.23 to 3.12)
Accidental poisoning (E870-E895)	6	1.06 (0.39 to 2.31)	5	2.20 (0.72 to 5.14)
Accidental poisoning by alcohol (E880)	1	1.18 (0.03 to 6.55)	4	2.78 (0.76 to 7.11)
Accidental falls (E900-E904)	8	1.68 (0.73 to 3.32)	2	1.07 (0.13 to 3.86)
Other accidents (E910-E936)	23	1.40 (0.89 to 2.10)	13	1.93 (1.03 to 3.30)
Accidental drowning (E929)	7	1.49 (0.60 to 3.06)	2	1.38 (0.17 to 4.98)
Suicide (E963, E970-E979)	34	1.68 (1.16 to 2.35)	24	1.38 (0.89 to 2.06)
Homicide (E964, E980-E985)	3	1.38 (0.28 to 4.02)	3	2.63 (0.54 to 7.69)
Injury undetermined whether accidentally or purposely inflicted (E980-E989)‡	6	1.51 (0.55 to 3.29)	3	1.86 (0.38 to 5.45)

*85 425 Person years.

†67 894 Person years.

‡ICD eighth revision.

ings were the main type of fatal accidents at sea, and our previous study on the same cohort showed that seamen aged 45-55 had the highest rates of drowning.⁶ The physiological limitations of older age might reduce the chances of surviving a fall into the cold North Atlantic Ocean.

The excess of suicide and homicide is noteworthy. One study indicates that homicide and suicide are common at work,²⁵ but we do not know whether this applied in our study. According to other studies, alcohol consumption is high among seamen and fishermen,^{26, 27} and those who consume alcohol are more likely to be victims of violence than are those who do not drink.²⁸ In a study of proportional mortality among veterans of the Vietnam war an excess risk of homicide was found among those formerly in the navy but not among those formerly in the army.²⁹ Though these results were not commented on, they could reflect a difference in lifestyle.

Higher standardised mortality ratios were found for several categories of accidents among those who had started working as seamen in 1978 or later compared with those who had started earlier. The standardised mortality ratios for all accidents and drownings at sea were, however, lower among those who had started working during the later part of the study. Whether this indicates that safety has improved is difficult to judge as the annual death rates for water transport accidents did not change from 1966 to 1986.⁶

CONCLUSION

We conclude that seamen seem to be a special group with a high risk of fatal accidents. This might be because the men who choose to be seamen are accident prone or because a risky occupation modifies behaviour. The occupation is more likely to be having an effect because the mortality from several kinds of accidents was related to length of employment. We believe that to prevent accidents at work as well as during leisure time attention should be focused not only on technical devices but also on seamen's lifestyle

in general. Only through additional studies on other groups who are at risk of accidents at work will it be possible to determine whether a hazardous occupation predisposes to accidents occurring outside the workplace.

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