Int Marit Health 2016; 67, 1: 9–13

topic of oral health of seafarers has been recently reviewed [1]. This paper has reported the lack of extensive information excluding some basic epidemiological studies among merchant ship crews. This review has also demonstrated that people working on board of navy units in general receive better and articulated dental care [1].

Based on the above consideration Centro Internazionale Radio Medico (CIRM), the Italian Telemedical Maritime Assistance Service (TMAS), developed and distributed a questionnaire on oral health habits of seafarers [6].

MATERIALS AND METHODS

An anonymous research questionnaire on oral hygiene was prepared [7]. It was proposed that all ships asking for medical advice from CIRM between 1st July 2014 and 31st October 2014 from CIRM should be requested to fill in the questionnaire. The questionnaire was prepared in English and Italian. A summary of all the questions on the questionnaire was also prepared for the captain of each ship to save time and paper work. Informed consent was taken from all sailors who wanted to be part of the research. Those interested in contributing to the initiative were required to send an e-mail in response, after which questionnaires and instructions were sent to the participating ships. In the 4 months CIRM conducted this survey, 1,198 ships required medical assistance to the Centre, but only 65 ships replied to CIRM's request and took part in the study by returning the summary of the filled questionnaires. The demographics of the sample taking part in the survey are shown in Table 1.

The captain of each ship was informed that he can fill the summarised chart after getting responses of all the seamen on board. In case the captain had any queries he was asked to contact via e-mail the CIRM dental specialists in charge of the project. To appreciate the efforts of the captain being part in this survey, CIRM also awarded certificates and appreciation letters. Ships collaborating with the initiative also received a complimentary copy of the book "Oral Hygiene and its Maintenance", specifically developed for increasing the awareness of seafarers to the problem [2].

The data analysis of the questionnaire was done as an active and interactive process. Researchers carefully sifted the results and analysed the data recorded through the questionnaire. Data was analysed after organising the questionnaire results systematically [8, 9]. Data analysis is the "Process of fitting data together, of making the invisible obvious, of linking and attributing consequences to antecedents. This is the process of conjecture and verification, of correction and modification, of suggestion and defence" [10]. At the outset the data were coded to form categories and subcategories emerging from the data. Codes were developed based on the list of themes. Coding as method of conceptualising research data and classifying them into meaningful and relevant categories for the participations in the study [11].

Charts were created and the results were pasted on these charts into different sections and categories and finally typed into Excel files. After the whole process was completed, a list of themes of categories and subcategories were identified and data was compiled and discussed under the identified categories.

RESULTS

Figure 1 shows the research questionnaire [7]. The results of the survey are summarised in Table 2. A large percentage of seafarers consumed alcohol and nicotine during the voyages. 56.11% of sailors surveyed (n = 1,156) stated that they regularly smoked, out of that population, almost 45% of the smokers said they smoked more than 10 cigarettes a day. 11.45% of the total survey population (n = 236) responded that they consumed alcohol on a regular basis. In recent decades shipping companies have made an effort to restrict alcohol use on cargo ships but policies and implementation of the policies varies [12]. Cross tabulation between the population that consumed alcohol and smoked tobacco showed that 15.39% of smokers (n = 178) also consumed alcohol. Sailors who consumed alcohol were more likely to smoke (80.93%, n = 191), sample population that consumed alcohol admitted that they also smoked tobacco.

55.67% of the participants (n = 1,147) acknowledged use of dairy products or candies which contain fermentable carbohydrates. Only the 61.11% of sailors (n = 1,259) had a complete set of natural tooth. 82% (n = 656) of the total 801 sailors without a complete set of teeth, lost their tooth due to extraction. The remaining people lost their tooth as a result of tooth mobility.

Cross tabulation of the data set showed that older sailors (50–60 years) had higher frequency of tooth loss. 6.6% of the total sample population (n = 137) was from this age group (50–60 years), 63.5% of them (n = 87) had missing tooth or several missing teeth. Around 30.48% of the sailors (n = 628) reported suffering from diseases of the supporting structure of teeth including gingivitis or periodontitis at some

Table 1. Demographics of study sample

Ships contacted	Took part in survey	No. of seafarers filling in the questionnaire	Rate of return
1,198	65	2,060	5.4%

1.	Your age is between	20-30	30-40	40-50	50-60
2.	Are you satisfied with your smile?		Yes		No
3.	Do you have a complete set of natural teeth?		Yes		No
4.	If you answered 'No', could you specify how many teeth you have lost?	Specify the number of missing teeth	Total loss upper teeth	Total loss lower teeth	all teeth missing
5.	Of teeth that were lost, were they extracted for trauma?		Yes		No
6.	Of teeth that were lost, were they extracted because they were mobile?		Yes		No
7.	If you answered 'Yes', do you know that you suffer from periodontal disease?		Yes		No
8.	Do you often suffer from abscesses?		Yes		No
9.	If 'Yes', in which side of your mouth?	Upper right	Upper left	Lower right	Lower left
10.	Are you a smoker?		Yes		No
11.	If "Yes", how many cigarettes a day?	Less than 10	10-20	20-30	More than 30
12.	Do you drink hard liquor?		Yes		No
13.	Do you often eat pastries or candy?		Yes		No
14.	Do you brush your teeth regularly?		Yes		No
15.	If you answered 'No', the reason is because you have pain if you try to brush them?		Yes		No
16.	If you answered 'Yes', how many time a day?	1	2	3	
17.	When you brush your teeth, do you notice bleeding from the gums?		Yes		No
18.	Do you know if you suffer from halitosis (bad breath)?		Yes		No
19.	Do you have the sensation of dry mouth?	Yes	No	Sometimes	
20.	If 'Yes', could you specify whether you seem to have little salivation?		Yes		No
21.	Do you have the sensation of having a burning mouth?		Yes		No
22.	If you look at your tongue in the mirror, could you specify how it seems?	Pink	White	Dark	Speckled pink and white
23.	When you chew, do you have the perception that the tongue is being scratched with some sharp tooth root or fractured tooth?		Yes		No
24.	If you look at your lips in the mirror, could you specify how they seem?	Pinky	Dry	Dry and chapped	They have darker patches
25.	If there are some darker patches, can you specify when they appeared?	1 month	2 months	6 months	1 year
26.	Do you happen to bite your cheeks while you chew?		Yes		No

Figure 1. Questionnaire proposed to seafarers on board ships taking part to this survey

Int Marit Health 2016; 67, 1: 9–13

Table 2. Summary of key findings

Synthesis of the key results of the survey questionnaire	
Variable	**No. (%) of seafarers**
Tobacco use	1,156 (56.11%)
Alcohol use	236 (11.45%)
Smokers who also consumed alcohol	178 (15.39%)
Alcohol consumers who also smoked	191 (80.93%)
Regular use of fermentable carbohydrates	1,147 (55.67%)
Twice a day tooth brushing	834 (40.48%)
Sailors with complete teeth set of teeth	1,259 (61.11%)

point of their life. 27.03% of the sample (n = 557) reported bleeding gums during brushing. Over 75% of the sample were satisfied with their smile.

74.07% of the total sample population (n = 1,526) were regularly brushing their teeth, but interestingly only 40.48% seafarers (n = 834) questioned brushed their teeth twice, which is recommended by dental professionals around the world, whereas the majority of them only brushed once a day. 5% of the sailors surveyed reported that pain was a reason for not brushing their teeth regularly. 4.02% of the total sample (n = 83) reported bad breath or halitosis, whereas only 1.31% (n = 27) sample population indicted feeling the sensation of burning mouth. Whereas 2% of the sailors also referred occasional cheek biting while chewing or eating.

DISCUSSION

Dental fitness of seafarers is considered critical by International Labour Organisation (ILO) and World Health Organisation (WHO) [13]. Seafarers are known to disregard oral hygiene during long voyages and also tend to consume high quantity of nicotine, which is probably done to relieve occupational stress due to odd duty hours and isolation [14]. Nicotine is considered the most important preventable risk factor associated with periodontal and lung disease [15]. The Danish Radiomedical service in its annual report 2010, which analysed 1,300 consultations, stated that dental problems (8.1%) were among the four most reported health issues of seafarers [16]. A study reported that on commercial cargo vessels, the causes of consultations for oral health problems at foreign ports can be as high as 67% [17]. A survey conducted in 1995 found that only 19 countries provide comprehensive oral health services for seafarers [18]. That is why more research is required to investigate the oral hygiene status of seafarers and to assess their awareness and concerns regarding oral health.

The results of the survey are reflective of poor oral hygiene of seafarers. Seafarers were also found to be smoking more than the general population. Global modelled age-standardised prevalence of daily tobacco smoking in the population older than 15 years was found to be 31% in 2012 [19], while 48% of the world population consumes alcohol [20]. In our sample of seafarers, 56% of them smoked and the 11% of them consumed alcohol (Table 2). Alcohol consumption on board vessels is a tricky subject as many shipping companies have banned or restricted alcohol consumption altogether, but implementation of these policies remains a subject of debate, hence it is entirely possible that seafarers are hesitant to openly talk about the subject [12]. The higher consumption of tobacco compared to the general population can be attributed to various factors including isolation, boredom and stress. The intake of dairy products and sweets were also deemed to be very high, which is clearly associated with high dental caries risk. Although a majority of the sailors surveyed were brushing their teeth, most of them were only brushing once, perhaps due to inadequate knowledge of oral hygiene protocols. Brushing the teeth twice a day with a fluoridated tooth paste is the recommended practice for maintaining good oral hygiene [21].

Over a quarter of the survey population suffered from bleeding gums which is troubling, and it could also signify underlying systemic diseases. Over half of the population didn't have complete natural teeth set which suggests that seafarers are more likely to lose tooth than the general population, perhaps due to ambivalent attitude towards oral hygiene.

The combination of high intake of alcohol, tobacco, refined carbohydrates (sweets/dairy products) and insufficient knowledge regarding oral hygiene creates a synergistic effect which is evident from the poor oral hygiene status exhibited by a majority of the seafarers. The fact that most seafarers only brushed teeth once daily is also proof enough that oral hygiene knowledge and motivation remains low in this group. There is a dire need to improve the motivation and knowledge level of seafarers regarding oral hygiene practices. Seafarers must also be made aware of the extreme dangers associated with the use of excessive amounts of alcohol, nicotine and refined carbohydrates. Alcohol and smoking are independent risk factors of many diseases, not just limited to diseases of the mouth, including oral cancer and submucous fibrosis [22].

In view of the oral status of seafarers, of the isolation of the ship and of the difficult access to health and dental care of seafarers, telemedicine based applications for dentistry (teledentistry) could represent a way for providing a reasonable level of oral assistance to seafarers. The emergence of teledentistry as a branch of telemedicine can be

traced back to 1994 when a United States Military project demonstrated that teledentistry reduced dental treatment costs and proved to be effective in providing dental care to distant communities living in rural areas [2]. Teledentistry has the potential to improve access to oral health care and decrease treatment costs [23] and could be integrated with electronic health records, digital imaging as a support of teleconsultations with dental specialists [24]. Teledentistry has been successfully implemented as models to improve dental education and access to care [25] and is effective in the management of oral health issues in remote and rural areas, where access to dentists and oral health specialists is limited [26, 27]. Teledentistry may become a new instrument for tending to the poor oral/dental conditions of people on board of seagoing vessels.

CONCLUSIONS

The results of this survey have shed light on important dental hygiene issues of seafarers. From the above discussion, it is clear that seafarers need better oral hygiene education and care to enable them to take care of their oral health in a better way. Life at the sea, under challenging circumstances is not without stress, that is why it is important that seafarers are given complete information about correct oral hygiene protocols and dental hygiene. Shipping companies should make sure that seafarers are exposed to regular health examinations including dental checkups, which should be made part of the health fitness test that are conducted before the sailor goes on board. Shipping companies should also develop comprehensive dental hygiene programs for seafarers which have shown to make a profound effect on overall dental health of any community [28]. Seafarers due to their unique lifestyle, represent a vulnerable community as far as oral health is considered, that is why more research is required on dental hygiene habits of sailors to expand our current understanding of the problems this community faces in maintaining its oral health, which has direct implications on overall health.

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REFERENCES

1. Sobotta BA, Reiber T, Nitschke I. Oral health of seafarers. A review. Int Marit Health 2011; 62: 8–16.
2. Amenta F, Dauri A, Rizzo A. Organization and activities of the International Radio Medical Centre (CIRM). J Telemed Telecare 1996; 2: 125–131.
3. Goethe WHG. Medical care on ships without a doctor. Radio medical advice. In: Goethe WHG, Watson EN, Jones DT eds. Handbook of Nautical Medicine, Springer, Berlin, 1984, pp. 53–65.
4. Holttinen T, Murtomaa H, Pentti J, Alvesalo I. Utilization of Dental services by Finnish seaman. Acta Odontologica Scandinavia 1994; 52: 71–81.
5. American Dietetic Association. Position paper: nutrition and oral health. J Am Dietary Association 2003; 103: 615–625.
6. International Maritime Organization (IMO). Medical Assistance at Sea. Circular MSC/Circ.960. IMO, London, 2000.
7. Mahdi SS, Mancini M, Sibilio F, Amenta F. Research questionnaire on perception of seafarers about oral hygiene and oral dietary habits. World J Dentistry 2015; 6: 1–4.
8. Patton M. Qualitative evaluation and research methods. Newbury Park, Calif, Sage 1990.
9. Morse JM, Field PA. Qualitative research methods for health professionals. Calif, Sage 1995.
10. Polit D, Beck C. Essentials of nursing research. Wolters Kluwer Health/Lippincott Williams & Wilkins, Philadelphia 2010.
11. Bowling A. Research Methods in Health: Investigating Health and Health Services Buckingham: Open University Press; 2002.
12. Ames G, Cunradi C, Moore R, Duke M. The Impact of Occupational Culture on Drinking Behavior of Young Adults in the U.S. Navy. J Mixed Methods 2009; 3: 120–150.
13. ILO/WHO. Guidelines for conducting Pre-Sea and Periodic Medical Fitness Examinations for SeaFarers 1997 www.ilo.org/public/english/dialogue/sector/techmeet/ilowho97/index.htm.
14. Dahl E. Sick leave aboard. A one-year descriptive study among crew on a passenger ship. Int Marit Health 2005; 56: 5–16.
15. Do LG, Spencer AJ, Dost F, Farah CS. Oral mucosal lesions: findings from the Australian National Survey of Adult Oral Health. Australian Dental J 2014; 59: 112–114.
16. Radio Medical Danmark. Annual Report 2010. Esbjerg, 2011.
17. Tomaszunas S. The work of ship's doctors of Polish Ocean Lines. Bull Inst Marit Trop Med Gdynia 1985; 36: 51–58.
18. Saarni U-M, Saarni H, Holttinen T, Fellman MT. Seafarer's dental health: an international problem? In: Third International Symposium on Maritime Health. Maritime Institute of Technology and Graduate Studies, Baltimore, MD, 1995; pp. 139–142.
19. Ng M, Freeman M, Fleming T et al. Smoking Prevalence and Cigarette Consumption in 187 Countries, 1980–2012. JAMA 2014; 311: 183.
20. Anderson P. Global use of alcohol, drugs and tobacco. Drug Alcohol Rev 2006; 25: 489–502.
21. Chester RK, Huntington E, Burchell CK, Stephen KW. Effect of oral care habits on caries in adolescents. Caries Res 1992; 26: 299–304.
22. Blot WJ, McLaughlin JK, Winn DM. Smoking and drinking in relation to oral and pharyngeal cancer. Cancer Res 1988; 48: 3282–3287.
23. Mihailovic B, Miladinovic M, Vujicic B. Telemedicine in Dentistry (Teledentistry). In: Graschew G, Roelofs TA eds. Advances in Telemedicine: Applications in Various Medical Disciplines and Geographical Areas. InTech, Rijeka (Croatia), 2011;. pp. 215–230.
24. Friction J, Chen H. Using teledentistry to improve access to dental care for the underserved. Dental Clinics of North America 2009; 53: 537–549.
25. Chen J, Hobdell M, Dunn K, Johnson K, Zhang J. Teledentistry and its use in dental education. J Am Dental Association 2003; 134: 342–346.
26. Yoshinaga L. The use of teledentistry for remote learning applications. Practical Procedures Aesthetic Dentistry 2001; 13: 327–328.
27. Chen H, Fricton J. Teledentistry: seeing the doctor from a distance. Northwest Dentistry 2007; 86: 27–68.
28. Sheiham A. Oral health policy and prevention. In: Murray JJ ed. The prevention of oral disease. 3rd Ed. Oxford University Press, New York, 1996, pp. 234–249.

ALLEGATO 3

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VIA MEDICA

ORIGINAL PAPER

An ontology-based consultation system to support medical care on board seagoing vessels

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ABSTRACT

Background: *A realistic possibility to obtain medical care for patients located in remote sites such as seagoing vessels, in which health professionals are not available, is to contact a doctor via telecommunication systems. In general, the medical knowledge of who on board ships is in charge of medical care is quite limited and therefore, in a first level telemedical consultation, the flow of information should be correct and its efficiency should be maximised. This paper describes an application conceived to improve requests of medical assistance from sailing ships. The ultimate objective of this system is a) to standardise as much as possible the requests of medical advice at a distance, b) to overcome language barriers and jammed-related troubles that could make difficult or not understandable a telephone conversation.*

Materials and methods: *The application is based on a software engine extracting data from an ontological knowledgebase built ad hoc using Protégé.*

Results: *Compared to the conventional consultation systems based on telephone and e-mail, the proposed device is more accurate and complete in terms of information contained in the request of assistance. Moreover, data received by the medical centre can be more easily managed, as they can be standardised.*

Conclusions: *The system described here allows people responsible of medical care on board ships to forward detailed requests of assistance containing symptom-guided information on patient clinical conditions. This may represent an innovative tool for medical consultations at distance allowing the remote centre to provide more precise and quicker medical advice.*

(Int Marit Health 2016; 67, 1: 14–20)

Key words: teleconsultation, remote medical advice, ontology, Protégé, medical assistance on board ships

INTRODUCTION

Telemedicine, consisting in the application of information and communication technology (ICT) to the solution of medical problems and in the exchange of medical information, is changing our approach in the delivery of several health services. Telemedicine includes a growing variety of applications and services the use of which will increase in the near future.

Teleconsultation (e.g. the medical visit made via ICT) can be divided into different levels based on the players involved and the complexity of the information exchanged. A basic (first level) teleconsultation is the electronic/telephonic communication between a client (patient) and a physician. A second level teleconsultation involves a physician or another health professional and a specialist delivering health care services and information over small and large distances. In the second level teleconsultation, data, information, images and/or voice are exchanged. A higher level of teleconsultation (third level) involves a medical team of a hospital addressing specific questions to the team of

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a specialised centre. In primary care, generally, teleconsultation takes place between a patient/caregiver and health care professionals for diagnostic or therapeutic advice or for educational purposes.

Medical assistance of good quality is a right of all citizens, but it is not always easily deliverable in remote areas, such as seagoing vessels as well as small islands, rural regions, or in developing countries. Remote teleconsultation therefore represents the only realistic way to deliver health care to patients not able to obtain direct medical assistance such as seafarers on board ships without medical facilities. Seagoing vessels represent a prototype of isolated place, and could remain at sea for days or weeks before reaching a port. The largest majority of merchant ships do not carry doctors or expert paramedic personnel and an officer with medical duties (the captain or the first mate) is the person in charge of the patient in case of accidents or diseases. For more than 80 years, several radio medical services have been operational, starting by using radio signals and Morse code [1], evolving through telephones to full blown telemedicine solutions. Today specialised ashore centres called Telemedical Maritime Assistance Service (TMAS) offer medical assistance to ships with no doctor on board [2]. Telemedical consultations, however, have some innate limitations. One consists in the fact that the great majority of people asking for medical advice by means of ICT resources do not have proper medical training. The communication of symptoms or specific clinical situations can therefore be difficult or misleading in case of absence of objective information such as biomedical data and/or video support [3].

This paper presents a system conceived to improve the first level teleconsultation by allowing the correct flow of the relevant information on the status of a patient, avoiding problems related to verbal communication or jammed transmission. This system guides the ship captain in the medical examination, increasing the preciseness of the information transmitted with the consequent possibility to obtain more accurate and quicker diagnosis.

Potential users of the system besides seafarers could be also other isolated populations such as personnel on board of commercial aircrafts or oil-rig workers or people living in rural areas. Hence, a potential high number of users can benefit from the system that will allow, starting from a given sign, the identification of the cohort of other signs and symptoms present.

MATERIALS AND METHODS

THE KNOWLEDGE BASE

A knowledgebase was built in the shape of an ontology. The ontology represents concepts and their logical relations and has a hierarchical structure. It is a suitable solution for data managing and sharing, allowing a universal codification of concepts. In this sense, the effort of the Open Biological Ontologies (OBO) Foundry to create a set of interoperable ontologies enabling scientists and their instruments to communicate with minimum ambiguity should be mentioned [4]. An ontology also permits the reuse of knowledge and the inference of new knowledge, through automatic reasoning [5, 6].

In the present work this ontology has been developed using the existing software Protégé 3.4.1 [7], aggregating free-text data from the relevant literature [8]. When possible, our terms for clinical signs were associated as synonyms with the ones from SYMP (the OBO Foundry Symptom Ontology) [6] exploiting the "Bioportal" function of Protégé that allows linking to external resources.

Two main classes were created: "Sign" and "Detailed info". A series of instances for the class "Sign" has been created to represent the main signs a patient could manifest, in example "Fever", "Cough", "Breathing difficulties", "Diarrhea", etc. Each main sign has relations (object property "hasDetailedInfo" in the ontology) with a series (1,n) of detailed information to be communicated to the medical centre. These information are represented in the ontology as instances of the class "Detailed info", or better, of its subclasses.

Each main sign has relations (object property "hasAdditionalSign" in the ontology) with a series (1,n) of other signs (other instances of the class "Sign"). For instance, "Fever" has relations with "Cough", "Breathing difficulties", "Diarrhea", etc., that represent possible associated clinical signs requested in the final application to the patient to be considered selecting "Fever" as main sign (Figs. 1, 2).

In the same way, to each detailed information has been assigned an answer that finally would represent the option the user should select or fill in the final application. A SPARQL query has been then created to retrieve data from the ontology. The following represents the general syntax to retrieve the detailed information and their relevant superclasses for the main sign "Fever" i.e.:

```
"SELECT ?detail ?answer ?superclass
 WHERE { :Fever :hasDetailedInfo ?detail.
?detail rdf:type ?superclass }".
```

THE APPLICATION

A software application was then built as the engine to interact with the ".owl" generated Protégé file.

Basic software technology and JSP

The system is based on a web service implemented in JSP. JSP seemed to be the most suitable solution, providing a Java library capable of interacting with the OWL standard. Java methods and classes can easily be called in a JSP page. The following are the main JSP pages (Fig. 3).

Int Marit Health 2016; 67, 1: 14–20

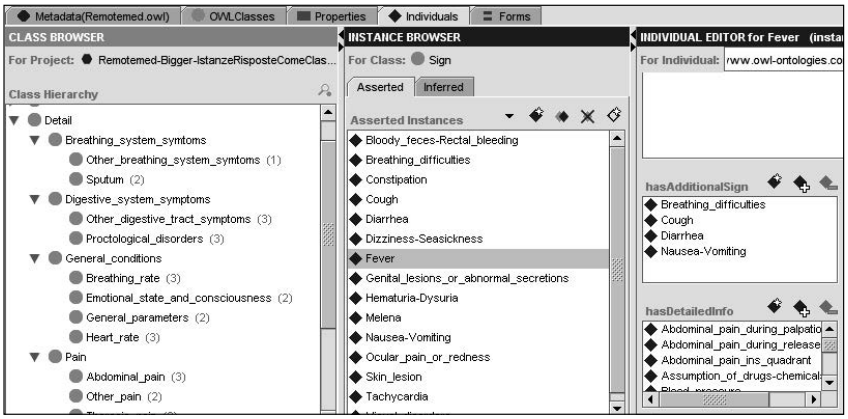

Figure 1. Protègè – some of the detailed information and additional signs (in the right) for the instance "Fever". Some of the superclasses in the left

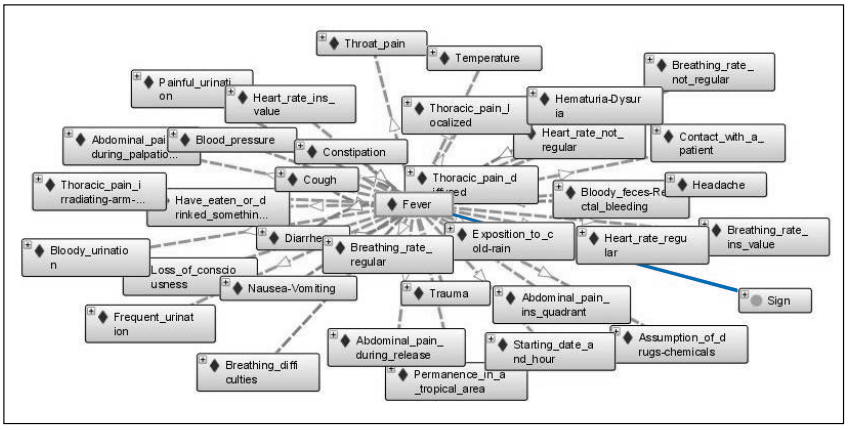

Figure 2. OntoGraph showing Additional Signs (blue line) and Detailed Info for the sign "Fever"

The system allows for saving data in an XML database:

- main.jsp, main page that allows the user to select the principal sign and answer the detailed information and the additional signs; it contains all the JavaScript functions related to the web service, such as the "Yes/No" functionality (Fig. 4);
- save.jsp, process page that saves the information inserted by the user in the XML database;
- menu.jsp, a navigation page;
- style.css, defines the CSS style of the elements.

The system even allows the doctors of the medical centre to answer the requests inserting a diagnosis and the admin to edit saved data. These are the relevant JSP pages:

- save_diagnosis.jsp, process page that saves the diagnosis inserted by the doctors in the XML database;
- view_data.jsp, allows doctors and admin to see and edit all the records. Admin could then, for instance, decide to delete one or more users' records and doctors to add or modify a diagnosis;
- delete_users.jsp, process page that permits to delete users' records from the XML file.

The two principal pages concerning the final user (patient, doctor or admin) are "main.jsp" and "view_data.jsp", the first to insert, the second to view data. The other pages, excluding "menu.jsp", are processing pages and have the task to interact with the XML database and to modify it.

The Java classes

The Java classes work as interface between the application, the ontology and the XML database (Fig. 3). The main Java classes used were:

- **OWLAPI**, it acquires all the information contained in the ontology. For instance, when the page "main.jsp" is loaded, this Java class gets all the principal signs or when a user selects a principal sign, a method of the OWLAPI acquires

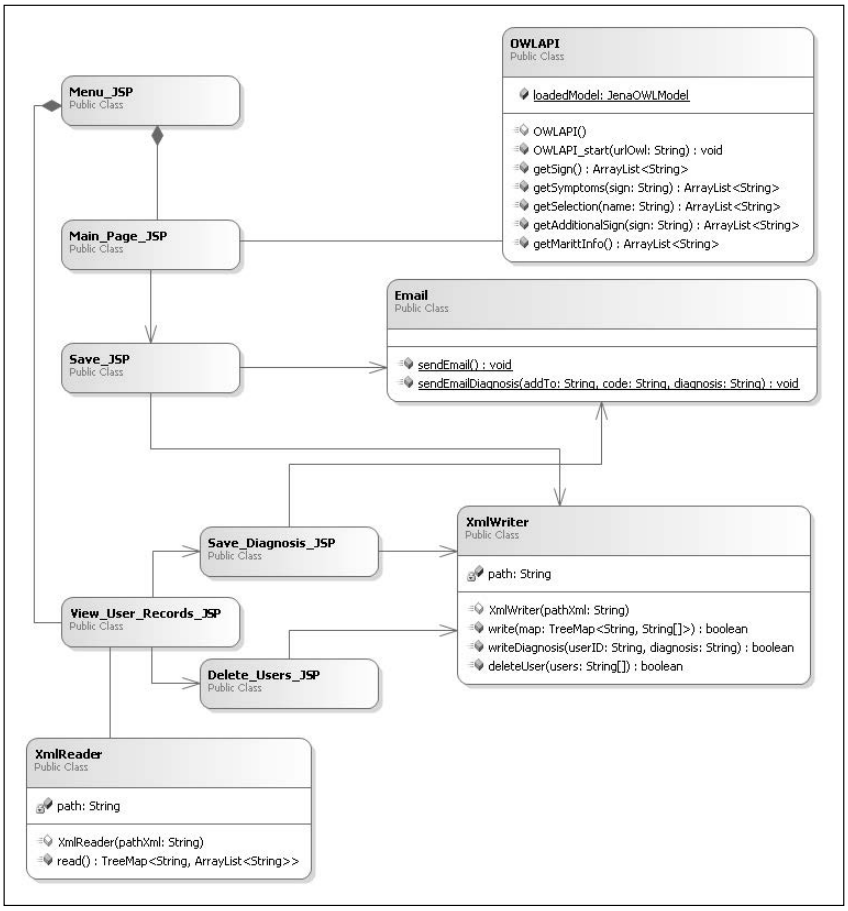

Figure 3. The main JSP pages and Java classes

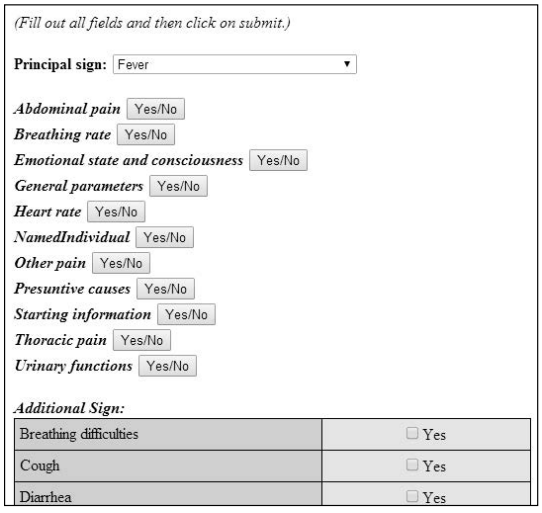

Figure 4. Groups of detailed information (ontological superclasses) to be explored/opened for the main sign "Fever"

from the ontology all the related detailed information and additional signs. This class takes advantage of the Protégé Java Library that permits to interact with an RDF/XML model that in fact is the structure of the ontology;

- **Email**, the task of this class is to send email to the medical centre with the list of information inserted by the user and to the user if a doctor has inserted or modified a diagnosis;
- **XmlReader**, this class is called when the page "view_data.jsp" is loaded. It takes all the records contained in the XML database;
- **XmlWriter**, as XmlReader it interacts with the XML database and inserts users' records and doctors' diagnosis.

THE PATIENT'S USER INTERFACE

Detailed info navigation and answering

The hierarchical organisation of concepts and the superclasses make easier and less time-consuming for the user to navigate the information. Selecting the main sign, the system asks to consider a series of additional signs and detailed infor-

Int Marit Health 2016; 67, 1: 14–20

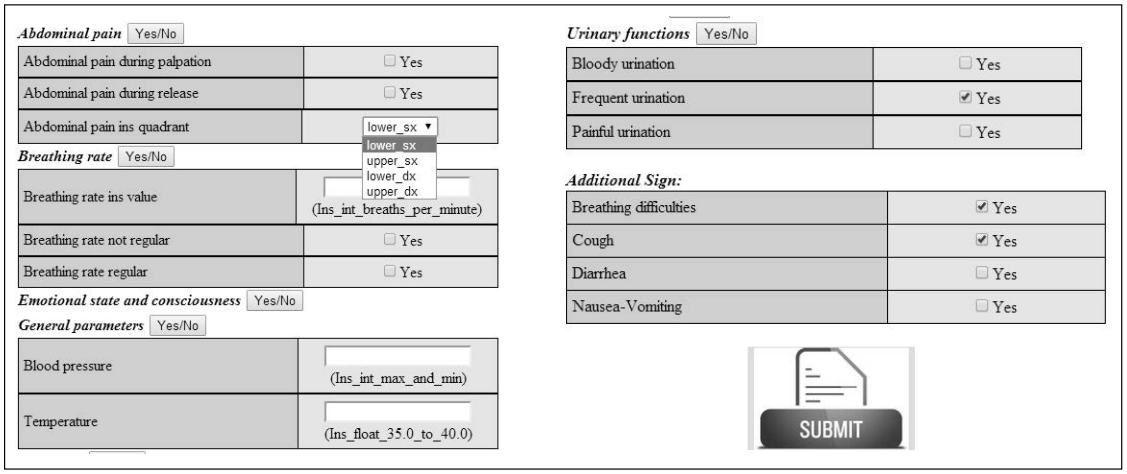

Figure 5. Left part shows a detailed information referring to each superclass with the relevant answer options to select or fill in. The right part of the figure shows the procedure ends with the submission of the compiled form

mation. These are organised in big groups (superclasses). If the patient doesn't manifest the sign to which the group is referring or doesn't want to consider that superclass, he can simply answer "No" (or don't click) to the relevant superclass (Fig. 4).

By clicking on a superclass, the series of detailed info about that clinical status appears. They can be answered in the following three main ways (Fig. 5):

— boolean selection (Yes/No);
— multiple selection;
— typing (generally a string or a number).

Other information

Patient's general info. Some basic details on the patient needing medical assistance and simple information on his personal history should be provided:

— age;
— name;
— birthdate;
— sex;
— nationality;
— rank.

Patient's clinical history and drugs administered. Basic medical history and drug history of the patient should be included in the following order:

— previous most significant diseases;
— chronically administered drugs;
— drugs administered for the actual condition.

Submission of data

Once answered all the detailed information referring to all the superclasses as described above, the user can submit them, sending the data package to the maritime telemedical centre (TMAS) (Fig. 5).

The system has been adapted in particular for naval communication. Then, a series of information about the ship is required to be inserted, such as:

— ship name;
— ship type;
— ship owner;
— call sign;
— master;
— ship nationality;
— port of departure;
— port of arrival;
— speed;
— position;
— telephone/fax/e-mail.

SYSTEM TESTING

Tests of the system are ongoing in collaboration with Centro Internazionale Radio Medico (CIRM), the Italian TMAS [9] using seagoing vessels as a prototype of isolated places. CIRM medical assistance is given to ships of any nationality sailing worldwide. The service is provided 24 h a day and 365/366 days per year by doctors on duty. The centre receives the request of assistance and gives instructions for the case. For assessing the quality of the system, 150 teleconsultations between seagoing participating voluntarily to the experiments (users) and CIRM medical team (experts), were evaluated. Evaluation of the system involved both the user's and the expert's side and both user's satisfaction and technical aspects. The parameters listed below were considered compared to standard communication systems:

— accuracy of the request (number of non-ambiguous signs communicated per request);

Table 1. Evaluation of the system effectiveness using 150 teleconsultations from seagoing vessels (user) and Centro Internazionale Radio Medico (CIRM) headquarters in Rome (expert)

Parameter	Tester	Score
Accuracy of the request	Expert	High
Accuracy of the possible diagnosis	Expert	High
Speed — overall	User-Expert	Medium
Speed — diagnosis	Expert	High
Usability	User	High
Wiliness to use	User	Medium
Completeness of the info	User-Expert	High
Easiness of data managing	Expert	High
Reliability of the system	Expert	High

"High", "Medium" and "Low" indicate respectively for better, same as, and worse compared to standard (telephone or e-mail) previous communication systems.

- accuracy of the diagnosis made by the centre (number of correct verified diagnosis/total cases);
- speed of a complete round: time to make the request/ /time to provide the answer;
- speed of the diagnosis;
- usability (easiness of use, even by an inexpert user);
- wiliness to use;
- completeness of the information;
- overall reliability of the system.

A score from "High" to "Medium" to "Low" was assigned by the testers (users and experts) for each of the above parameters.

RESULTS

The system described here has shown the capability to forward accurate remote requests of assistance with no technical problems in terms of software functionality and integrity of data transmission.

Differently to other tools that are diagnosis-oriented [10], the proposed system does not provide diagnostic solutions, but results efficient in guiding the user towards the collection of appropriate signs, already codified according to the guidelines provided by the maritime telemedical centre, with no possibility for self-ambiguity and ensuring the information transmitted to be as complete as required.

Table 1 summarises the results reporting the prevalent mark on the total number of evaluations provided by the testers. The system has shown, in respect to the existing consultation tools, a higher completeness and accuracy of the request of assistance in terms of information transmitted, a quicker and more accurate diagnostic possibility and an overall high usability and reliability.

DISCUSSION AND CONCLUSIONS

The system allows the user to prepare telemedical requests of advice with precise and circumstantial information. A substantial advantage derived from adopting the application for telemedical consultation consists in the fact that a great number of specific information about the patient (automatically suggested starting from the main symptom) could be transmitted to the physicians in charge of medical assistance, increasing the chance to get a correct and faster advice. Moreover, data transmitted are encoded using a standard vocabulary and a standard formulation. The information transmitted is therefore more easily managed by the centre. The system will also contribute to constitute a patient's historical data repository as a support for further teleconsultations.

Thanks to the ontologies, an easy to obtain multi-language selection is available. This option could reduce communication barriers caused by language troubles, misunderstandings and verbal hesitations mostly due to the unavoidable use of technical clinical terms. Problems of jammed telephonic communication are also eliminated through the direct transmission of data.

As a result, the user is able to get a faster and more accurate answer of assistance from the maritime telemedical centre. Referring to the maritime assistance, a correct and quick diagnosis could avoid unnecessary transfers of the patients, limiting costs for changes of course/evacuations and discomforts for the crew.

In 2013, CIRM reported several problems in providing correct diagnosis due to imprecise information from the ship side. The test of the support communication system described here, showed an improved definition of the medical problems to be treated. The potential advantages of the system appear therefore promising.

FUTURE IMPLEMENTATIONS

As a possible future enhancement of the system, we are considering the possibility of crowdsourcing the requests, through a server, from the mobile terminal of the patient

Int Marit Health 2016; 67, 1: 14–20

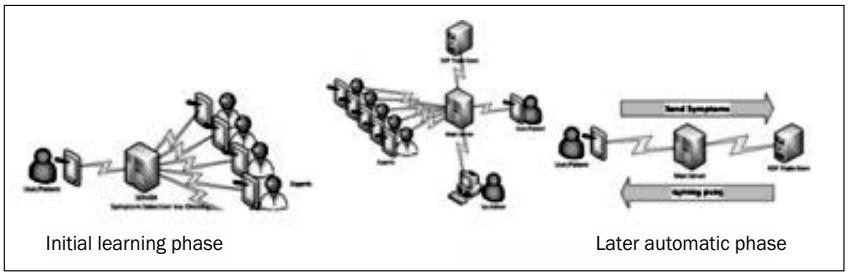

Figure 6. General architecture showing the flow of the information for a future possible distribution system. The users' request dispatched to the server would be redistributed to a set of experts and the answers would be both returned to the user and stored into a knowledgebase creating the basis for automatic diagnosis

(a mobile version should be first developed) to a pool of clinicians. Once the clinicians will answer the requests, these data will be returned back to the patients and stored into a knowledgebase (as actually for the XML database), creating the fundamentals for further automatic processing of medical information (Fig. 6).

This will allow the development of a medically-validated, punctiform, status-diagnosis association. In the second automated phase, the clinicians' work will be significantly reduced, but reliable medical answers could be still obtained since they will be inferred from researches and learning processes on the knowledgebase.

Considering the application, it would be interesting to investigate the possibility to perform automatic reasoning on the main ontology in order to infer new knowledge and to rearrange the existing data structure such as the subclasses hierarchy and the positioning of the instances.

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REFERENCES

1. Goethe WHG, Watson EN, Jones DT eds. Medical care on ships without a doctor. Radio medical advice. Handbook of Nautical Medicine, Springer, Berlin 1984; 53–65.
2. Medical Assistance at Sea. International Maritime Organization (IMO). Circular MSC/Circ.960. IMO, London 2000.
3. Sabesan S, Allen D, Caldwell P et al. Practical aspects of telehealth: doctor-patient relationship and communication. Intern Med J 2014; 44: 101–103.
4. The OBO Foundry. www.obofoundry.org. (accessed 5 Feb 2014).
5. Köhler S, Bauer S, Mungall CJ et al. Improving ontologies by automatic reasoning and evaluation of logical definitions. BMC Bioinformatics 2011; 12: 418.
6. Nageba E, Fayn J, Rubel P. A knowledge model driven solution for web-based telemedicine applications. Stud Health Technol Inform 2009; 150: 443–447.
7. Protégé documentation. http://protege.standford.edu. (accessed 5 Feb 2014).
8. Camerucci S. I call the CIRM. A manual of first aid and medical assistance for sailors, 2005.
9. Amenta F. The International Radio Medical Centre (C.I.R.M.): an organization providing free medical assistance to seafarers of any nationality world wide. Int Marit Health 2000; 51: 85–91.
10. Luger TM, Houston TK, Suls J. Older adult experience of online diagnosis: results from a scenario-based think-aloud protocol. J Med Internet Res 2014; 16: 1.

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VIA MEDICA

ORIGINAL PAPER

Development of software for handling ship's pharmacy

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ABSTRACT

Background: *Ships are required to carry a given amount of medicinal products and medications depending on the flag and the type of vessel. These medicines are stored in the so called ship's "medicine chest" or more properly — a ship pharmacy. Owing to the progress of medical sciences and to the increase in the mean age of seafarers employed on board ships, the number of pharmaceutical products and medical devices required by regulations to be carried on board ships is increasing. This may make handling of the ship's medicine chest a problem primarily on large ships sailing on intercontinental routes due to the difficulty in identifying the correspondence between medicines obtained abroad with those available at the national market. To minimise these problems a tool named Pharmacy Ship (acronym: PARSI) has been developed.*

Materials and methods: *The application PARSI is based on a database containing the information about medicines and medical devices required by different countries regulations. In the first application the system was standardised to comply with the Italian regulations issued on the 1st October, 2015 which entered into force on the 18 January 2016.*

Results: *Thanks to PARSI it was possible to standardize the inventory procedures, facilitate the work of maritime health authorities and make it easier for the crew, not professional in the field, to handle the 'medicine chest' correctly by automating the procedures for medicines management. As far as we know there are no other similar tools available at the moment. The application of the software, as well as the automation of different activities, currently carried out manually, will help manage (qualitatively and quantitatively) the ship's pharmacy.*

Conclusions: *The system developed in this study has proved to be an effective tool which serves to guarantee the compliance of the ship pharmacy with regulations of the flag state in terms of medicinal products and medications. Sharing the system with the Telemedical Maritime Assistance Service may result in avoiding mistakes in drug administration. Last but not least the availability of PARSI could help reduce/avoid problems with maritime health authorities in case any of the required medicinal products are missing.*

(Int Marit Health 2016; 67, 2: 72–78)

Key words: pharmacy ships, software, medicine inventory management, pharmaceutical compound, medical device

INTRODUCTION

Pharmacotherapy is a pillar of modern medicine. This is true also in case of diseases or accidents occurring on board of seagoing vessels [1]. Ships are required to carry given amount of medicines and medical devices which may vary depending on the flag and on the type of the vessels [1, 2]. Medicinal and medical equipment stores form the so called "Ship Medicine Chest". The "Ship Medicine Chest" is not really a chest anymore, but the name is still there, although it would be more appropriate today to define it as ship's pharmacy [2, 3].

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The types of activities performed on board a ship are entirely different from the ones performed on shore. The situation is complicated by the fact that ships become both a workplace and a living environment for an extended period of time, also, cargo ships do not carry qualified medical or paramedic personnel and sailors have a higher risk of accidents which may result in death or a serious injury [4].

This concern is not completely new, because almost all national law systems — even before the European Union regulations required that medical safety standards are applied and a minimum supply of drugs is carried aboard vessels. A large number of national and international regulations (World Health Organisation [WHO], European Union) [5, 6] makes it difficult for ship officers managing the ship's pharmacy to perform their tasks. Medicinal products considered restricted by some countries are not restricted in others. This could create confusion aggravated by the fact that ship's personnel do not usually have enough knowledge of pharmacology/pharmacy regulations to prepare a cabinet for restricted products before they stop in different countries, e.g. Russia or Nigeria. Another problem may occur as a result of a language barrier; if a given medicine expired or has been used, it would be difficult to replace it with a local product, especially if it is labelled in a rare language.

At the international level, ship pharmacies should follow the regulations/recommendations as listed below:

- An "old" recommendation from WHO/International Labour Office/International Maritime Organisation in the second edition of the International Medical Guide for Ships (IMGS) with the list of types and quantities of medicines to be carried [5].
- This list was updated in the 3rd edition of IMGS [7]. The main problem of the more recent recommendation is that it did not mention the minimum quantities of different active principles to *be carried out*. In spite of the justifications of the rationale of this choice, this omission apparently has caused more problems than advantages. Problems that were nor approached or solved in the so-called "Quantification Addendum: International Medical Guide for Ships 3rd edition" published in September 2010 [7].

Increasingly complex regulations for medical supplies and the maintenance of ship pharmacies as well as the possibility of getting medicinal products in various countries may make difficult to supervise the ship pharmacy especially for ships sailing on intercontinental routes. In general, seafarers may expect support/help from local pharmacies or organizations selling medicinal products. However, the fact that in the majority of cases they limit their intervention to the sale of medicinal products is not enough support.

In view of this in order to help the ship personnel maintain ship pharmacy, the software called Pharmacy Ships (acronym: PARSI) was developed. PARSI is a system designed to manage and monitor drug types and quantities available on board ships. It reduces the manual management of the inventory allowing for quick identification of the medicines available on stock which results in their faster administration in case of diseases or injuries on board.

MATERIALS AND METHODS

MICROSOFT WINDOWS ACCESS SOFTWARE

Pharmacy Ships is a pharmacy management system, which helps improve inventory management (the type and amount of medicinal products available on board). It was created using the Windows Access 2007 software and it consists of two sections: medicines and medical devices. Both of them have a storing section, access database, with detailed information about particular items and a mask to edit the database according to national regulations. The decision to divide the database into two main parts was taken after careful evaluation of the available data. The medicinal products database includes more information compared to the medical devices database; also medicinal products have a shorter expiry date and are more often used than medical devices.

RESULTS

SOFTWARE HOMEPAGE

The first page appearing after opening the program is a report showing, if present, medicines that will expire within the next 30 days. Hence, the report notifies the user in advance of the expiry date of medicinal products available on board (Fig. 1).

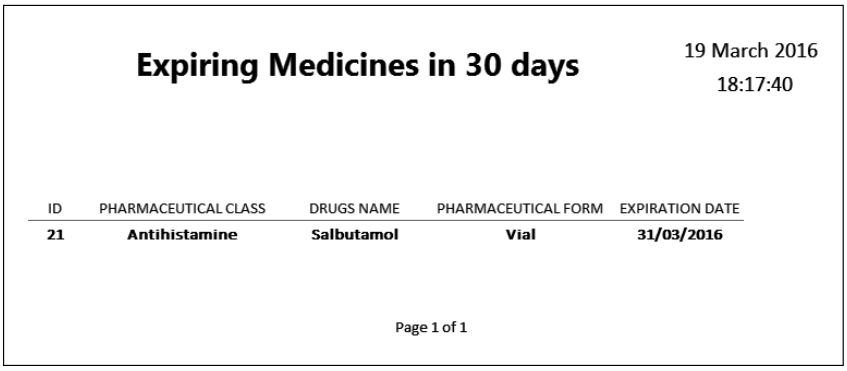
MEDICINAL PRODUCTS SECTION

A snapshot of the medicinal products database is shown in Figure 2.

Each line lists one medicinal products and the following information:

- pharmaceutical class;
- ATC code;
- active ingredient's name;
- pharmaceutical form;
- dose;
- minimum quantity required according to the ship's flag requirements;
- quantity on board;
- expiration date;
- note;
- amount available; this section will indicate with a green sign if the amount available is that required by regulations and a red sign if not.

Int Marit Health 2016; 67, 2: 72–78



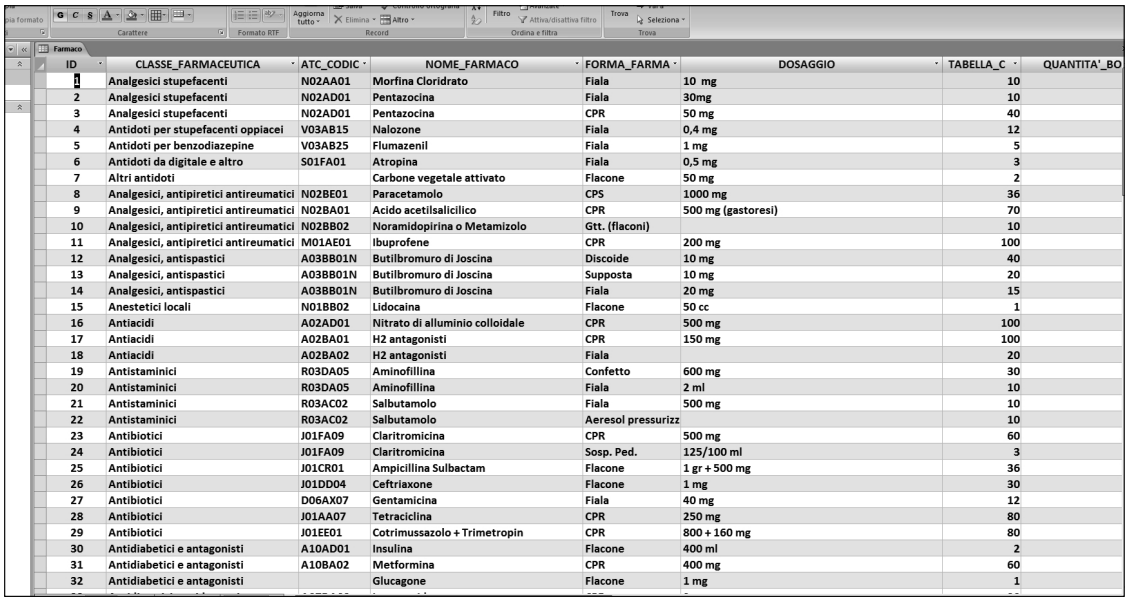
Expiring Medicines in 30 days

19 March 2016
18:17:40

ID	PHARMACEUTICAL CLASS	DRUGS NAME	PHARMACEUTICAL FORM	EXPIRATION DATE
21	Antihistamine	Salbutamol	Vial	31/03/2016

Page 1 of 1

Figure 1. Medicines expiring within the next 30 days



ID	CLASSE_FARMACEUTICA	ATC_CODIC	NOME_FARMACO	FORMA_FARMA	DOSAGGIO	TABELLA_C	QUANTITA'_BO
1	Analgesici stupefacenti	N02AA01	Morfina Cloridrato	Fiala	10 mg	10	
2	Analgesici stupefacenti	N02AD01	Pentazocina	Fiala	30mg	10	
3	Analgesici stupefacenti	N02AD01	Pentazocina	CPR	50 mg	40	
4	Antidoti per stupefacenti oppiacei	V03AB15	Nalozone	Fiala	0,4 mg	12	
5	Antidoti per benzodiazepine	V03AB25	Flumazenil	Fiala	1 mg	5	
6	Antidoti da digitale e altro	S01FA01	Atropina	Fiala	0,5 mg	3	
7	Altri antidoti		Carbone vegetale attivato	Flacone	50 mg	2	
8	Analgesici, antipiretici antireumatici	N02BE01	Paracetamolo	CPS	1000 mg	36	
9	Analgesici, antipiretici antireumatici	N02BA01	Acido acetilsalicilico	CPR	500 mg (gastoresi)	70	
10	Analgesici, antipiretici antireumatici	N02BB02	Noramidopirina o Metamizolo	Gtt. (flaconi)		10	
11	Analgesici, antipiretici antireumatici	M01AE01	Ibuprofene	CPR	200 mg	100	
12	Analgesici, antispastici	A03BB01N	Butilbromuro di Joscina	Discoide	10 mg	40	
13	Analgesici, antispastici	A03BB01N	Butilbromuro di Joscina	Supposta	10 mg	20	
14	Analgesici, antispastici	A03BB01N	Butilbromuro di Joscina	Fiala	20 mg	15	
15	Anestetici locali	N01BB02	Lidocaina	Flacone	50 cc	1	
16	Antiacidi	A02AD01	Nitrato di alluminio colloidale	CPR	500 mg	100	
17	Antiacidi	A02BA01	H2 antagonisti	CPR	150 mg	100	
18	Antiacidi	A02BA02	H2 antagonisti	Fiala		20	
19	Antistaminici	R03DA05	Aminofillina	Confetto	600 mg	30	
20	Antistaminici	R03DA05	Aminofillina	Fiala	2 ml	10	
21	Antistaminici	R03AC02	Salbutamolo	Fiala	500 mg	10	
22	Antistaminici	R03AC02	Salbutamolo	Aeresol pressurizz		10	
23	Antibiotici	J01FA09	Claritromicina	CPR	500 mg	60	
24	Antibiotici	J01FA09	Claritromicina	Sosp. Ped.	125/100 ml	3	
25	Antibiotici	J01CR01	Ampicillina Sulbactam	Flacone	1 gr + 500 mg	36	
26	Antibiotici	J01DD04	Ceftriaxone	Flacone	1 mg	30	
27	Antibiotici	D06AX07	Gentamicina	Fiala	40 mg	12	
28	Antibiotici	J01AA07	Tetraciclina	CPR	250 mg	80	
29	Antibiotici	J01EE01	Cotrimussazolo + Trimetropin	CPR	800 + 160 mg	80	
30	Antidiabetici e antagonisti	A10AD01	Insulina	Flacone	400 ml	2	
31	Antidiabetici e antagonisti	A10BA02	Metformina	CPR	400 mg	60	
32	Antidiabetici e antagonisti		Glucagone	Flacone	1 mg	1	

Figure 2. The database containing a list of medicines

The third field appearing in the database is shown in Figure 3. Here, the user can select a specific medicine and instantly obtain the information about the drug chosen. Each user can check the quantity of medicinal products available on board.

The software allows the user to modify some fields such as 'quantity on board'. For instance, if there is an emergency on board and a specific drug is used, an update of the field "quantity on board" must be made/will be stored inside the database. If the amount of a given drug on board is less than required, the software pops up an alert to notify the user that the depot needs to be refilled (Fig. 4).

If the amount of a given medicine on board is less than 50% of the minimum quantity required, the software pops up another alert. However, in this case, the alert is blocked and the user cannot use the software again before refilling the depot (Fig. 5). There is a field informing the user if the quantity on board is bigger or equal to the minimum quantity required by showing a red "X" or a green "V". In Figure 3 the quantity on board is bigger than the minimum quantity required and thus a green "V" appears on the screen.

The software is capable of monitoring the expiration date of all medicines listed in the database, thus a user can easily see all the medicines expiring within the next 30 days (Fig. 1). The user can print out a copy containing information about the expiry dates of medicinal products at any time.

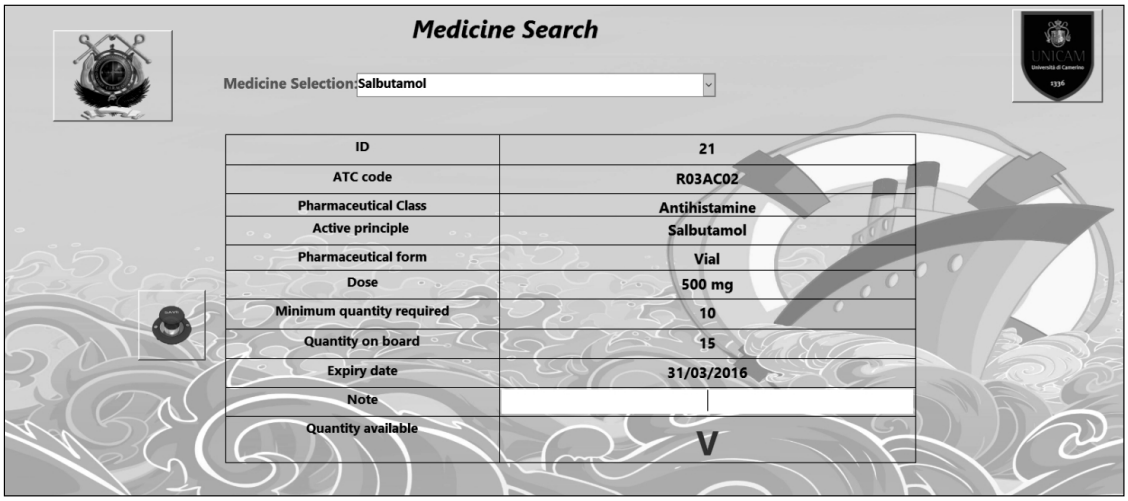


Figure 3. Graphical user interface – a medicine search box

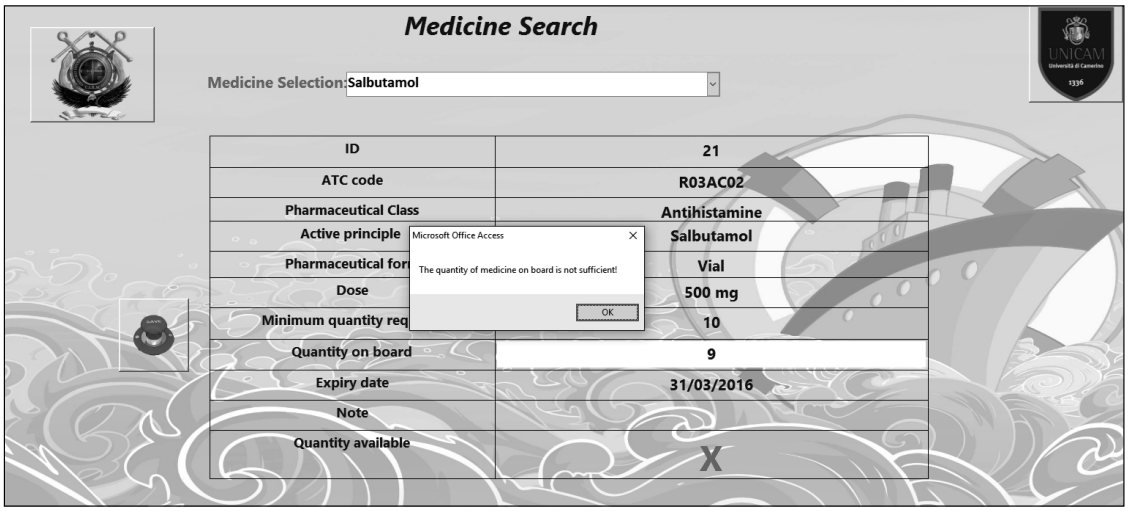


Figure 4. A screenshot of the non-blocking warning created automatically by the software to alert the user that the quantity on board is less than minimum required by regulations

MEDICAL DEVICES SECTION

The medical devices section is quite similar to the medicinal products section. It includes another database with the information on the medical devices and another mask to manage and modify the related information. For each medical device the following data are included:

- ID;
- group;
- medical device name;
- minimum quantity required;
- quantity on board;
- note;
- amount available (Fig. 6).

The medical device mask has the same functions as the medicinal products section mask. There are two warnings related to the quantity on board when it is less of the minimum quantity required, which has been discussed in the previous section of this article (Fig. 7).

As an additional facility, the software has the ability to create an Excel file with the entire contents of the database for a transfer or printing for monitoring the inventory, thus optimising the timing and the quality of service. PARSI does not require the internet connection which is important as nowadays, most of the ships do not have stable internet connection. In the future, along with technological advance of the telecommunication systems on board, a web software

Int Marit Health 2016; 67, 2: 72–78

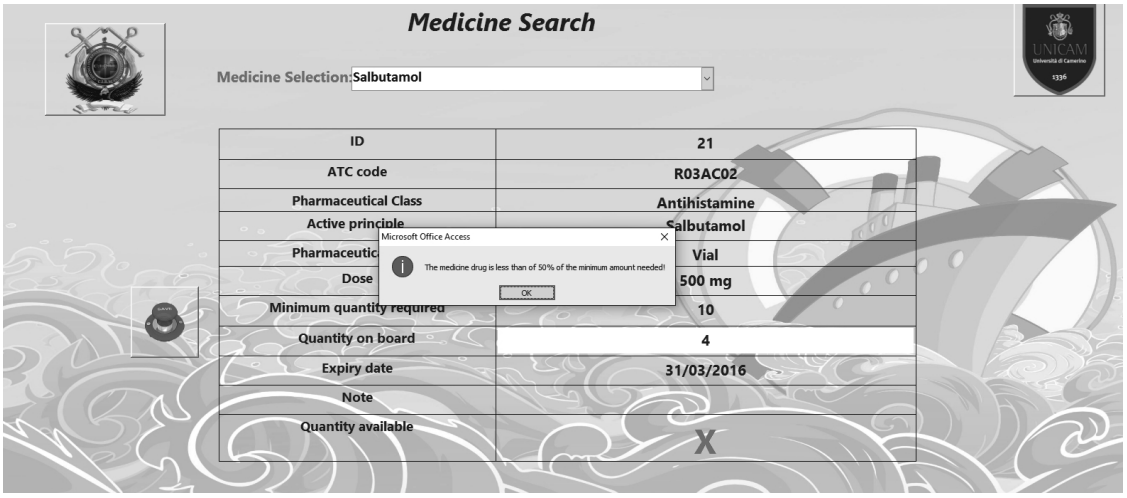


Figure 5. A screenshot of the blocking warning created automatically by the software to alert the user of the quantity on board less than 50% of the minimum quantity required. An immediate refill is mandatory

ID	GRUPPO	NOME MEDICAMENTO	TAB C	QUANTIT	NOTE_MEDICAMENTO	VALUTAZ
1	Kit per medicazione e chirurgia	Pinza standard chirurgica	3			X
2	Kit per medicazione e chirurgia	Forbice mayo	2			X
3	Kit per medicazione e chirurgia	Pinza mosquito	3			X
4	Kit per medicazione e chirurgia	Telino	1			X
5	Kit per medicazione e chirurgia	Pinza adson chirurgica	1			X
6	Kit per medicazione e chirurgia	Filo seta montato su ago	5			X
7	Basic life support	Pallone autoespansibile di ambu adulto	3			X
8	Basic life support	Cannula di guedel adulto mis.4	3			X
9	Basic life support	Cannula di guedel adulto mis.3	3			X
10	Basic life support	Cannula di guedel adulto mis.2	3			X
11	Basic life support	Maschera ambu adulto	3			X
12	Basic life support	Pinza tiralingua	1			X
13	Venopuntura terapie parenteral	Abbassalingua monouso	30			X
14	Venopuntura terapie parenteral	Agocannula 16g	20			X
15	Venopuntura terapie parenteral	Agocannula 18g	20			X
16	Venopuntura terapie parenteral	Agocannula 20g	20			X
17	Venopuntura terapie parenteral	Agocannula 22g	10			V
18	Venopuntura terapie parenteral	Agocannula 24g	10			X
19	Venopuntura terapie parenteral	Siringa sterile 2.5ml 22g	20			X
20	Venopuntura terapie parenteral	Siringa sterile 5ml 22g	30			X
21	Venopuntura terapie parenteral	Siringa sterile 10ml 21g	50			X
22	Venopuntura terapie parenteral	Laccio emostatico	3			X
23	Venopuntura terapie parenteral	Laccio emostatico di esmark	2			X
24	Venopuntura terapie parenteral	Strisce determinazione glicemia conf.	2			X
25	Venopuntura terapie parenteral	Glucometro	1			X
26	Venopuntura terapie parenteral	Lancetta pungidito sterili	30			X
27	Venopuntura terapie parenteral	Strisce reattive multiparametriche urine	50			X
28	Venopuntura terapie parenteral	Siringhe da insulina 100UI/ml	20			X
29	Vari	Aspiratore secreti set cannula	2			X
30	Vari	Assorbenti igienici	10			V
31	Vari	Bacinelle reniformi	5			X
32	Vari	Barella cucchiaio con cintura di sicurezza	1			V

Figure 6. The database containing a list of medical devices

module can be integrated to enable real-time, and independent sea-to-shore communication.

DISCUSSION

People living ashore usually have an easy access to medical services available. This is not the case with seagoing ships, the majority of which do not have a doctor or any professional medical personnel and may be at sea for days or weeks before they can reach a port. In this situation, the best ways/methods to treat diseases or injuries on board are:

- to provide medical advice via telecommunications systems;
- to guarantee proper training of personnel responsible for health care on board;
- to have an adequate supply of drugs and essential medical equipment (the so called 'ship's medical chest').

The types and quantity of medicinal products and medical devices which need to be stored on board vary greatly depending on the type of ship and the routes the ship follows; the lists of the recommended medicinal products are estab-