

Telemedical Advice to Long-Distance Passenger Ferries

Olaf C. Jensen, Niels Bo Bøggild, and Søren Kristensen

Background: Radio medical (RM) advice for seafarers and traveling passengers is important and can be crucial for the optimal medical treatment on board ships. The aim of this study was to analyze the data from consultations with passenger ferries to identify areas for possible improvements.

Methods: Data from the journals for 1 year from Radio Medical Denmark consultations with the medical officers on passenger ferries were analyzed retrospectively.

Results: Two hundred fourteen RM records, 73% pertaining to passengers and 27% for crew members, were analyzed. Passenger patients were generally older and more seriously ill than patients among the crew. A high number of potential and life-threatening medical conditions such as angina pectoris was seen among the passengers, and nine of these patients were evacuated by helicopter. Sixty-three percent ($n = 135$) of the calls related to pain complaints, and more than half of these involved severe or considerable pain. Only acetaminophen (paracetamol) and opioids were in the ferry medicine chest. At least 77 patients would have benefited from use of nonsteroidal anti-inflammatory drugs.

Conclusions: The paramedical assistance and the medicine chest contents were considered insufficient in several cases. Passengers and crew members with chronic illnesses should be thoroughly prepared and advised before their travels.

During the past seven or eight decades, the radio medical (RM) centers in seafaring countries such as Italy, Spain, Germany, Singapore, and Denmark have delivered expert telemedical advice to ill and injured seafarers and passengers at sea on a 24-hour basis all over the world. The risky working and living conditions at sea with no direct access to medical assistance underscore the need for a specified and effective RM service.

The RM centers operate as hospital-based radio medical advice centers for ships worldwide. Radio Medical Denmark is located at the Department of Head and Neck Surgery, Ribe County Central Hospital in Esbjerg. A team of six physicians from different specialties with practical experience in maritime telemedical and emergency medicine are routinely in charge to respond to calls from ships during 24-hour watch periods. If needed, other medical specialists are consulted. The calls from ships are

normally followed up with several communications via phone, e-mail, and telefax, and occasionally photos are sent by e-mail. No other specific telemedical equipment such as electrocardiography is used.

The "hospital" on the ship includes a small room with a couch, the ship's medicine chest, the ship's medical guide, a telephone, and other relevant medical equipment. The navigators on board are specifically educated to perform the medical health assistance guided by the RM doctors on shore.¹

Passenger transport at sea includes domestic ferries that sail for just a few hours at a time and international passenger ships that travel for more than 30 hours. Cruise ships are unique in that they offer vacations and amusement, with large cruise ships touring long distances over several weeks. Although the telemedical advice in general and for cruise ships specifically has been described previously, the telemedical advice for passenger ferries has not been described before.²⁻⁵

The aim of this study was to describe the telemedical advice for passengers and the crew of passenger ferries, with specific attention to the types of illnesses and the treatment of pain.

Methods

Since 1995 all telemedical consultations for ships in the region have been directed to the Radio Medical Denmark center at the Ribe County Hospital in Esbjerg, which has a staff of medical consultants with full admittance to specialized advice from all relevant medical spe-

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cialties in the region. All RM records archived for the period of January 1 to December 31, 2001, were compiled and analyzed retrospectively. The journals for patients traveling on Danish long-distance ferries (seven routes) were selected and analyzed. Included were basic information about the patient, the ship, and the ship's precise position at sea. Preliminary diagnoses were registered according to the World Health Organization International Classification of Diseases 10 coding system.⁶

Severity of the Diseases

The severity of the diseases was classified according to a five-item coding system:

1. Extremely severe case: acute evacuation by helicopter was necessary and performed
2. Severe case: patient with life-threatening condition but not evacuated
3. Normal case: relevant cause for acute medical help, as would have occurred ashore
4. Subacute case: important but without the urgent need for medical advice
5. Minor disease case: medical condition that should not have involved acute telemedical help

Pain Analysis

The intensity and the mechanism of pain was analyzed and coded by an experienced expert in pain treatment (N.B.B.). The intensity of the pain was coded according to the visual analog score (VAS) for pain:

- Severe pain (VAS 8–10): opioids given or not, but considered necessary to relieve the pain
- Considerable pain (VAS 4–7): patient suffering to a high degree as expressed in the journals or according to the doctors' knowledge of pain that occurs with the mentioned disease or injury
- Light pain (VAS 1–3): acetaminophen (paracetamol) considered sufficient to relieve the pain satisfactorily

The mechanism of pain was coded according to the following categories:

- Nociceptive (somatic or peripheral) from skin muscles or bone
- Visceral from the inner organs
- Neurogenic from damaged/compressed/dysfunctional peripheral nerves or central nerves, as in general diffuse headaches

Treatment with prescription drugs such as non-steroidal anti-inflammatory drugs (NSAIDs) and opioids was done only by order of the physician at the Radio Medical Denmark and was always registered. All patients with pain were offered acetaminophen. Treatment with acetaminophen or other nonprescription drugs by the

navigation officer in charge of the medical assistance on board was not registered.

Results

The patients who were passengers represented all age groups, whereas patients who were crew members were generally younger (Table 1). Twenty-two percent of the patients had very serious illnesses, and 71% had conditions comparable to those seen at a hospital emergency ward or a general practitioner's 24-hour service. Seven percent had minor medical problems that could have been solved by an educated nurse without calling Radio Medical Denmark (Table 2).

Twenty-eight percent of the passenger patients and 5% of the crew patients were very seriously ill (see Table 2 and Figure 1). Nine passengers were evacuated by helicopter, 4 with severe angina pectoris and 5 with degrees of unconsciousness owing to apoplexy, diabetic coma, meningitis, hematemesis, and head injury. A 59-year-old crew member was found dead in his cabin, probably owing to cardiac arrest.

Thirty-eight (18%) severely ill patients had possible life-threatening conditions such as angina pectoris (10), apoplexy (3), and episodes of unconsciousness (4). Other severe cases included patients with asthma, pulmonary stasis, mental delirium, epileptic cramps, anaphylactic shock, Quincke's edema, commotio cerebri, febrile cramps (child), and tachycardia. Only two of these patients were crew members, one with commotio cerebri and the other with unexplained fainting.

Types of Diseases

Diseases of the gastrointestinal, mental and nervous, and circulatory/respiratory systems constituted 47% and 29% among passengers and crew members, respectively (Table 3). Fourteen passengers (9%) but no crew members had angina pectoris. The crew had relatively more diseases related to infections, the genitourinary system, sense organs, and the skin (Figure 2). Apart from one crew member who was found dead and had possibly suffered a heart attack, the crew members had no complaints related to the cardiovascular system, allergy, or diabetes. Three crew members but no passengers had acute tooth problems. Complaints from the mental and nervous system were mainly headache, mental confusion, and veneficium of drugs or alcohol.

Nineteen percent of the patient complaints involved injuries. Injuries among the crew were typically minor and were related to their work on board. Two of the crew were scalded with hot fluids, 1 had presumably broken a finger, and 1 had broken a tooth. The passengers sustained major and minor injuries related to different causes, for example, 4 had fractures, 1 was bitten by a dog, 1 swallowed pieces of glass, and several had multiple injuries of the body, typ-

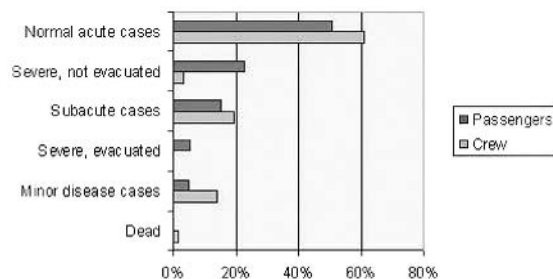
Table 1 Age and Gender of Radio Medical Patients* on Danish Ferries

Characteristic	Passengers (n = 156)		Crew Members (n = 58)	
	n	%	n	%
Age (yr)				
< 10	18	11.5	0	0.0
10–20	12	7.7	3	5.2
20–40	43	27.6	47	81.0
40–60	40	25.6	8	13.8
60–80	40	25.6	0	0.0
> 80	3	1.9	0	0.0
Mean	42 yr		31 yr	
Range	14 d–83 yr		18–59 yr	
Gender				
Male	95	60.9	25	43.1
Female	61	39.1	33	56.9

*n = 214.

Table 2 Severity of the Radio Medical Patients' Diseases

	Passengers (n = 156)		Crew Members (n = 58)		Total (n = 214)	
	n	%	n	%	n	%
Fatal	0	0.0	1	1.8	1	0.5
Severe, evacuated	9	5.7	0	0.0	9	4.2
Severe, not evacuated	36	22.9	2	3.5	38	17.8
Normal acute cases	79	51.0	36	62.0	115	53.7
Subacute cases	24	15.3	11	19.3	35	16.4
Minor disease cases	8	5.1	8	14.0	16	7.5

**Figure 1** Severity of the cases referred to Radio Medical Denmark from ferries. Percentages of the total number of patients among passengers (n = 156) and crew (n = 58).

ically from falling on the moving ship. One patient was evacuated because of bleeding, unconsciousness, and cramps from facial fractures. Another had a serious chest injury.

Pain and Pain Treatment

Pain was the reason for 135 (63%) of the calls made, of which 72 (53%) involved cases of severe or considerable pain (Table 4). Nociceptive pain occurred in 77 patients, half from injuries and the others from infections, otalgia, tooth pain, and other complaints. Thirty-four of

the patients experiencing nociceptive pain had considerable or severe pain strength. Visceral pain from the inner organs occurred in 49 patients, 31 of which had considerable or severe pain. In general, they were very ill and most of them experienced chest pain. The neurogenic pain was of the central type, such as migraine, meningitis pain, or other types of headaches.

For treatment of pain, mainly acetaminophen, NSAIDs, and opioids were used. Acetaminophen was offered to all those with pain and was not registered. Among the patients with nociceptive pain, 4 were treated with NSAIDs and 1 with morphine. The NSAIDs were supplied by the other passengers. Among the patients with visceral pain, 1 was treated with an NSAID and 22 with opioids.

Of the 23 patients treated with opioids, 19 used sublingual buprenorphine, 3 had morphine injections, and 1 used his personal codeine tablets. No problems were reported in terms of resorption of the buprenorphine resorbibles, which seemed to work well.

Other Medical Treatments

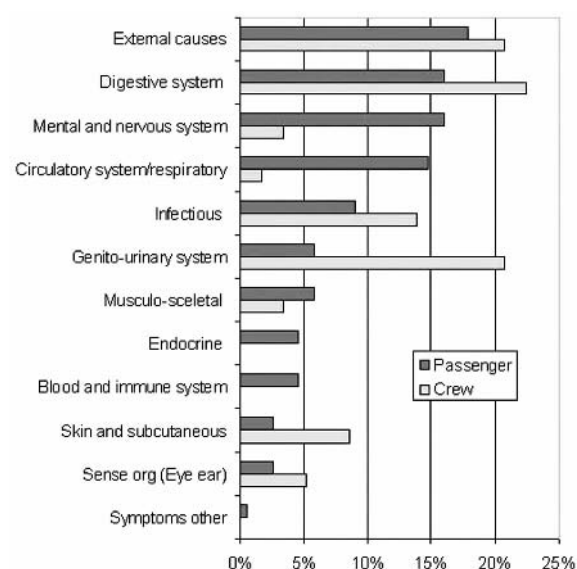
Forty-seven percent of the patients were treated with prescription drugs, mainly antibiotics, pain relievers, and steroids (Table 5). Some were treated with more

Table 3 ICD-10 Disease Categories for Radio Medical Patients* from Danish Ferries

Disease Categories	Passengers (n = 156)		Crew Members (n = 58)	
	n	%	n	%
I. Infectious	14	9.0	8	13.8
III. Blood and immune system	7	4.5	0	0.0
IV. Endocrine	7	4.5	0	0.0
V–VI. Mental and nervous system	25	16.0	2	3.4
VII–VIII. Sense organs (eyes and ears)	4	2.6	3	5.2
IX–X. Circulatory/respiratory systems	23	14.7	1 [†]	1.7
XI. Digestive system	25	16.0	13 [‡]	22.4
XII. Skin and subcutaneous	4	2.6	5	8.6
XIII. Musculoskeletal	9	5.8	2	3.4
XIV. Genitourinary system	9	5.8	12	20.7
XVIII. Other symptoms	1	0.6	0	0.0
XX. External causes (trauma)	28	17.9	12	20.7

ICD = World Health Organization International Classification of Diseases.

*n = 214.

[†]Sudden death, probably owing to cardiac arrest.[‡]Three patients with tooth problems in this group.**Figure 2** Distribution of illnesses referred to Radio Medical Denmark from ferries for passengers (n = 156) and crew members (n = 58).

than one type of drug. Other drugs used were antiemetics, antacids, antihypertensives, laxatives, neuroleptics, ear drops, eye ointments, methylergonovine maleate (Methergine), and tetanus vaccine.

A confused patient with violent behavior and signs of being potentially suicidal, probably owing to drug abuse, was handcuffed and taken into custody by the ship's officers. Another patient with urinary retention was catheterized in the bladder. Three patients who had been injured by acid, base, or diesel oil in the conjunctivae or face were treated with water sluiced in the eyes or face for an extended time. A 2-week-old baby was treated for bleeding from the umbilicus.

Discussion

Based on an estimate of 27 million passengers per year, the incidence rate for passenger patients needing RM assistance is 5.7/1 million tours at sea.⁷ The different types and severity of the illnesses among passengers and crew could be explained partly by the different age structure

Table 4 Type, Strength, and Treatment of Pain among Patients Referred to Radio Medical from Danish Ferries

	Noiceptive Pain (n = 77)		Visceral Pain (n = 49)		Neurogenic Pain (n = 9)		Total (n = 135)	
	n	%	n	%	n	%	n	%
Pain strength								
Pain light, VAS 1–3	43	55.8	18	36.7	2	22.2	63	46.7
Pain considerable, VAS 4–7	25	32.5	12	24.5	4	44.4	41	30.4
Pain severe, VAS 8–10	9	11.7	19	38.8	3	33.3	31	23.0
Treatment*								
Opioids	1	—	22	—	2	—	25	—
Nitroglycerine	0	—	8	—	0	—	8	—
Ergotamine	0	—	0	—	1	—	1	—
NSAIDs	4	—	1	—	0	—	5	—

*n = 39. Treatment with acetaminophen was not registered; therefore, percentages have not been given for treatment since they are not representative of total treatment.

Table 5 Drug Treatment of Passengers and Crew Members on Ferries*

Type of Drug	n	%
Antibiotics	30	24.7
Opioids	25	20.7
Steroids	20	16.5
Nitroglycerine	8	6.6
Benzodiazepine	7	5.8
NSAIDs	5	4.1
Diuretics	5	4.1
Asthma drugs	3	2.5
Antihistamine	0	0.0
Insulin	2	1.7
Others	16	13.2

**n* = 121.

and by the fact that crew members must regularly pass health examinations. Angina pectoris among other illnesses seemed to be a problem for passengers. Some of the elderly passengers had poor health with chronic diseases and there was acute deterioration of the health conditions. The risk of falls and slips increases with age and is further increased on a moving ship.

Passenger ferries with tour lengths at sea of more than 72 hours with more than 100 passengers are considered cruise ships and are required to have a medical doctor on board. If the number of passengers exceeds 500, they are also required to have a nurse on board. Denmark has no such ships and there is no specific requirements regarding health care services for passenger ferries or for cruise ships, apart from the requirements for the merchant ships.

Pain Structure and Treatment

The mechanism and intensity of patients' pain were analyzed and treated according to recognized principles. Non-neurogenic acute pain, postoperative pain, and cancer pain should be treated similarly with acetaminophen and NSAIDs for weak and moderate pain and opioids for stronger pain.^{8,9} The combined effect of the three pain relievers given together is even stronger.¹⁰ However, patients with considerable and severe nociceptive pain were treated with only acetaminophen, obviously an undertreatment, whereas those with considerable or severe visceral pain were well treated with opioids.

NSAIDs are very effective drugs for treatment of nociceptive pain but are ineffective for neurogenic or visceral pain, except for spastic conditions of gall bladder or ureter.¹¹ Thus, the 77 patients with nociceptive pain could have benefited from treatment with NSAIDs had they been in the medicine chest. Patients with neurogenic pain were mostly left untreated and were observed; however, specific drugs could have been used.⁹

Sublingual buprenorphine, a partial μ - κ - δ opioid receptor agonist/antagonist, was used for 19 patients. It

might be considered weaker than morphine but is sufficiently effective even as sublingual tablets after major abdominal surgery, for example.^{12,13} It is easy to administer and is resorbed within 2.5 minutes from the inside of the mouth and works after 30 minutes.¹⁴ The drug has a low risk of respiratory depression and drug addiction and is considered a safe drug.¹⁵ Its receptor properties might also give better heart protection than morphine.¹⁶ In the studied cases, it was proved excellent and no patient needed supplemental treatment with morphine.

The passengers' pain strength was generally worse than that of crew patients, who had mainly nociceptive, weak pain. This trend, together with the list of diagnoses, confirms the impression that the crew usually called RM regarding minor diseases. Obviously some of the calls could have been avoided if patients had visited their general practitioner before the tour, which is easier for passengers on ferries than for those on long-distance ships.

Medical Assistance on Board

All officers undergo a basic paramedical training for 2 weeks and a refresher course every 5 years. They can observe, report, and carry out treatment based on the RM advice but do not diagnose and treat independently. They are supposed to be the "physicians' eyes, ears, and hands."^{1,17}

The medical assistance was typically given by the youngest mates, who often had to keep up with their normal tasks at the same time. As the number of serious cases of illness on board is small, the capacity of treating severely ill patients is limited and handling them is not routine. A medically trained passenger who could assist with care taking of a patient during the critical observation period was often unavailable, and when such a passenger was found, he or she had absolutely no paramedical education.

Evacuations by helicopter rely on good weather conditions, and not all ferries are equipped with a helipad. The patients must be hoisted up in a stretcher or first transported in a smaller boat before they are hoisted up. As transport for several hours to the hospital can be very stressful for the patient, helicopter transport is of limited value.

There were no nurses or physicians on board, and the medical officers were not educated to correct asystolia or tachycardia according to recommendations from the Danish Council for Resuscitation 2000.¹⁸ Any attempt to bring the crew member who had a sudden cardiac arrest back to life would presumably have been useless as only the basic cardiac resuscitation equipment was available. Even if a physician had happened to be among the passengers, he or she would have had only a small chance of reviving the crew member as neither electrocardiography apparatus nor a defibrillator was available on board. In contrast, when trained security officers in casinos have used automated external defibrillators for sudden cardiac arrests, the

survival rate has been 49 to 74%.¹⁹ It is owing to pure luck that all of the 14 patients with angina pectoris survived; 1 of these had tachycardia, another had pulmonary edema, and 4 were comatose owing to unknown causes.

The content and organization of the ship's medicine chest complied with the international agreements for ocean-going trade ships (Chest Type A), and there is no special requirement for supplemental drugs for passenger ferries. Passengers are uninformed about the limited medical help on board; five patients had left their anti-diabetic medicine at home, and one patient was evacuated in diabetic coma. In some cases other diabetic passengers were able to supply insulin. One patient was evacuated in poor condition and shock owing to bleeding from a stomach ulcer. Outside the study period, we at Radio Medical Denmark have encountered severe bleedings in anticoagulated patients.

This study has some limitations. The study size was small, but still it was possible to point out some important specific needs for improvements of the medical service on board.

Conclusions and Recommendations

In conclusion, passenger patients had more severe diseases than did the crew members. The content of the medicine chest and the structure and quality of the paramedical assistance on the ferries were insufficient in several cases and should be improved in the following manner:

- Consider whether a skilled nurse should be available on board some ferries.
- The officers should be higher educated to meet and handle serious diseases. It is recommended that more paramedics be educated and ready to support the medical officers in critical situations.
- The possibilities for diagnosing and treating cardiac arrests and diseases should be improved. It is not required that any type of ship have automated external defibrillators, but it is recommended for the large passenger ferries. Although the ferry companies are still considering whether they should introduce this equipment, some of the large cargo ships have already introduced them.
- The ferries' medicine chest should be equipped with drugs other than just those drugs available on cargo ships, for example, more life-saving drugs, phytonadione, and insulin. The availability of NSAIDs would allow the crew members to treat pain without having to call for RM advice. Sublingual buprenorphine and the standard ampoules of morphine for injection should be kept in the chest as optional pain-relieving drugs.

- The calls to RM for the crew's minor medical problems should be reduced.
- Consistent with other authors' advice, passengers should be well informed and well prepared before sailing.²⁰ A booklet for their travel preparation and information on the limitations of the health care on board should be given to passengers together with their ticket. Crew members with chronic diseases should also attend health examinations or visit their general practitioner so that they are informed and prepared before they go to sea.

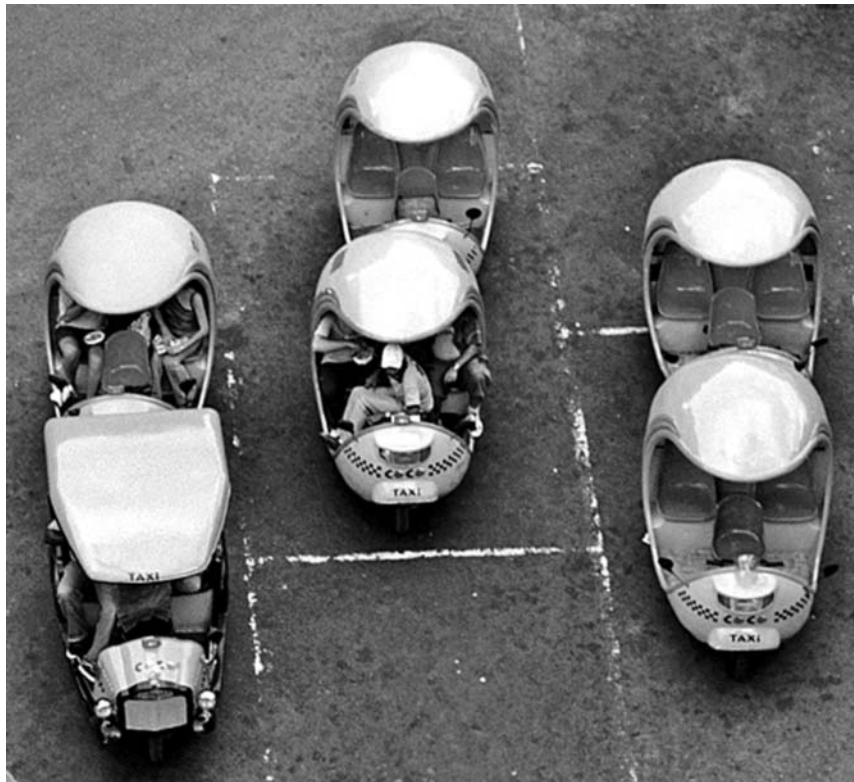
Declaration of Interests

The authors have no financial or other conflicts to disclose.

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City transportation in Cuba. Submitted by Mina Potasman.