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Evaluation of maritime accident reports of main search and rescue coordination centre between 2001 and 2012

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ABSTRACT

Background: *The aim of the study was to evaluate the marine accident and incident reports between 2001 and 2012 by the Main Search and Rescue Coordination Centre (MSARCM). The method of the study was a descriptive-cross-sectional epidemiological study.*

Materials and methods: *The data of the research were composed of MSARCM's marine accident, incident and medical evacuation reports between 2001 and 2012. In the research, 1796 marine accident/incident reports were examined. The data were evaluated statistically by frequency distribution, univariate and bivariate regression analysis and multidimensional scaling analysis.*

Results: *The highest number of cases in the study occurred in 2010 (n = 228, 12.7%). Considering the time of realisation of the cases, the highest number of cases occurred between 12:00 and 17:59 (n = 538, 30.0%). In the total of 1796 cases, there were 150 injured, 6046 rescued, 311 deaths, 202 missing and 73 patients. Considering the causes of accidents, the first three places were bad weather conditions (n = 287, 16.0%), human errors (n = 241, 13.4%) and machine malfunctions (n = 232, 12.9%). In the univariate and bivariate analysis of the data, it was seen that injuries in the Istanbul region were statistically more significant than those in the international region (8.5 fold, 95% confidence interval).*

Conclusions: *The risk management activities on injuries and accidents need to be carried out more carefully particularly in the areas with a high occurrence of marine accidents/events and medical evacuations (such as strait traffic, ports, shipyards), in the hotspots for shipping accidents.*

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Key words: maritime accident, maritime ıncident, medical evacuation, search and rescue, Turkey

INTRODUCTION

There has been an increase in man-made disasters due to developing technology and growing population every day. One of the reasons of such increase is the growing number of accidents. An accident refers to an unplanned, unexpected event, which results in injury, damage or human/property losses. Intentional events are not considered as accidents [1]. Transportation accidents have an important place in human-induced disasters. According to the World Disasters Report 2003 published by the Red Cross, the disasters related to transportation are a major source of injury and death. The accidents in the transportation sector can be classified as the accidents in or on aviation vehicles, marine vehicles, rail vehicles and road vehicles [2].

Seventy one per cent of the earth's surface is covered with water. Ninety per cent of the World's trade is carried by the sea [3, 4]. Despite the developments in the aviation sector, the maritime trade is preferable since it is more cost-effective particularly for long distances. Turkey is a peninsular country surrounded on three sides by wa-

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ter with the Dardanelles and the Bosphorus strait having a strategic importance. In this regard, Turkey is a transit country in maritime transportation and maritime trade. For these reasons, it is a country at risk in regard to marine accidents. A marine accident is defined as an event resulting in unexpected and unintentional deaths or injuries leading to full/partial loss of limbs; and resulting in one or more of the following consequences: the loss of human life, the sinking or loss of a vessel, severe material damage in the vessel, the grounding of a vessel, environmental damage due to a vessel or vessels in an incident in a vessel and/or in relation to a vessel [5–7].

Numerous marine accidents/incidents have taken place in the World and in Turkey. Titanic, considered as "Unsinkable Ship", hit an iceberg and sank within 2 hours and 40 minutes on April 15th 1912 in "New Foundland" [8]. Only 710 out of 2,207 passengers in Titanic survived the disaster while a total of 1,514 passengers could not. Most of them died from hypothermia and in less than 15 minutes because of the water temperature at –2°C. A tanker with a cargo capacity for 120,000 tons of crude oil, namely Torrey Canyon, was shipwrecked due to a navigation error on March 18th 1967, causing a serious environmental disaster.

The increase in the number and tonnage of the vessels endangers the community health; in particular, the increase in the number of vessels carrying hazardous cargo and in the amount of hazardous cargo creates a serious danger in terms of the course of the ship, human life and environmental safety. International Maritime Organization (IMO) introduced new regulations and measures especially upon major accidents [9]. In parallel with the developments in the maritime sector, there have been increased efforts to save human life and to enforce international measures in order to minimise marine accidents and losses. The IMO is a private organization of the United Nations (UN) responsible for ensuring safety for ships and preventing marine pollution [10]. The organization has established a global system providing the actions and operations to be performed for sea and air vehicles when in need of help at anywhere in the world [11]. The purpose of the system is to provide effective air and sea search and rescue (SAR) services, to support the coherence of these services, and to ensure that the units in distress around the world receive assistance regardless of their nations and locations [11].

Contemporary SAR systems help a number of people, who become lost, injured or trapped in different places. Governments provide SAR services in response to plane crashes, ship accidents, lost and trapped people or those in need of rescue through this system. In order to set standards for the global system in the world, the IMO and the International Civil Aviation Organization published the International Aeronautical and Maritime Search and Rescue Manual (IAMSAR) in 1999 [10]. The manual was prepared so as to ensure that there is standardised cooperation and coordination in regard to SAR services among the member states.

Air and sea SAR services involve the use of various facilities including sea planes, helicopters, submarines, rescue boats and vessels [9].When a marine accident takes place, the priority is to coordinate the SAR services effectively, quickly and properly as well as to reach out the patients/injured as soon as possible. All of the institutions and organizations under the National SAR Plan must use the most proper rescue method within the shortest possible time in the operations where several institutions take part in and give the utmost importance to coordination so as to rescue the victims [10, 11].

The Main Search and Rescue Coordination Centre (MSRCC), which was established to coordinate search and rescue operations in Turkey, is responsible for the coordination of the SAR operations necessary as a result of air and marine accidents (Fig. 1) and provides services for 24 hours a day. Table 1 presents the main tasks of the centre [12–14].

The marine accidents/events and medical evacuations in Turkey are coordinated and recorded by the MSRCC. Since the analysis of these records would have a critical importance in the prevention and reduction of accidents as well as the rescue of lives, this study was conducted.

MATERIALS AND METHODS

This descriptive study evaluated the marine accidents/events and medical evacuation reports between the dates of January 1st 2001 and December 31st 2012 in the MSRCC section of the official web-site of the Turkey Ministry of Transport, Maritime Affairs and Communications. The reports on electronic media were printed out and the data were transferred to the registration forms. The information on these registration forms were entered into the database created by means of SPSS 15.0 software and then evaluated statistically. The statistical evaluation was performed through frequency distribution, one-variable and bivariate Poisson regression, Multidimensional scaling method. The study was performed between the dates of October 2012 — March 2014.

The frequency analysis examined the following variables: the years, months and hours of the accidents, the types of accidents, the causes of accidents, the locations of accidents, the number of the injured, the dead, the patients, the missing people and the rescued people, the presence of pollution, the units participating in the rescue operations, the types of ships, the flags of ships, the loads of ships, the types of loads, the methods of evacuation, the types of vehicles participating in the evacuation, the status of the person/institution who informed about the event, the distribution of the internationally coordinated centres.

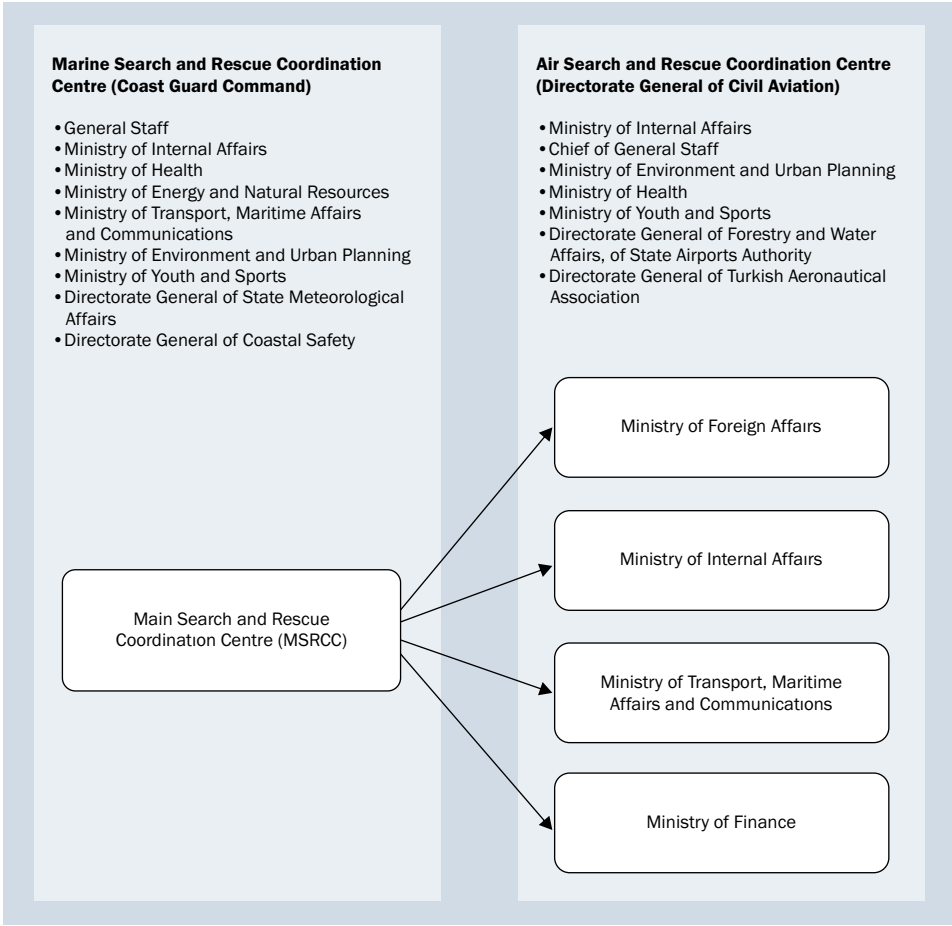

Figure 1. The institutions in coordination with the Main Search and Rescue Coordination Centre (MSRCC)

Table 1. The main tasks of Main Search and Rescue Coordination Centre (MSRCC)

1. To ensure the coordination of sea search and rescue operations at the highest level
2. To establish, maintain and operate the search and rescue facilities in accordance with international standards in Turkish sea search and rescue field
3. To carry out the task of preparing the national legislations on sea search and rescue operations in accordance with international legislations, to prepare and publish the necessary announcements
4. To get in touch with the Turkish flagged sea/air vehicles in distress all over the world and activate the sea search and rescue units in the region
5. To serve as the first point of contact in case of armed robbery, piracy and terrorist attacks which may take place in Turkish search rescue region and its jurisdiction area
6. To maintain coordination and cooperation for the operations with neighbouring countries inside/outside the search rescue region
7. To act to liaise with the Turkey Ministry of Foreign Affairs in the enforcement of bilateral agreements on search and rescue region

The variables in the study were examined in the one variable and bivariate Poisson regression analysis through NCSS statistical package software. The lowest variable or the highest variable in the data sets in the one variable Poisson regression analysis was considered as reference (R) and the study then determined whether there was a potentially significant decrease or increase in the other variables. The bivariate Poisson regression revealed that most of the variables were in interaction with each other. The section of findings indicated the ones which were significant and those which could be explained. This resulted in the use of the analysis of non-metric multidimensional scaling (NMDS), which is an interdependence technique, rather than the analysis of multivariable Poisson regression, which is a dependence technique.

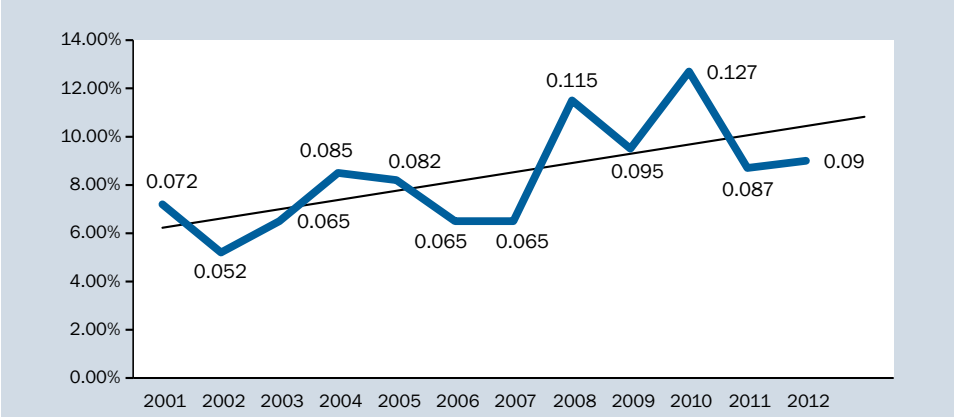

Figure 2. The distribution of the marine accidents/events and medical evacuations according to years (Turkey Ministry of Transport, Maritime Affairs and Communications, the Directorate General of Maritime and Inland Waters Regulation, Main Search and Rescue Coordination Centre, Ankara, Turkey, 01.01.2001–31.12.2012)

The study employed a multivariate analysis technique, namely NMDS, in order to find out the interdependencies among many characteristics (variables) of the marine accidents/events and medical evacuations, which were the subject of this study. Then, the study identified the areas where the characteristics (stimulants) of the units in the multidimensional scaling, which were the subject of this study, could be indicated by points in multidimensional space, and the representation in the two-dimensional space attempted to reveal the confidential nature of the data. Since the data were classified or sorted, the chi square distance measure was used. The multidimensional locations of the characteristics of the marine accidents/events and medical evacuations coordinated between 2001 and 2012 were analysed through IBM-SPSS (Alscal) programme and the results were interpreted.

The permission (dated November 8th 2012 and numbered B.30.2HAC.05.07.00/826) was obtained from the Non-Interventional Clinical Research Ethics Board of Hacettepe University.

RESULTS

FREQUENCY DISTRIBUTION

In accordance with the reports which were analysed in this study, the percentage of the years when the most accidents/events took place were respectively 12.7% in 2010 (228 accidents/events/medical evacuations), 11.5% in 2008 (207 accidents/events/medical evacuations) and 9.5% in 2009 (171 accidents/events/medical evacuations) (Fig. 2). The distribution of the accidents/events/medical evacuations in the study according to seasons indicated that the highest number of events occurred in fall season by 27.7% (497 accidents/events/medical evacuations) whereas the lowest number of events took place in spring season by 22.2% (398 accidents/events/medical evacuations). Further, the distribution of the marine accidents/events/medical evacuations according to months, the highest number of events happened in November by 10.0% (179 accidents/events/medical evacuations) while the lowest number of events took place in April by 6.5% (116 accidents/events/medical evacuations). When the marine accidents/events/medical evacuations were analysed according to the hours that they occurred, the highest number of events took place at 12.00–17.59 by 30.0% (538 accidents/events/medical evacuations) whereas the lowest number of events occurred at 06.00–11.59 by 22.1% (397 accidents/events/medical evacuations).

The highest number of the marine accidents/events and medical evacuations took place in the region of Istanbul (795 accidents/events/medical evacuations, 44.3%) while the lowest number of them occurred in the region of Trabzon (26 accidents/events/medical evacuations, 1.4%) (Table 2).

In regard to the flags of the vessels in the marine accidents/events and medical evacuations, Turkish flagged vessels ranked the first (1043 accidents/events/medical evacuations, 49.2%); Panamanian flagged vessels ranked the second (124 accidents/events/medical evacuations, 5.8%) and Maltese flagged vessels ranked the third (112 accidents/events/medical evacuations, 5.3%).

In terms of the types of the vessels in the marine accidents/events and medical evacuations, the top three vessels were respectively cargo ships (1058 accidents/events/medical evacuations, 49.9%), small boats (627 accidents/events/medical evacuations, 29,5%) and tanker ships (174 accidents/events/medical evacuations, 8.2%). In regard to the capacity of vessels in this study on marine accidents/events and medical evacuations, 70.0% of the vessels (1486 ships) had a gross tonnage of 120,000 gross tons or below; 7.3% of them (154 ships) had a gross tonnage of 10,001–25,000 gross tons; 5.8% of

Table 2. The distribution of the Marine Accidents/Events and Medical Evacuations According to Regions (Turkey Ministry of Transport, Maritime Affairs and Communications, the Directorate General of Maritime and Inland Waters Regulation, Main Search and Rescue Coordination Centre, Ankara, Turkey, 01.01.2001–31.12.2012)

Region	Number	Percentage
İstanbul	795	44.3%
Çanakkale	297	16.5%
İzmir	297	16.5%
Antalya	108	6.0%
Mersin	73	4.1%
Samsun	72	4.0%
Trabzon	26	1.4%
International	128	7.1%
Total	1796	100%

them (123 ships) had a gross tonnage of 25,001 gross tons or above. The information on these marine accidents/events and medical evacuations indicated that only 0.7% of a total of 2,122 recorded vessels (14 ships) had a date of manufacture. It was revealed that the masters of 43.5% of 2,122 recorded vessels (923 ships) were present at the ships when the accidents/events/medical evacuations took place. 27.7% of these recorded vessels (588 ships) had an IMO number. This study on the marine accidents/events and medical evacuations found out that 58.7% of the vessels which were involved in an accident/event/medical evacuation were carrying cargo. In terms of the types of the cargos, the vessels carrying building materials (iron, sand, cement, etc.) ranked the first by 10.9% (136 ships); those carrying passengers ranked the second by 5.8% (73 ships); those carrying passengers and vehicles ranked the third by 5.2% (37 ships).

The most frequent types of the marine accidents/events and medical evacuations were respectively grounding by 18.5% (333 accidents/events/medical evacuations); clashes by 15.1% (272 accidents/events/medical evacuations) and overturning by 14.1% (254 accidents/events/medical evacuations). The rarest types of the marine accidents/events were the attacks by sea raiders by 0.6% (11 accidents/events/medical evacuations), contact with other vessels by 3.1% (56 accidents/events/medical evacuations), and machine failure by 3.6% (65 accidents/events/medical evacuations), respectively.

The top three reasons of the marine accidents/events were respectively adverse weather conditions by 16.0% (287 accidents/events/medical evacuations), human errors by 13.4% (241 accidents/events/medical evacuations), and machine errors by 12.9% (232 accidents/events/medical evacuations).

As for notices of the marine accidents/events and medical evacuations, 4.2% of them (76 accidents/events/medical evacuations) were made by shipmasters whereas 2.6% of them (47 accidents/events/medical evacuations) were made by telehealth centres. However, the sources of the notices of 85.7% of them (1539 accidents/events/medical evacuations) were unknown.

The Regional Cooperation Centre in Greece (17 accidents/events/medical evacuations) ranked the first among the international centres coordinated in the marine accidents/events and medical evacuations. While 58.7% of the marine accidents/events and medical evacuations (1054 accidents/events/medical evacuations) were intervened by the Coast Guard Command, 13.7% of them (246 accidents/events/medical evacuations) were addressed by the Directorate General of Coastal Safety.

A total of 150 people were injured in a period of 12 years as a result of the marine accidents/events and medical evacuations. 3.7% of the marine accidents/events/medical evacuations involved injuries. The average number of the injured was 2.2 ± 0.6 (lower-upper limit = 1–19, median = 1.0).

A total of 73 people fell ill in a period of 12 years as a result of the marine accidents/events and medical evacuations. 3.6% of the marine accidents/events involved ill persons. The average number of ill people was 1.1 ± 0.4 (lower-upper limit = 1–5, median = 1.0). A total of 202 people went missing in a period of 12 years as a result of the marine accidents/events and medical evacuations. 4.7% of the marine accidents/events involved missing people. The average number of missing people was 2.4 ± 0.8 (lower-upper limit = 1–25, median = 1.0). A total of 312 people died in a period of 12 years as a result of the marine accidents/events and medical evacuations. 7.1% of the marine accidents/events/evacuations involved death. The average number of the dead people was 2.1 ± 5.6 (lower-upper limit = 1–67, median = 1.0). A total of 6042 persons were rescued in a period of 12 years as a result of the marine accidents/events and medical evacuations. 20.9% of the marine accidents/events/evacuations involved rescuing people. The average number of the rescued people was 16.1 ± 97.8 (lower-upper limit = 1–1636, median = 3.0).

Evacuations were ordered in 62.8% of the marine accidents/events. The most commonly used vehicle for the evacuations was boat by 22.7% (407 accidents/events/medical evacuations). The study concluded that marine vessels (boat, tugboat, ship, boat/tugboat) were the most preferred among the vehicles used for the evacuations by 30.0% (538 accidents/events/medical evacuations).

There were state hospitals, university hospitals, private hospitals and foreign hospitals among the hospitals to which people were referred. The referrals were not focused on a single hospital. The type of the hospitals to which most

of the referrals were made was state hospitals by 70.6% (48 hospitals).

ONE-VARIABLE AND BIVARIATE POISSON REGRESSION ANALYSIS

The average number of the accidents/events which resulted in injuries in the international region was significantly higher than that of the accidents/events which resulted in injuries in the region of Istanbul (8.5 times, 95% confidence limits 4.5–15.8).

It was observed that the number of the accidents/events in the type of overturning, clashes, the attacks by sea raiders, fire and explosion and in other types was significantly higher than the number of the accidents/events in the type of grounding which resulted in death (approximately 27 times, 95% confidence limits 8.3–87.6; 4.2 times 95% confidence limits 1.1–15.4; 11 times 95% confidence limits 1.1–115.2; 7.8 times 95% confidence limits 2.2–27.9; 9.2 times 95% confidence limits 2.5–34.2 and 37 times 95% confidence limits 11.4–120.3, respectively).

MULTIDIMENSIONAL SCALING ANALYSIS

The multidimensional scaling analysis (MSA) was conducted in order to determine the positions of the dimensions of the marine accidents/events in the study in the multidimensional space, to provide an overall structure of the marine accidents/events and, in the case that there may be variations in the structure, to reveal the dimensions of the marine accidents/events that lead to such variations.

The characteristics of vessel (IMO number, the year of manufacture, crew, captain, cargo status, gross register tonnage [GRT] and vessel type), the place of accident, the time of accident (year group, season, time of the incident), the type of accident, the cause of accident and the results of accident (the incidence of injury, death, rescue, loss or disease, the unit involved in the operation, environmental pollution) (20 variables) were analysed through the MSA and the study accordingly reviewed the patterns of the marine accidents/events which have taken place for 12 years.

There was a poor fit in 1-dimensional solution, a slightly lower fit in 2-dimensional solution and a better fit in 3-dimensional solution. Given that the transition from 2-dimensional solution to 3-dimensional solution resulted in a slight decrease in the stress value less than 0.05, it was concluded that 2-dimensional solution would be the most appropriate solution for the study. The stress value in 2-dimensional had a slightly lower fit and explained the data by 93.1%.

The coordinates of the variables in 2-dimensional indicated that the variables of season, time of the incident, the type of accident, cargo status, year groups and the unit involved in the operation had positive loading values above 1. These variables were of primary importance in the evaluation of marine accidents/events in a similar way. The most important discriminators in the primary dimension were season and the time of incident. The type of vessel had a positive loading value close to 1. In a similar way, GRT, captain, region and the cause of accident were positive. That is, the type of vessel, GRT, captain, region and the cause of accident, respectively, were variables of secondary importance in the primary dimension.

The coordinates of the variables in the 2-dimensions demonstrated that IMO number and crew had a positive loading value above 1 and were the most important discriminators in the secondary dimension. These variables in the secondary dimension were of primary importance in the evaluation of marine accidents/events in a similar way. Year groups had a positive loading value above 1; similarly, season, the time of incident, the type of accident, the cause of accident, region, GRT and the cases of disease were positive, which indicating that these variables were of secondary importance. The variable of Captain with the highest negative value was insignificant in the secondary dimension.

The study observed that the characteristics of the time of accident (year, season, the hour of incident), the type of accident, the unit involved in the operation and the cargo status of vessel were centred on the primary dimension (axis) in the 2-dimensional space. The results of accident (injuries, death, rescue, missing or disease, environmental pollution) and certain characteristics of vessels (IMO number, year of manufacture, crew) were at the other end of the primary dimension, which showed that the time and type of accident as well as the cargo status of vessel were important in the marine accidents/events and have an impact on the consequences of accident (Fig. 3).

DISCUSSION

National and international coordination are of critical importance for quick, efficient and effective response to marine accidents. This study was performed through the marine accidents/events and medical evacuation reports published at the website of the Main Search and Rescue Coordination Centre (MSRCC) affiliated to the Turkish Ministry of Transport, Maritime Affairs and Communications. The MSRCC is the centre responsible for coordinating search and rescue operations at the highest level in case of any accident related to marine or air vehicles in Turkey.

The distribution of the marine accidents, events and medical evacuations coordinated by the MSRCC from 2001–2012 (for 12 years) showed that there were differences depending on years (Fig. 2). According to the 2012 Maritime Trade Statistics (marine vehicles, maritime transport and incentive statistics) published by the Directorate General of Merchant Marine in 2012, the number of registered vehicles has increased from 2003 to 2011. It was concluded that one of the most important factors re-

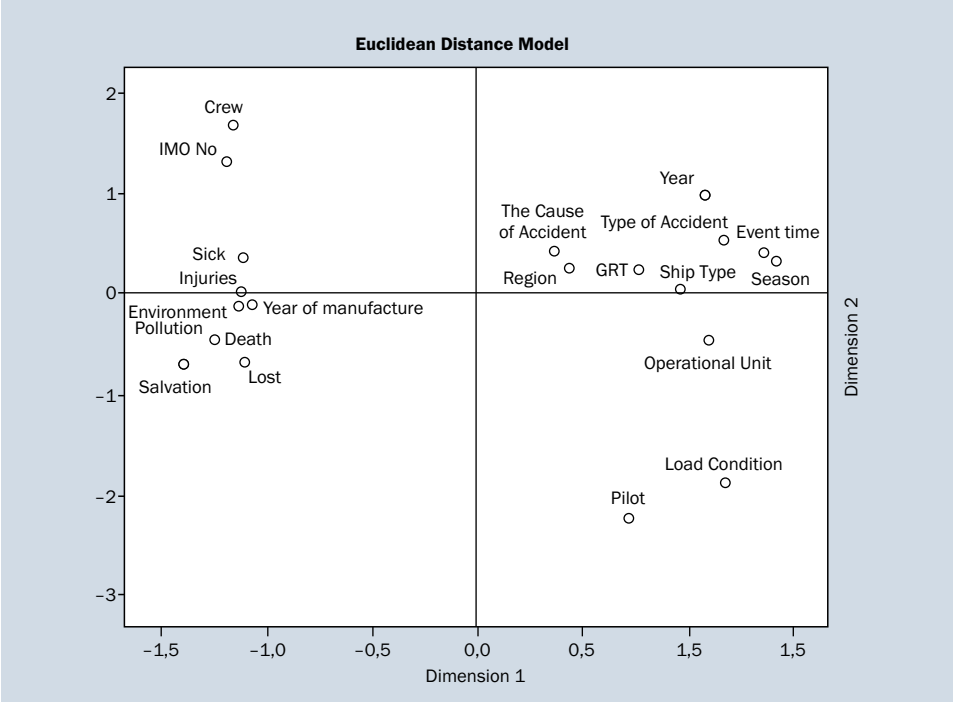

Figure 3. Spatial view of the dimensions of the marine accidents/events and medical evacuations

sulting in a yearly difference might have been the increase in the number of marine vehicles. Moreover, there has been a gradual increase in the number of vessels calling on the ports in Turkey and the amount of cargo transported over the years [15]. Accordingly, the number of vessels of other countries, thus, the number of vessels passing through the territorial waters of the country has increased as well [16]. These factors were considered to lead to the increase in the number of cases in the last 5 years.

The distribution of the cases coordinated by the MSRCC according to seasons demonstrated that the highest percentage of the cases took place in the season of fall by 27.7% (497 accidents/events/medical evacuations). The results of a study on the accidents of fishing vessels in England between 1948 and 2008 indicated that the highest number of accidents occurred in the season of winter [17]. The results of this study do not conform with the results of the study on the accidents of fishing vessels. The reason might have been a number of factors such as the different maritime geography, different climatic characteristics of the study as well as different features of the vessels.

The distribution of the cases coordinated by the MSRCC according to months indicated that the highest percentage of the cases took place in the month of November by 10.0% (179 accidents/events/medical evacuations). These variations might have resulted from the different climatic conditions over months (types of wind, extreme cold, extreme precipitation) and the differences in the vehicular traffic in the sea.

The distribution of the cases coordinated by the MSRCC demonstrated that the highest percentage of the cases occurred between the hours of 12.00 and 17.59 by 30.0% (538 accidents/events/medical evacuations). This finding was similar to the results of the study on the accidents of fishing vessels in England. The results of the study on the accidents in England revealed that more accidents took place in afternoon and after midnight [18]. The factors such as fatigue and heavy maritime traffic might have been the reasons that lead to the emergence of more accidents at such hours.

The region where the marine accidents/events and medical evacuations were most commonly seen was the region of Istanbul (795 accidents/events/medical evacuations, 44.3%) and the region where they were the least commonly seen was the region of Trabzon (26 accidents/events/medical evacuations, 1.4%). The analysis on the vessels registered to Turkish International Vessel Registry and the National Vessel Registry showed that almost half of them were registered to Istanbul [15]. Among the most important reasons that the region of Istanbul was the region where marine accidents/events and medical evacuations were most commonly seen, we may mention heavy maritime traffic due to the Bosphorus, the presence of the largest passenger and freight ports, and the busiest maritime trade routes in the region.

The analysis on the flags of the vessels involved in the marine accidents/events and medical evacuations indicated that Turkish flagged vessels ranked the

first (1043 accidents/events/medical evacuations, 49.2%); Panamanian flagged vessels ranked the second (124 accidents/events/medical evacuations, 5.8%) and Maltese flagged vessels ranked the third (112 accidents/events/medical evacuations, 5.3%). This finding was reasonable given that most of the vessels in Turkish seas were Turkish flagged vessels.

In terms of the types of vessels in the marine accidents/events and medical evacuations, cargo vessels ranked the first place (1058 accidents/events/medical evacuations, 49.9%); small boats ranked the second (627 accidents/events/medical evacuations, 29.5%) and tankers ranked the third (174 accidents/events/medical evacuations, 8.2%). Since 90% of the freight transportation in the world takes place by sea, the most commonly used type of vessels was cargo vessels. As a result, this type of vessels were involved in more marine accidents/events/medical evacuations. In regard to the capacity of vessels in this study on marine accidents/events and medical evacuations, 70.0% of the vessels (1486 ships) had a gross tonnage of 120,000 gross tons or below; 7.3% of them (154 ships) had a gross tonnage of 10,001–25,000 gross tons; 5.8% of them (123 ships) had a gross tonnage of 25,001 gross tons or above. The review on the sinking of the vessels with 100 GRT or more around the world and the reasons of these incidents between 2001 and 2012 in the Safety and Shipping Review 2013 demonstrated that cargo ships ranked first by 41% (n = 640) among the vessels, which was a finding similar to that of this study. Another study was conducted on the accidents of Greek flagged vessels between 1993 and 2006 in Greece and cargo vessels ranked first in regard to the types of vessels [19]. The 2007 study by Sanal [20], which was titled as "Vessels Casualties Occurred on Turkish Territorial Waters Resulted from Machinery Failure and Analysis", reflected that the type of vessels involved in accidents most was dry cargo ships by 31.2% [16]. A thesis study in 2010 by Kızkapan [3] performed an analysis of safety management in coastal areas and marine accidents between 2004 and 2008, and indicated that the type of vessels involved in accidents most in a total of 115 cases, which were analysed in the study, was general cargo and dry bulk vessels by 54.8% [21]. In regard to the types of vessels, the 2012 data of the Turkish commercial fleet demonstrated that cargo vessels accounted for almost half of the vessels [15]. The reason that cargo vessels ranked first in the marine accidents/events/medical evacuations was that they were high in number.

As for the notices of the marine accidents/events and medical evacuations, 4.2% of them (76 accidents/events/medical evacuations) were made by shipmasters whereas 2.6% of them (47 accidents/events/medical evacuations) were made by telehealth centres. Given that the master of a ship is the one who leads the vessel, it is expected that the master should be among the people who made the notice. Furthermore, the notices of most of the medical evacuations were made by telehealth centres. Telehealth centres are the primary institutions to seek medical consultancy services when injuries/diseases occur in a vessel. Moreover, these centres decide whether to transfer an injured/a patient to the hospital via marine vehicles or not. For that reason, these two were expected to rank first and second. However, the lack of records on these data was remarkable since the number of unknown notices was 1539 (85.7%).

Furthermore, the top three causes of the marine accidents/events/medical evacuations were respectively weather conditions by 16.0% (287 accidents/events/medical evacuations), human errors by 13.4% (241 accidents/events/medical evacuations) and machine errors by 12.9% (232 accidents/events/medical evacuations). Weather conditions are one of the most critical factors affecting the marine transportation. The conditions such as severe storms, fog, heavy snowfall, in particular, may dramatically disrupt the marine transportation. It is the people who are in control of any kind of vehicle in the maritime sector, like in many other sectors. For that reason, the most important factor in a potential injury or accident is the human factor. There are certain factors that have an impact on the human factor such as educational background, psychological state, physical factors, work environment, equipment and the design of engine room [17]. Although only 12.9% of the errors identified in the reports, which were analysed in this study, involved a human error, the direct or indirect effect of the human error (such as carelessness, lack of education, lack of maintenance and repair) in regard to the causes of accidents/incidents was believed to be more reasonable.

A total of 150 people became injured as a result of the marine accidents/events and medical evacuations in a process of 12 years. 3.7% of the marine accidents/events/medical evacuations resulted in injuries. Although the percentage seems to be low, certain types of accidents (such as grounding, machine error) did not affect the health of crew members and passengers in any way. The analysis on the number of injuries in relation to the marine accidents/events and medical evacuations in the study according to regions indicated that the highest number of injuries took place in international waters.

A total of 6042 people were rescued from the marine accidents/events and medical evacuations in a process of 12 years. A rescue operation was performed in 20.9% of them. The effectiveness and speed of search and rescue services are of vital importance in reducing the number of injuries and deaths. A total of 312 people died as a result of the marine accidents/events and medical evacuations in a process of 12 years. 7.1% of the marine accidents/events

resulted in death. Although the mortality of marine accidents is significantly lower than that of traffic accidents, they are to become a disaster since a marine accident results in the death or injury of a great number people.

In regard to the type of hospitals to which most of the referrals of the patients/injured people were made within the study, state hospitals ranked the first place by 70.6% (48 hospitals). It is essential that the state hospitals located on the coast are prepared to manage injuries and diseases that may emerge due to marine accidents. Due to the heavy maritime traffic across the hospitals in the area surrounding the Bosphorus and the Dardanelles, in particular, a disaster and emergency planning for potential marine accidents is fundamental.

Among the international centres in coordination in the marine accidents/events and medical evacuations, Greece Rescue Coordination Centre ranked the first place (17 accidents/events/medical evacuations, 12.3%). Greece ranks first in the merchant fleets of the world. Greece, a neighbouring country of Turkey, has a maritime border to Turkey. That being said, there is a great cooperation between Turkey and Greece in regard to any potential maritime accident that may take place and such cooperation will be essential in the future as well.

The results of the multidimensional scale analysis revealed that the time and type of an accident as well as cargo status had an impact on the consequences of the accident (injury, death, rescue, loss and disease) (Fig. 3).

LIMITATIONS OF THE STUDY

The limitations of the study may include the lack of sufficient variables related to health (such as cause of death, cause of injury, type of injury, interventions made during the evacuation of vessel) in the forms analysed in the study, the lack of the socio-demographic characteristics of the injured, dead and missing people (such as age, gender, passenger/personnel or staff in charge) and certain information unfilled by these people in the forms. The temporal information, which was not duly included in the forms and was indeed of critical importance for the study, posed an obstacle to the evaluation of search, rescue and medical evacuations according to time. The strength of the study was that this has been the first study to evaluate the search, rescue operations and medical evacuations throughout Turkey.

CONCLUSIONS

The study has provided valuable insights into the marine accidents/events and medical evacuations which took place in the activity area of MSRCC in Turkey. The risk management activities on injuries and accidents need to be carried out more carefully particularly in the areas with a high occurrence of marine accidents/events and medical evacuations (such as strait traffic, ports, shipyards), in the hotspots for shipping accidents. Additional emergency measures may be taken in the weather conditions and at the hours when most accidents happen. The available data collection forms can be improved based on these insights and more detailed research can be conducted given that the problematic areas have been already identified.

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