

**WORK RELATED MORTALITY AMONG MERCHANT
SEAFARERS EMPLOYED IN UK ROYAL FLEET AUXILIARY
SHIPPING FROM 1976 TO 2005**

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ABSTRACT

Background: Over 2300 merchant seafarers are currently employed on board UK Royal Fleet Auxiliary (RFA) ships. However, little is known about work related mortality among these seafarers, and whether it is lower than among seafarers in merchant fleets.

Objectives: To establish the causes and circumstances of all work related deaths among seafarers who were employed in RFA ships from 1976 to 2005, to compare mortality rates with those in other merchant fleets, and to identify implications for maritime health.

Methods: A population based study of work related mortality over 30 years.

Results: A total of 60 deaths among seafarers in RFA ships were caused by disease (30), accidents (19), suicide (6), homicide (one), and inconclusive causes (4). Six of the 19 fatal accidents were directly related to work duties (occupational accidents), 12 occurred during off-duty time and one resulted from a shipping disaster. The fatal accident rate was about one half, and the fatal work related accident rate was about one quarter, of corresponding rates in UK merchant shipping from 1976-2002;

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and they were much lower than those in merchant fleets internationally. The fatal accident rate in RFA shipping also fell by about 80% over the 30 year study period.

Conclusions: The lower fatal accident rates in RFA shipping, particularly for work related accidents, presumably reflect a lower incidence of hazardous working practices, arising from better training and career pathways for seafarers in RFA shipping, as well as better maintained ships with higher manning levels than in merchant shipping.

Key words

Royal Fleet Auxiliary ships, seafarers, fatal accidents, mortality rates.

INTRODUCTION

Traditionally, merchant seafaring has been shown to be a notoriously hazardous occupation.[1-6] However, these studies have been based on seafarers who were employed exclusively or largely in privately-owned merchant cargo ships. The UK Royal Fleet Auxiliary (RFA) was first set up in 1905 to provide supplies and support for the Royal Navy. The RFA fleet currently includes tankers, replenishment ships, stores ships and amphibious ships, and it presently employs 2365 civilian seafarers. These seafarers undergo standard training in line with their counterparts in the UK merchant fleet, but also receive additional training specifically aimed at operations on board RFA ships. However, little is known about the work related mortality of seafarers who are employed in the RFA fleet.

The overall aim of this study was to investigate work related mortality among merchant seafarers who work on board RFA ships. The first objective was to identify the causes and circumstances of all deaths that occurred among seafarers in the RFA fleet. Further aims were to analyse the causes and rates of mortality in RFA shipping, to compare mortality rates in RFA ships with those in the UK and other merchant fleets internationally, and to discuss implications for maritime health and safety.

METHODS

Deaths at sea in RFA ships are not usually registered with the local registrars of deaths, and are not included in routine national mortality figures, but are instead registered at the Registry of Shipping and Seamen (RSS), or the Registrar General for Shipping and Seamen as it was formerly known. In this study, details of the causes and circumstances of all deaths in RFA shipping were identified from paper death inquiry files that were held at the RSS. Documents contained in these RSS death files included

autopsy reports, death certificates or extracts from deaths registers, summary reports of coroners' inquisitions, marine inquiries, and extracts from log books. Further details of the causes and circumstances of some deaths were obtained from electronic and narrative fatal accident inquiry data provided by Britain's main marine investigative authority, the Marine Accident Investigation Branch (MAIB).

This study included all work related deaths among seafarers who were working on board UK RFA ships between 1st January 1976 and 31st December 2005; provided that the deaths arose at work or within 30 days of any discharge ashore to hospital as a consequence of an accident or illness. The study excluded deaths among non-crew members such as passengers, Royal Navy personnel and pilots; and also excluded several deaths of seafarers that occurred through the Falkland Islands conflict in 1982.

At the time of writing, there are 2365 seafarers employed in RFA ships. Although, exact annual crewing population data for merchant seafarers employed in RFA shipping is not available for the full 30 year study period, RFA Personnel have advised that the number of seafarers crewing the RFA fleet has remained fairly constant over time since 1976; at between 2200 and 2700 seafarers. Therefore, the total population of seafarers employed in RFA ships between 1976 and 2005 is estimated at between 66 000 and 81 000 seafarer-years.

The British (or UK) merchant fleet, which is used for comparative purposes with RFA shipping in this study, refers to merchant ships in the national UK fleet that are registered in ports in the UK. However, it excludes ships that are registered with the Isle of Man registry, as well as with other commonwealth registries such as Gibraltar and Bermuda.

CERTIFICATION OF DEATHS

Out of a total of 60 deaths that satisfied the study inclusion criteria and exclusion criteria, 30 were caused by disease. One of these deceased was buried at sea, following a cause of death provided by a ship's surgeon. For the other 29 deaths from disease, 22 (76%) of the causes of death were based on autopsy examination, 15 of these were performed in the UK and seven were undertaken abroad. For the remaining seven deaths, three causes of death were obtained from foreign death certificates, one was provided by a ship's surgeon, while the other three were provided by ships' captains.

Of the 30 deaths from external causes, four seafarers were lost at sea. In the other 26 cases, 19 (73%) of the causes of death were based on autopsy examination, three were obtained from foreign death certificates, one was provided by an attending doctor, one through a marine inquiry and the other two by ships' captains.

RESULTS

Out of the 60 work related deaths in RFA shipping, 30 were caused by disease, 19 resulted from accidents, six from suicide and one from homicide (Table 1). The circumstances in which the other four deaths occurred were inconclusive: two seafarers disappeared at sea, another was found drowned in a dock, while the other died from intoxication; with an open verdict recorded at a subsequent coroner's inquisition. Of the 30 deaths from external causes, 11 died from injuries, eight were asphyxiated, five drowned, four were lost at sea, one died from hypothermia and one from intoxication.

Table 1 Causes of all work related deaths among seafarers who were employed in RFA shipping, 1976-2005

Cause of death	Number of deaths	(% of all deaths)
Deaths from disease:		
Circulatory disease		
- Ischaemic heart disease	23	(38.3)
- Other cardiovascular disease	1	(1.7)
- Cerebrovascular disease	1	(1.7)
Neoplasms	1	(1.7)
Respiratory disease	1	(1.7)
Other & unspecified diseases	3	(5.0)
Deaths from external causes:		
Accidents		
- Maritime disasters	1	(1.7)
- Occupational accidents	6	(10.0)
- Off-duty accidents	12	(20.0)
Suicide	6	(10.0)
Homicide	1	(1.7)
Unknown circumstances		
- Drowned	1	(1.7)
- Missing at sea	2	(3.3)
- Intoxication	1	(1.7)
All deaths	60	(100.0)
All accidents at work *	16	(26.7)

* All accidents at work refer to all accidents except traffic-related accidents that occurred ashore, and accidental alcohol or drug intoxication.

Thirty-seven (62%) of the 60 deaths occurred in port, and 23 at sea. Of the 37 deaths in port, 18 (49%) occurred in the UK, 12 in other European countries, three in North America, one each in Asia, Australasia and South America, with one unknown

location. The 23 deaths at sea occurred most frequently in the North Atlantic and the South Atlantic (6 each; 26%).

All but three (95%) of the 60 deceased were British, the others were Hong Kong Chinese. The counties in which most of the 57 deceased British were resident were Devon (11 deaths), Tyne & Wear (eight), Cornwall, Dorset, Hampshire, Lincolnshire, Strathclyde and Lothian (three each). All of the 60 deceased were men.

DEATHS FROM DISEASE

Of the 30 deaths from disease, 24 seafarers (80%) died from cardiovascular disease, one from cerebrovascular disease, one from a malignant neoplasm and one from respiratory disease, while the causes of three deaths from natural causes were not specified (Table 1). All but one of the 24 deaths from cardiovascular disease were due to ischaemic heart disease. The mean age at death from cardiovascular disease was 49.3 years (SD = 11.4; range = 22-65), and all but two of the 24 were ratings (12; 50%) or catering staff and stewards (10; 42%; Table 2).

Of the 24 seafarers who died from cardiovascular disease, eight were taken ill at sea, and 14 were taken ill on board ships in port, while the other two were ashore at the time of illness. Only two of the 14 deceased who were taken ill on board ships in port were evacuated before death - both were dead on arrival at hospital - while none of the eight who were taken ill at sea were evacuated before death. Thirteen of the 24 deceased (54%) were off-duty at the time of onset, eight were on-duty, and for three it was not recorded whether they were on or off-duty.

DEATHS FROM EXTERNAL CAUSES

Accidents have been classified into three categories. These are firstly, maritime disasters which refer to an incident involving the ship such as a collision, foundering or fire; secondly, occupational accidents occurring among individual seafarers through their work duties; and thirdly, off-duty accidents that occurred when seafarers were off-duty. The 19 fatal accidents were caused by a maritime disaster (one death), occupational accidents (six) and off-duty accidents (12).

The single death from a maritime disaster resulted from a fire in the accommodation area of a ship in port. The six occupational accidents refer to seafarers who were injured when struck by heavy seas on deck (two), struck by other moving objects (two), electrocuted (one) and struck by a mooring rope during berthing

operations. Two of these six fatal occupational accidents arose at sea, the other four were in port.

The 12 off-duty accidents include two seafarers who fell into docks when returning to vessels after drinking ashore, one fell when disembarking, two fell down ladders on board and one fell overboard. Three others respectively, choked on food, drowned while swimming from a beach, and died from hypothermia while ashore; while the remaining three died in road traffic accidents. Of the 19 seafarers who died from accidents, most were ratings (11; 58%) or cooks and stewards (three; 16%), while the other five were cadets (two) and nautical or electrical officers (three; Table 2).

Table 2 Causes of work related deaths according to the rank of the deceased among merchant seafarers employed in RFA shipping, 1976-2005

Cause of death	Deck Officer	Engineer	Cadet	Deck rating	Engine room rating	Catering / steward / other	(Total)
Deaths from disease:							
Circulatory diseases	1	1		5	7	10	(24)
Other & unspecified diseases	1			3	2		(6)
Deaths from external causes:							
Maritime disasters					1		(1)
Occupational accidents		2		3	1		(6)
Off-duty accidents	1		2	1	3	5	(12)
Suicide		1		2		3	(6)
Homicide					1		(1)
Unexplained causes				1	2	1	(4)
Total	3	4	2	15	17	19	(60)

Of six seafarers who died from suicide, five hanged themselves when in port and one jumped overboard at sea, while another seafarer died from a homicidal attack at sea. The circumstances surrounding the remaining four deaths were unclear. Two disappeared at sea with no reported indications as to their causes, and another was found drowned in a dock and was thought to have fallen overboard; although a coroner subsequently recorded an open verdict. Finally, another seafarer died from alcohol intoxication at sea.

The mean age at death for all fatalities from external causes was 37.0 years (SD = 13.2; range = 17-59) and it was 37.9 years (SD = 14.0; range = 23-53) for fatal work related accidents and 36.4 years (SD = 15.3; range = 17-59) for fatal off-duty accidents.

MORTALITY RATES

Of the 19 fatal accidents between 1976 and 2005, 16 occurred at the workplace; excluding three traffic-related accidents that occurred ashore. Using approximate crewing information (detailed in the Methods section), the corresponding fatal accident rate for all accidents at work was between 20 and 24 per 100 000 seafarer-years. For the seven fatal work related accidents (six occupational accidents and one maritime disaster), the fatal work related accident was 8.6 to 10.6 per 100 000. The suicide rate for six confirmed suicides in the RFA fleet was similarly 7.4 to 9.1 per 100 000. If the one unexplained drowning in a dock was included as an accident, for improved comparison of fatal accident rates with other studies of seafarers in merchant fleets internationally, the overall fatal accident rate would be 21 to 26 per 100 000.

The number of fatal accidents that occurred in RFA shipping during the six five-year time periods from 1976-1980 to 2001-2005 were respectively, 5, 5, 3, 4, 1 and 1. Assuming a roughly constant population of seafarers employed in RFA shipping over time, this indicates that the fatal accident rate in RFA shipping fell by about 80% from 1976-1985 to 1996-2005.

DISCUSSION

This study identified 60 deaths among merchant seafarers who were employed in UK RFA ships over the 30 year period from 1976 to 2005. The fatal accident rate (for accidents at the workplace) identified from this study, 20-24 per 100 000 (or 21-26 per 100,000 after including unexplained drowning in docks), is about one half of that (47 per 100 000) for seafarers who were employed in UK merchant shipping during a similar time period from 1976 to 2002.[6] Similarly, the rate for all fatal work related accidents in the RFA fleet is about one quarter of that in UK merchant shipping (35 per 100 000). These fatal accident rates in RFA shipping are even more greatly reduced when compared with those in other merchant fleets internationally. For example, they are typically much lower than fatal accident rates of about 35 to 160 per 100 000, as well as fatal work related accident rates of 25 to 130, for the Danish, Hong Kong, Polish, Singapore and Swedish fleets in the last 25 years.[4,7-10]

Hence, the fatal accident rates in RFA ships are remarkably low, particularly for accidents related to work duties. During the 30 year study period, there was only one death from a maritime disaster in the RFA fleet - a death that occurred through a fire in the accommodation area of a ship - compared with a total of 176 deaths that arose in the UK merchant fleet between 1976 and 2002.[6] Although the population of seafarers crewing the UK merchant fleet was much larger than in the present study of the RFA fleet, mortality from maritime disasters in merchant shipping was about 10 to 13-fold higher than in RFA ships. Mortality from occupational accidents in the merchant fleet was increased over two fold compared with that in RFA shipping, although mortality from off-duty accidents was similar to that in the RFA fleet.

In the UK merchant fleet, a total of 26 lives were lost through nine separate incidents of fires and explosions in oil tankers; which frequently occurred in engine rooms, during cargo transfer operations. Since there were no similar occurrences in the RFA fleet, this indicates that safety procedures may have been much better than in the merchant tankers during these operations.

The large majority of deaths from natural causes (80%) in this study of seafarers who were employed in RFA shipping were caused by cardiovascular disease. This is slightly higher than figures of 71% for seafarers in the British fleet during the 20-year period from 1976 to 1995,(11) and 58% in the Danish fleet,(7) but is more similar to figures of 75% and 81% for Polish shipping.[9,12] Although these differences are almost certainly linked to case mix differences between the different populations of seafarers, since the (crude) mortality rate for non-cardiovascular disease was almost four times higher in the UK merchant fleet than in RFA ships, this would indicate better identification and treatment for more chronic diseases, as well as more rapid evacuation to hospital of sick seafarers in RFA than in merchant shipping.

Over the 30 year study period, the work related suicide rate (for confirmed suicides) was estimated at 7 to 9 per 100 000 seafarer-years. However, since two disappearances at sea may also have been caused by suicide, the actual suicide rate could have been up to 12 per 100 000. These suicide rates are similar to corresponding rates of 5 and 14 per 100 000 in UK merchant shipping from 1976 to 2002,[6] and are broadly comparable or lower than those reported from other studies.[7-10,12,13] Since suicides are much more common among seafarers employed in inter-continental trading ships than in coastal ships,[6] whereby seafarers are at sea for longer periods of time, the suicide rate in the RFA fleet is therefore relatively low.

Over the 30 year study period, there was a sharp reduction over time of about 80% in the fatal accident rate in RFA shipping. The fatal accident rate in UK merchant shipping also fell sharply over time; by about 75% from 65 per 100 000 seafarer-years in 1976-1980 to 15 per 100 000 in 1996-2002.[6] The reduction for the merchant fleet is

partly because of an increase over time in the proportion of seafarers who work on board merchant ships that carry little cargo such as passenger ferries and cruise ships. The risks of fatal accidents are typically lower in these passenger ships than in cargo ships such as bulk carriers, general cargo ships, and offshore supply vessels,[6,14] particularly as many fatal accidents occur on deck areas,[6,7,10,15] especially during cargo loading, inspection and discharge related operations. In RFA ships, however, seafarers are frequently engaged in cargo related operations, often in potentially hazardous circumstances; particularly when transferring supplies to Royal Navy ships at sea by means of netting equipment. Importantly, therefore, the fatal accident rate in RFA ships is lower despite the seafarers continuing to be engaged frequently in cargo related operations.

Generally, the lower fatal accident rates in RFA shipping than in merchant fleets are probably closely linked to several factors. Firstly, RFA ships are generally better maintained than merchant ships. This would reduce the risks of both casualties to the ships, which sometimes lead to loss of life, as well as accidents to seafarers on board. Secondly, seafarers who are employed in RFA shipping undergo additional training that is specifically aimed at operations on board these ships, to help reduce hazardous working practices. This includes training related to specialised cargo handling and transfer operations, as well as advanced training in rescue and fire fighting. Thirdly, the RFA provides a better career path, with more stable and secure employment, than is typically available in various merchant shipping sectors. Seafarers who join the RFA often remain with the RFA throughout their seafaring careers; with a consequent lower turnover of personnel - about 5% per annum - and a higher retention of skills than in merchant shipping. In the merchant sectors, seafarers can move frequently between different trades and ships, as well as between different shipping companies and flags of registration. A high turnover of personnel can lead to seafarers being subject to different cultures of health and safety that can vary greatly between different shipping companies and ships; and it can also lead to increased employment of younger and less experienced seafarers. There is some evidence, although not always confirmed, that younger or inexperienced seafarers may be at elevated risks of accidents.[4,16-21]

Fourthly, and perhaps most importantly, the RFA use manning levels on board their ships that are typically higher than those in merchant fleets. Under-manning, particularly of qualified navigational crew, is strongly linked to fatigue levels among seafarers, which, in turn, have been found repeatedly to be a major contributory factor in many merchant marine accidents; including collisions and grounding of ships as well as personal accidents to seafarers.[22-27]

To summarise, this study of work related mortality among merchant seafarers who were employed in UK RFA shipping has identified very low fatal accident rates,

particular for work related accidents. The main implications of these findings is that for fatal accident rates in merchant fleets generally to decline to the levels found for RFA shipping, some of the safer and more positive aspects of RFA shipping may need to be introduced into the merchant sectors. Although shipping economics and market forces would mean that some measures may be impracticable on board many merchant ships, other measures could include improved training for hazardous or specialised tasks on board particular types of cargo ships, together with incentives to retain highly skilled seafarers, and wider efforts to detain badly maintained, substandard merchant shipping.

CONCLUSIONS

1. Over the 30 year period from 1976 to 2005 there were 60 work related deaths identified for seafarers employed in UK RFA ships.
2. The fatal accident rate in RFA shipping was about one half, and the fatal work related accident rate about one quarter, of corresponding rates in the UK merchant fleet during a similar time period.
3. Compared with merchant fleets internationally, the fatal accident rates in RFA shipping are particularly low.
4. The low fatal accident rates in RFA shipping probably reflect better training and career pathways for seafarers, with a lower turnover of personnel and a higher retention of skills, as well as better maintained ships with higher manning levels than in merchant shipping.

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