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## MAJOR DIFFERENCES IN RATES OF OCCUPATIONAL ACCIDENTS BETWEEN DIFFERENT NATIONALITIES OF SEAFARERS

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### ABSTRACT

#### Objectives

Earlier studies and statistics have shown that merchant seafarers from the South East Asia had considerable lower accident rates when compared with seafarers from Western Europe. The purposes of the study were to investigate whether the earlier

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observations were sustained if further sources on occurrence of accidents were used and to identify specific causes of excess accident rates among certain nationalities.

#### **Methods**

Occupational accidents aboard Danish merchant ships during one year were identified from four different sources. These included accidents reported to the maritime authorities, accidents reported to a mutual insurance company, files on medical costs reimbursed by the government and finally, accidents in which there has been contact to the radio medical service. Time at risk aboard was obtained from a register on all employment periods aboard merchant ships.

#### **Results**

A total of 943 accidents causing personal injury to a seafarer directly caused by work aboard were identified. Among these accidents, 499 had taken place aboard cargo ships in international trade. Only these were used in the detailed analysis. The accident rate for all identified accidents aboard cargo ships were 84 accidents per 1,000 years aboard. The crude incidence rate ratio (IRR) for East European seafarers was 0.88 and for South East Asians 0.38 using West European seafarers as reference. In a Poisson regression analysis, the IRR for South East Asians was 0.29 (0.22-0.38). In an analysis including only more serious accidents, IRR for South East Asians rose to 0.36 (0.26-0.48).

#### **Discussion**

This study indicates that seafarers from South East Asia, mainly the Philippines, may have a genuine lower risk of occupational accidents in comparison with seafarers from Western and Eastern Europe. Differences in approach to safety and risk taking between South East Asian and European seafarers should be identified and positives attitudes included in accident preventing programmes.

#### **Main messages**

Seafarers from South East Asia, mainly the Philippines, seem to have a genuine lower risk of occupational accidents in comparison with seafarers from Western and Eastern Europe.

#### **Policy implications**

Differences in approach to safety and risk taking between South East Asian and European seafarers should be identified and positives attitudes included in accident preventing programmes.

## INTRODUCTION

It was noted already several years ago that there were major differences between ethnic groups in rates of reported occupational accidents aboard Danish merchant ships [1]. Even when adjusted for major confounders, merchant seafarers from South East Asia had considerable lower accident rates when compared with seafarers from Western Europe. It was not possible to clarify whether the cause was underreporting, a genuine difference in accident rates, or a combination. Later, similar observations have been done in the large Norwegian merchant fleet manned by the same ethnic groups as the Danish ships [2] and in an international survey based on self-reported accidents aboard ships, a similar trend was seen [3].

Differences in accident rates between different nationalities and ethnic groups working under similar conditions have been observed in some other settings [4-7]. The accident frequency between Danish and Swedish construction workers working on the same large construction project showed remarkable differences between the two nationalities [8] and the authors found that differences in education and experience, training and learning, and attitude were important explanatory factors. Major differences in accident rates have also been observed on oil drilling platforms where the workers are doing similar work [9]. Platforms located in South East Asian waters and manned locally have far fewer occupational accidents in comparison to platforms located in the North Sea manned by Europeans.

In all studies so far, the comparisons have been based on reported accidents or self-reported accidents which have made it difficult to determine the magnitude of underreporting or reporting bias and thus the true differences in accident frequencies among different nationalities working under similar conditions.

The overseas Danish merchant fleet consists of some 500 ships [10]. The fleet is among the newest in the world with a mean age in the beginning of 2003 of 6.9 years compared to a mean age of the world merchant fleet of 12.3 years. The fleet consists of primarily container ships, tankers, dry cargo ships, sea going tugs, supply- and stand by vessels servicing the off-shore oil industry, and finally some passenger ships. The crews are most often multinational. The majority of officers are from Denmark or other Western European countries but the number of foreign officers has been rising in the last decade. Ratings are increasingly recruited in the Far East or Eastern Europe. In contrast to the officers, the ratings aboard a ship will often be from the same country of

origin although maintenance crews very often have a different nationality than the ordinary crew.

The purpose of the study was to investigate whether the earlier observed differences in rates of reported accidents between different nationalities were sustained if further sources on occurrence of accidents were used. Further, it was the aim to find out, if any of the sources added important new information. Another aim was to identify specific causes of excess accident rates among certain nationalities which may be targeted when planning preventive measures.

## MATERIAL AND METHODS

The main inclusion criteria for this study were personal injury to a seafarer while on board. Some of the data sources include notifications of accidents causing damage to personal belongings like glasses and teeth prostheses, injury due to violence, injury or death due to maritime disasters and accidents while ashore on courses or while travelling to or from the ship. These accidents were excluded.

Accidents were identified from four different sources. The primary source was accidents reported to the Danish Maritime Authorities on a special form for accident reporting. It is mandatory to notify all accidents causing more than one day off duty beyond the day of the accident but a considerable number of accidents not fulfilling this criteria is forwarded to the maritime authorities. The second source of information was accidents reported to a mutual insurance company insuring almost all seafarers aboard Danish merchant ships, Danish Ship-owners Accident Insurance Association (UFDS). During the study period, only one small shipping company used an alternative insurance company. To notify the insurance company, a copy of the form sent to the maritime authorities has to be sent to the insurance company. The insurance company and the Danish Maritime Authority do not exchange information. All seafarers aboard Danish merchant ships have a legal right to receive compensation in case of disability above 5%. It is mandatory for the shipowners to insure all aboard.

The third source of information is the office of social security in the Danish Maritime Authorities. According to Danish law, seafarers aboard Danish flagged ships have the same right to free access to health services as citizens ashore. When a seafarer needs medical assistance ashore, the ship will normally have to pay the expenses. The ship-owner then afterwards can get all medical expenses reimbursed by forwarding the bills and other documents to the maritime authorities. Not all cases include detailed medical information. If the maritime authorities receive requests for reimbursement of

medical expenses due to an accident, it may be checked, if the accident has been reported and if not, request it from the shipping company. The reimbursement process is although not halted even when no notification has been received.

The fourth source of information on accidents is the Danish radio medical service which functions completely independent of the other sources. All Danish ships may without any costs to the ship seek medical advice from the doctors at the central hospital in the port of Esbjerg, Denmark. The doctors are involved in some 1 200 cases per year. The radio medical service does not exchange medical information about the individual seafarer with the maritime authorities or the insurance company described above. The medical records are stored in a database which was accessible for this study.

Information on time on board, and thus time of risk, has been obtained from a register in the Danish Maritime Authorities. It is mandatory for all shipping companies to forward a copy of the employment contract to the maritime authorities each time a seafarer is signed on and off as described in detail elsewhere [11]. The reported time is the number of days actually spent on board. The shipping companies may alternatively report the information electronically. For ships in domestic trade and passenger ships sailing between Denmark and neighbouring countries, the reported periods aboard may represent employment periods, whereas the data on employment periods from ships in international trade reflects the actual period spent aboard.

When data on seafarers is recorded in the Danish Maritime Authorities, whether it is information on employment periods, recording of accidents or issuing certificates of competence, a personal identification number is used to identify the individual. Danish citizens gets this 10-digit personal identification number when they are born and foreign seafarers get a special personal identification number the first time they have contact with the Danish maritime authorities.

The nationality of the individual seafarer is recorded in the register of the maritime authorities. In this study, the seafarers were divided in three groups. The largest group consists of seafarers from Western Europe, the far majority being Danish citizens. In the cargo ships in international trade, a total of 11,786 different seafarers were employed during the year in study. A total of 6 442 different seafarers were from Western Europe, among which 5 777 (89.7%) were Danish citizens. The second group consists of seafarers from South East Asia and seafarers from the Philippines counted 2 446 out of 3 252 (75.2%). The third group, mainly from Eastern Europe, counted 2 092 among which 1 030 were Polish (49.2%) and 396 from the Baltic States (18.9%).

The accident rates for the different nationality groups were compared using a Poisson regression model, adjusting for ship size (below 3 000 gt., 3 000 gt and above), officer/non-officer and age in 5-year groups. These variables were chosen because an earlier study has shown that they are of significant importance when dealing with

occupational accidents at sea [1]. In the analysis, 95% confidence intervals (CI) are calculated. To be included in the analysis, the injured person should be identified by a unique identification number, the date of the accident should be within the employment period recorded in the above mentioned register on employment periods, the name and call signal of the ship should correspond and if the injured had more than one accident during the same employment period, only the first accident was included. Only accidents aboard cargo ships in international trade is included in the Poisson regression analysis due to limitations in the information on time at risk aboard other ships and due to the fact that only the crews on the cargo ships in international trade are multicultural. Separate analysis of back injuries and accidents happening while moving around was performed to test the hypotheses that these factors were some of the explanation for the observed differences. The categorisation was performed based on the information on the type of accident and the consequences of the accident in each individual case. An accident was defined as belonging to the group “moving around” if the seafarer was walking from one task to another or as a part of a task. The group included trips and falls, but also e.g. fingers caught in slamming doors. All the other accidents took place while the injured seafarer worked on a specific workplace. A special analysis was performed for “serious accidents”. Serious accidents includes accidents which has caused medical treatment ashore, radio medical contact or reported as an accident which has caused the injured to be off duty for at least one day beyond the day of the accident.

## RESULTS

A total of 994 incidents which happened in the year 2003 were identified from the four different sources. Among these, 943 incidents caused personal injury to a seafarer directly caused by work aboard a Danish-flagged ship. Only these are included in the following analyses.

Among the 943 accidents included in the study, 60.4% had been reported to more than one of the four sources of accidents used in this study. Most frequently, an accident was reported to the mutual insurance company as 67.7% of all identified accidents were known in this file. Fewest cases had been in contact with the radio medical centre (10.6%). Among the 100 radio medical contacts, 41% was not known in the files of any of the three other sources.

A total of 499 accidents occurred aboard cargo ships in international trade (Table 1). The Table shows the raw data showing the number of accidents identified from each of the four sources divided on each group of nationalities. In the following analysis, the

accidents were divided in accidents which had happened while moving around on the ship, either from one task to another or as a part of a task and accidents occurring at a stationary work place on board. A total of 131 accidents (26.3%) took place while moving around. Among the seafarers from Western Europe, there were 102 accidents out of 345 (29.6%), the figures for seafarers from Eastern Europe were 21 out of 82 accidents (25.6%) and for South East Asian seafarers the figures were 8 out of 72 accidents (11.1%). The difference between European and Asian seafarers are statistically significant ( $p = 0.002$ ).

	Nationality of injured seafarers						Total
	West Europeans		East Europeans		South East Asians		
Time at risk (years)	3 038		820		1 670		5 529
Categories of accidents	Number	Crude incidence rate ratio	Number	Crude incidence rate ratio	Number	Crude incidence rate ratio	Number
All identified accidents	345	1.00	82	0.88	72	0.38	499
All accidents reported to the maritime authorities	249	1.00	36	0.54	35	0.26	320
Accidents reported to the maritime authorities, mandatory notification	146	1.00	31	0.79	27	0.34	204
Accidents reported to the insurance company	232	1.00	26	0.42	34	0.27	292
Accidents causing medical treatment ashore	179	1.00	63	1.30	57	0.58	299
Accidents with radio medical advice	50	1.00	15	1.11	13	0.47	78

Table 1. Number of different categories of accidents and incidence rate ratios divided into three categories based on nationality. Only accidents aboard cargo ships in international trade included.

In another analysis, the 499 accidents aboard cargo ships in international trade were divided in two groups depending on whether the accident had caused back injury. A total of 61 accidents (12.2%) caused back injury. Among the seafarers from Western Europe, there were 49 back injuries out of 345 accidents (14.2%), the figures for seafarers from Eastern Europe were 9 out of 82 accidents (11.0%) and for South East Asian seafarers the figures were 3 out of 72 accidents (4.2%). The difference between European and Asian seafarers are statistically significant ( $p 0.03$ ).

It was possible to merge 462 of the 499 accidents (92.6%) aboard cargo ships in international trade with a corresponding employment period in the register of seafarers' active service and include them in a Poisson regression analysis. Age of the injured, ship size and rank (officer/non officer) was included in the analysis. The results of an analysis including all identified accidents are seen in Table 2.

Nationality of injured seafarers	Total number of identified accidents	Time at risk	Accident rate per 1.000 years at sea	Crude incidence rate ratio (95% CI)	Adjusted incidence rate ratio (95% CI)
West Europeans	321	3038	106	1	1
East Europeans	73	820	89	0.84 (0.65-1.09)	0.65 (0.50-0.85)
South East Asians	68	1670	41	0.39 (0.30-0.50)	0.29 (0.22-0.38)
Total	462	5528	84		

Table 2. Incidence of accidents, crude and adjusted incidence rate ratios (IRR) with 95% confidence intervals, aboard Danish cargo ships in international trade in 2003 among different nationality categories. Only accidents which could be merged with a specific employment are included. The adjusted IRR includes adjustment for ship size, charge and age.

An analysis including only 384 accidents categorised as "serious" are seen in Table 3. The analysis is performed in the same way as in Table 2.

Nationality of injured seafarers	Total number of identified accidents	Time at risk	Accident rate per 1.000 years at sea	Crude incidence rate ratio (95% CI)	Adjusted incidence rate ratio (95% CI)
West Europeans	248	3038	82	1	1
East Europeans	70	820	85	1.05 (0.80-1.36)	0.82 (0.62-1.08)
South East Asians	66	1670	40	0.48 (0.37 – 0.64)	0.36 (0.26-0.48)
Total	384	5528	69		

Table 3. Incidence of accidents categorized as serious, crude and adjusted incidence rate ratios (IRR) with 95% confidence intervals, aboard Danish cargo ships in international trade in 2003 among different nationality categories. Only accidents which could be merged with a specific employment are included. The adjusted IRR includes adjustment for ship size, charge and age.



## DISCUSSION

In this study, information on accidents was gathered from four different sources. The study is although not likely to have included all serious accidents and certainly not all minor incidents. There is in a large part of the shipping industry motives to avoid notifying accidents. Good accidents statistics is an important factor when competing for cargoes especially in the oil industry and vessels employed in the off shore oil sector. The captains may lose a special personal economic benefit if they have reported too many lost time accidents in the previous year. In other parts of the Danish shipping business, the company does not record accidents and accidents reports may be forwarded directly from the ship to the maritime authorities or the insurance company. These factors will tend to lower the reporting rate in general and does not explain differences between different nationalities. The Radio Medical service is the only source of information on accidents where there is no basis for biased underreporting as it is run completely independent. The seafarers may although not be aware of this. It is noteworthy that a large proportion of the accidents with Radio Medical contact were not identified in other ways. The detailed analyses were restricted to cargo ships because an earlier study has shown that accident patterns on passenger ships differ a lot from cargo ships [1].

A lower rate of reported accidents among foreigners aboard Danish ships could be a consequence of selective underreporting of accidents among foreigners. The foreigners may not have any interest in having an accident reported and may possibly even experience negative consequences. Contradictory to the majority of Danish seafarers, the foreigners are almost always only employed for one period aboard and have to apply for a new employment via a manning agency in their home country. Reported accidents during the last period of employment may diminish the possibilities of a new employment. Seafarers from East Europe are in general not better off and this factor can thus not fully explain why the Eastern European seafarers have accident rates close to West Europeans.

Asking for medical treatment may have the consequence that the doctor ashore advises the captain to sign off the seafarer. This may cause considerable economic losses to the foreigner whereas the Danish seafarer in most cases will be in a considerably more favourable position. This factor will thus tend to underreport accidents among foreigners but cannot explain differences in the observed differences in accident frequencies between the three different groups of nationalities included in this study.

It is remarkable how large a proportion of the total number of accidents back injuries makes up among West Europeans and East Europeans. Back injuries and chronic back pain are well known among Filipino seafarers repatriated from abroad [12] but there could be genuine differences in prevalence between Asian and the European seafarers. Other studies indicate that cultural differences may play a role [13]. The differences could also reflect differences in physical performance among the two groups. Danish seafarers have considerable problems with overweight [14] which give an excess risk of back problems. The differences in the occurrence of back problems can explain some of the differences between the different groups of nationalities. Another cause is a statistically significant difference in accidents occurring while moving around on the ship.

Restricting the analysis to what may be categorised as serious accidents diminish the differences between the seafarers from Western Europe and the two other groups included in the study. This shows that there is some reporting bias as the West European seafarers have a number of accidents reported which haven't caused neither medical treatment ashore or caused the seafarer to be off duty. The presence of lay medical facilities aboard merchant ships may influence the reported number of accidents, as the initial treatment may reduce the number of referrals to shore-based medical facilities [15] and there may be ethnic differences in the impact of shipboard treatment.

In conclusion, this study indicates that seafarers from South East Asia, mainly the Philippines, have a genuine lower risk of occupational accidents when employed aboard Danish merchant ships in comparison to seafarers from Western and Eastern Europe. This may be due to different safety attitudes. The reasons for being at sea are different between different nationalities [16, 17]. For the Filipino seafarer, it is of utmost importance to be able to support the extended family at home. The Filipino seafarer is also aware of the risks at sea and the potential risk of losing the job due to an accident. This may have an influence on risk-taking although no exact knowledge exists on this subject. Differences in degree of individualism and attitudes towards working in groups may be of importance.

It may be worthwhile to identify the differences in approach to safety between South East Asian and European seafarers and attempt to implement the positive attitudes in accident preventing programmes.

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