Mobile Pharmacies Throughout History

Aziz Sukalo¹, Tarik Catic², Armin Skrbo³, Lejla Zunic⁴, Izet Masic³

ABSTRACT

Background: Mobile pharmacies are special organizational units or infrastructures that serve to supply medicines to remote communities or are stationed on ships or as such exist during war conflicts on the battlefields to provide first aid to the wounded and to provide the necessary medicines. The establishment of mobile pharmacies is regulated by the law of each state and only preparations approved by law can be found in it. There are also regulations for the good storage and warehousing of these drugs. 

Objective: The aim of this article was to provide an overview of the available literature on the topic “Mobile pharmacies through history”, which shows the development and progress in the structure and function of mobile pharmacies throughout history.

Methods: This is an descriptive study based on the searched available literature from the on-line databases regarding to present a historical overview of mobile pharmacies during the most significant war events in Europe and the USA.

Results and Discussion: Mobile pharmacies were first mentioned in Egypt and the Roman Empire, but it was not until 1500 that military and ship’s doctors began using them, and wealthy nobles had their own boxes of medicines, which they carried on long voyages. Mobile pharmacies became more and more popular, so in the 18th century, practical manuals on the use of the contents of the box began to be published. The importance of a mobile pharmacy was shown on ships or as such exist during war conflicts on the battlefields to provide first aid to the wounded and to provide the necessary medicines. The advanced medicine and pharmacy that developed on land, greatly affected the health care at the sea. The constant incidence of infectious diseases, poverty and inadequate nutrition, insecurity of navigation and long voyages are the main reasons why sailors often fell ill and were exposed to injuries at work. A situation like that required that the problem of health protection on ships gets solved in accordance with the then principles of medicine and pharmacy. 

Conclusion: Authors demonstrated the importance of mobile pharmacies in treating and providing medical protection on boat trips. Regarding the ship’s pharmacies, pharmacists have the role of supplying ships with medicines, conducting training for captains and ship staff, advising shipping companies and captains on equipping ship pharmacies and advising on the preparation of national regulations and national ship pharmacy supply policy.

Keywords: mobile pharmacy, ship’s pharmacy, military medical boxes.

1. BACKGROUND

A pharmacy is an organizational unit whose main function is the sale of pharmaceutical products and the procurement of pharmaceutical products. The name pharmacy comes from the Greek word ἀποθήκη which means warehouse. Other functions that must be performed within the pharmacy are: storage of goods, finances, accounting, marketing, personnel, legal and general affairs, and in accordance with legal obligations, input and output documentation must be kept. To work in a pharmacy, a pharmacist, in order to provide a complete pharmaceutical service, must be well acquainted with the action of each drug, and master the skills of good communication and management (1). Pharmacy as a profession dates back to the time of Babylon, 2600 BC. The oldest pharmacy in Europe dates from 1221 and was located in the Church of Santa Maria Novella in Florence, Italy. The oldest pharmacies that still operate today are those in Dubrovnik in the Franciscan monastery from 1317 and one located in the town square in Tallinn and dating from 1442 (2).

1.1. Mobile pharmacies

Mobile pharmacies are special organizational units or infrastructures that serve to supply medicines to remote communities or are stationed on ships or as such exist during war conflicts on the battlefields themselves to provide first aid to the wounded and to provide...
the necessary medicines (3). The establishment of mobile or mobile pharmacies is regulated by the legal framework of the state on whose territory it is established. Only legally approved supplements or medications are available. Every mobile pharmacy must be insulated with double wall panels and with good ventilation. Work surfaces, cabinets, shelves and all other equipment in mobile pharmacies must comply with the requirements that other pharmacies respect. Lighting conditions, temperature and humidity inside the mobile pharmacy must also be in accordance with the storage conditions of pharmaceutical products.

There must be separate rooms for washing hands and equipment in every mobile pharmacy. A separate sampling area for monitoring must also be provided. Worktops in a mobile pharmacy must be large enough to allow at least two people to work in it. Medicinal substances and medicines available in mobile pharmacies must be stored in the original packaging or repackaged according to the legal framework. Thermostable substances, if possible, according to the conditions of the institution itself, must be stored in refrigerators at a temperature of 2-8 °C and the temperature must be under constant control. None of the substances should be stored on the floor or outside the mobile pharmacy unit (4).

2. OBJECTIVE

The aim of this article is to provide an overview of the available literature on the topic “Mobile pharmacies throughout history”. Based on the available literature, the goal is: a) to show the development and progress in the structure and function of mobile pharmacies throughout history; b) to present a historical overview of mobile pharmacies during the most significant war events in Europe and the USA; and c) demonstrate the importance of mobile pharmacies in treating and providing medical protection on boat trips.

3. MATERIAL AND METHODS

The key subject of research for the preparation of this article was a review of the historical development of mobile pharmacies with the most significant reference to military and ship pharmacies. In order to realize the set goals, an internet search and review of available scientific and professional literature on this topic was performed in the period from November 7th to November 25th, 2015. In total, 36 literature sources were used to prepare this article. Out of that, the following were used: history books that contain data for the mentioned topic, scientific and professional articles, websites, manuals, etc.

4. RESULTS

4.1. Origin and development of mobile pharmacies

Archaeological evidence shows that the Egyptians and Romans had special containers in which they kept medical preparations. From 1500, ship and military surgeons encouraged the development of large medical chests, and wealthy nobles had their chests carried with them on trips. Although there is a long tradition of self-medication in Great Britain, domestic medical boxes (mobile pharmacies) appeared at the end of the 18th century, and reached their popularity only in the middle of the 19th century. The increase in the number of chemical drugs, powders and tinctures, the industrial revolution, which turned to the needs of the people, led to an increase in the number of potential buyers. Drugstores and pharmacies buy crates and fill them with the necessary preparations. They were filled according to the needs of customers, and were very rarely of the same content. The earliest British mobile pharmacies were covered with fish skin, and later oak and walnut wood was used to make them. Mahogany, rosewood and walnut became popular in the 1800s. Since 1820, military mobile pharmacies have had brass handles. Also, in addition to mobile pharmacies, manuals for lay people were written. Between 1760 and 1890, over twenty titles were published in Great Britain, those were practical guides consisting of a list of the contents of the box, explanations of how to use preparations, detailed explanations of weights and measures, and how to take appropriate doses according to the patient’s age. The manuals also contained instructions for cleaning wounds, stopping bleeding, and also the first guidelines on how to help a person with poisoning. Of course, everyone also recommended the presence of a qualified doctor. Medicines and equipment for cleaning and rinsing the intestines, emetics, preparations for releasing blood were typical preparations that could be found in the box. Rhubarb, as an astringent and purgative, ipecacuanha as an emetic and expectorant. The only painkillers available were opium-based, usually as tinctures (5, 6).

The accessories that were in the medical boxes were standardized after some time. It usually included (6):
- Hand scales and weights,
- Lancets, although bloodletting or minor surgery without the presence of a qualified doctor was not recommended,
- Marble or ceramic tiles, spatula, avan with pestle, for preparing and mixing ingredients,
- A combination of two powders dissolved in water used as a remedy for indigestion,
- Blisters,
- A long flexible device used in case food would get stuck in the esophagus and

Figure 1. Appearance of the medical box from 1836 (left) and today’s medical first aid box (right)

- Silver nitrate.

Mobile pharmacies have enabled a larger number of available aids, improved public health, which has meant fewer epidemics, and diseases related to unhygienic conditions. They were used until the early 20th century and then replaced with first aid kits (6). Figure 1 shows the appearance of the medical box from 1836 and today’s first aid kit.

4.2. Mobile pharmacies in the Civil War
The American Civil War began on April 12th, 1861, with a shooting in Fort Sumter, South Carolina. Although President Abraham Lincoln thought the conflict would last only about 90 days, the war escalated into the bloodiest conflict in American history. The fields of health and pharmacy have undergone a significant transformation as a result of pressure for as many healthy soldiers as possible. Of the 600,000 deaths that occurred during the Civil War, two-thirds occurred due to illness, and the rest were the result of wounds received in combat. A large number of battles were postponed due to the large number of sick soldiers. The time of the Civil War is the period before the development of advanced diagnostic methods.

The biggest changes concerned the operation and organization of hospital work, the development of nursing practices, the development of surgical techniques and the development of new drugs within the pharmaceutical industry. Due to the lack of adequate hospital facilities, most of the injured soldiers were without adequate care for days before help arrived to the battlefield. War hospitals were housed in churches, hotels, warehouses, barns, and private homes. The leaders of the war units were against the construction of permanent hospitals because they believed that the departure of injured soldiers to them would also mean that they would never return to the battlefields. The construction of real hospitals began in 1861. Also, during the Civil War, means of transport for the wounded, hospital trains and hospital ships were developed for the first time. Pressure for mass drug production led to the development of pharmacy as a science and business in America. Statistics show that up to 6 million cases of illness and treatment were recorded before the end of the war.

The role of pharmacy as a science was crucial: every disease easily spread among the troops and led to the illness of a large number of soldiers who were then unable to fight and led to the demoralization of the healthy. During the war itself, the development of pharmacy was at the very beginning. In the period up to 1861, there were six schools for pharmacists and most doctors were also pharmacists. Several key drugs that were needed in large quantities during the war were: chloroform and other anesthetics, painkillers (opium and alcohol) and quinine to treat malaria, and the controversial mercury-containing calomel. Each of these drugs had significant side effects and their dosing was based on the mechanisms of error and experience gained during administration.

Thus, after a certain number of deaths with the use of large doses of quinine was found to be extremely toxic, the use of opiates and alcohol resulted in addiction in a large number of soldiers. Surgeon William Hammond put calomel out of use as early as 1863, finding it to do far more harm than good. Although the growth and development of the pharmaceutical industry was conspicuous in that period, most pharmaceutical drugs were based on the use of natural substances more than synthetic ones. A network of pharmaceutical laboratories was established in all major cities of the South. In this way, the South created a separate pharmaceutical industry, but the largest number of today's pharmaceutical business companies originated in the North, for example, Pfizer, Squibb, Wyeth etc.

The development of pharmacy and medicine during the Civil War was a transition between the traditions of the past, the demands of war and the discoveries of the modern age. When Joseph Lister proposed the Microbial Theory of Bacterial Infections in 1865, there was a complete reversal in the development of both health and pharmacy. Touching millions of injured and sick has led to conditions for the development of educational and research fields of health and pharmacy (7).

4.2.1. The role of medical staff

For doctors who worked in the field, during the wars, antiseptic medical practice, modern equipment and an organized hospital system were unknown. Diseases such as syphilis have been treated with mercury and poisonous treatments. These aggressive drugs were often worse than the disease itself. Medical equipment and knowledge were not at an enviable level at the beginning of the war. Diseases such as dysentery, typhus, pneumonia, mumps, measles, and tuberculosis have spread among poorly sanitary camps. A large number of people who suffered from various diseases and severe injuries, forced the army to develop new therapies, technologies and practices against death. Although the death rate was higher for soldiers wounded on the battlefields, Polish hospitals provided health care in all possible advanced ways. Medical staff on the battlefields provided first aid by giving whiskey to cushion the impact and morphine, if necessary, for pain (8). Figure 2 shows the appearance of a medical box used on battlefields during the Civil War.

Figure 2. Medical box during the Civil War

The substances on the prescription were monitored to be of appropriate quality. Pharmacists and doctors who prepared and dispensed medicines bought raw materials from wholesalers or importers. There was no effective drug regulation, so conscientious pharmacists learned to distinguish acceptable substances from those of poor quality, mislabeled and counterfeit. An experienced pharmacist knew how to find useful herbs. During this period, the drugs were obtained in unusable form and had to undergo technical treatment of crushing, drying, grinding or dilution by infusion or alcohol in order to make adequate tinctures. Prescriptions are written on plain paper on which is not always but occasionally written the date and name of the patient and the signature and initials of the doctor himself. The recipe itself consisted of four parts. The first part was an inscription consisting of Rx, which in Latin
Table 1. The most frequently prescribed extracts

| Extract                        | Action                                                                 |
|--------------------------------|------------------------------------------------------------------------|
| Ext. Aconiti Fluidum           | rheumatism, neuralgia                                                   |
| Ext. Belladonnae               | neuralgia, cough, fever, spasmodic asthma                               |
| Ext. Buchu Fluidum             | for diseases of the urinary tract                                       |
| Ext. Colchini Seminis Fluidum  | sedative, in higher doses emetic and purgative, for rheumatism         |
| Ext. Colocynthis Fluidum       | purgative, in combination with calomel-safe purgative                  |
| Ext. Conii                     | sedative, once used for cough and asthma                                |
| Ext. Ergota Fluidum            | internal hemorrhage and cough                                           |
| Ext. Gentianae Fluidum         | Tonic                                                                  |
| Ext. Glycerrhizae              | Demulcent                                                               |
| Ext. Hyoscyami                 | sedative and anodine                                                    |
| Ext. Ipecacuanhae              | strong emetic, used in small doses as an expectorant                    |
| Ext. Nucis Vornicae            | same action as strychnine                                               |
| Ext. Pruni Virginianae Fluidum | Laxative                                                               |
| Ext. Rhei Fluidum              | diarrhoea, a useful purgative                                           |
| Ext. Senega Fluidum            | stimulant, expectorant, diuretic, in higher doses emetic                |
| Ext. Spigeliae Fluidum         | strong anthelmintic                                                    |
| Ext. Valerianae Fluidum        | antispasmodic, in epilepsy, hysteria, dyspepsia                         |
| Ext. Veratri Viridis Fluidum   | antitumor agent, in influenza, dysentery and peritonitis                |
| Ext. Zingiberis Fluidum        | stimulant and carminative, often prescribed for dyspepsia              |

Table 2. The most frequently prescribed oils

| Ointments                      | Their application                                      |
|--------------------------------|--------------------------------------------------------|
| Olei Menthae Piperitae         | aromatic stimulant, for nausea and dyspepsia, carminative|
| Oleum Cinnamomi                | Carminative                                            |
| Oleum Morrhus                  | rheumatic diseases, in tuberculosis                    |
| Oleum Olivae                   | Laxative                                              |
| Oleum Ricini                   | purgative and laxative                                 |
| Oleum terebin-thinae           | anthelmintic and stimulant, dysentery, rube-facies     |
| Oleum Tiglii                   | in apoplexy and paralysis                              |

4.2.2. The most frequently prescribed preparations

The military pharmacy most often contained *acacia pulvis* (used for inflamed areas, mixed with water, and also used in the form of tablets), *citric acid* (used to make other preparations), *ether* (as an inhalation and topical anesthetic), *strong alcohol* (as a stimulant, solvent and suspension medium), *Argenti Nitas* (used topically against irritations and orally against dyspepsia, diarrhoea, cough, even against gonorrhoea), *a solution of arsenic and potassium* that had a large number of effects and applications, and most against high fever, *bismuth subcarbonate* as a tonic, *camphor* as a stimulant, analgesic, against sweating and sometimes in the treatment of typhus. *Capsici Pulvis* was used as a strong stimulant, topically for rheumatism, and orally for stomach diseases and lethargic tendencies, *chiloriform* as an anesthetic, *Cinchonae Pulvis* as an antipyretic, *creasotum* topically against hemorrhagic eruptions, as an antiemetic and against bronchial diseases. *Cubeba Oleo resina* has been used as a diuretic, stimulant and carminative (10). Table 1 shows the most commonly used medical extracts and how they work.

Of the iron preparations, iron chloride tincture was used to raise the pulse and induce the production of secretions, iron iodide syrup for inflammation of the lymph nodes, especially in the neck area, as well as in secondary syphilis. Iron oxide was used in combination with water as an antidote for arsenic poisoning, and iron and quinine sulfate as a specific tonic in chronic diarrhoea and dysentery, anemia and dyspepsia. Magnesium sulphate is often combined with arsenic and acts as a laxative, and morphine sulphate as a strong sedative (10). Table 2 shows the most commonly
used medicinal oils and the method of their application.

Opium pulvis was available as a tincture. Opium was extracted from *Papaver somniferum* and served as a strong sedative, and in some cases, it was also used for diarrhea. Quinine sulfate was the strongest antipyretic during the war. Sodium bicarbonate was used as an antacid, sodium borate as a strong antiseptic and a combination of sodium and potassium in the form of tartrate was used as a laxative. Potassium was used in the form of potassium iodide in secondary and tertiary syphilis, and potassium acetate as rubefacies (10). Zinc acetate, zinc carbonate, zinc chloride and zinc sulfate were used as zinc preparations. Zinc acetate was used as an ophthalmic astringent, carbonate topically in superficial wounds, chloride in ulcers and tumors, and sulfate as a tonic and astringent, and in epidemic diphtheria (10).

Mobile pharmacies were common in Prussia and Bavaria. In 1787, the Prussian army numbered 46 pharmacists, who were often involved in the production itself. At the beginning of the 19th century, a large number of medical services were established in almost all major German provinces (11).

4.3. Mobile pharmacies in the World Wars

The German navy had its own pharmaceutical service, with several dozen pharmacists working in the colonies. During World War I, about 3,639 pharmacists participated in the war, as military employees. The German military corps participated in water preparation, hygiene, disinfection and analysis (11). Most of the materials in the military pharmacy were procured from one of the main military warehouses, which played the role of wholesalers in the civilian world. A large number of doctors prescribed prescriptions based on official lists. An approved list of finished products, ingredients and consumables was used and was an effective tool to stop using expensive products. The list of all necessary materials and equipment was formed in 1942 in the USA and included biological, surgical and dental instruments, equipment for a Polish hospital and laboratory, as well as medicines and chemical substances. A large number of preparations, such as cough syrups, boric acid solutions, ointments were routinely used. Where tablets could be used, capsules were omitted. APC (acetylsalicylic acid, phenacetin and caffeine) capsules were mixed, filled manually and given for any small indication. The conditions of the war required the use of alcoholic elixirs, especially because they were easy to make and procure, because the alcohol procured by the army was tax-free. The use of alcohol decreased a lot during the war, because liquid preparations were much more difficult to transport than solid oral preparations. Pharmaceutical practice in the military was not much different from that in civil society, except in one thing, the use of tobacco, soda or candles was forbidden in military pharmacy. The military pharmacy was in charge of supplying the entire camp. In one year, the pharmacy filled more than 70,000 prescriptions, and during the cold season, it made more than 5,000 gallons of cough syrup and more than 1 million cold tablets. Some of the preparations sought and used during World War II are belladonna extract, glycerin, glycerose and opium mixture, hydrogen peroxide, iodine, ipecacuahna powder and opium, liquid carbon detergent, mercury cyanide tablets, mercuric oxide and mercuric chloride fat, morphine sulfate, petroleum ether, phenolphthalein, potassium permanganate, quinine sulfate, sodium bicarbonate, sodium salicylate, sodium thiosulfate, strychnine sulfate, sodium sulfadiazine for intravenous administration, sulfanilamide, sulfapyridine, sulfathiazole, zinc, tincture (12).

Of the biological products, antitranxerxa, anthrax serum, cholera vaccine, plague vaccine, shrimp, antitetanus, and tetanus toxoid have been used (12).

4.4. Russian military pharmacy

In Russia, military medicine appeared much later than in other European countries. In the 17th century, when the armies of European kings already had military surgeons and mobile pharmacies, members of the Russian army treated themselves mostly on their own, connecting wounds to each other and collecting medicinal herbs. Peter the Great radically changed the situation around military medicine in Russia. As early as 1695, when the Russian army set out to conquer the Turkish fortress, it was accompanied by ships loaded with medical equipment, and doctors and pharmacists set out from Moscow together with the army. At the beginning of the 18th century, the army and navy ordinances prescribed instructions for performing sanitary actions and listed the medical preparations and instruments that were necessary in the campaigns. They were becoming aware that the skill of the military doctor was of inestimable importance in the army. One of the most prominent students of the Russian school of military medicine is N.I. Pirogov. Until the age of 57, this genius of military medicine did not go out on the battlefield, but studied medicine exclusively theoretically. He worked in the silence of his office on new methods of wound healing that made it possible to significantly reduce the number of amputations. Pirogov was the first to use frozen corpses to model various wounds. This seemed sacrilegious to his contemporaries, but thanks to these experiments he compiled an anatomical atlas of a completely new type, without which no military surgeon in Russia or the West could have imagined his work for a long time. At a time when in the English fleet anesthesia meant a glass of rum or a blow with a wooden hammer on the head, methods very close to today’s were introduced in the Russian army, i.e., medical sedation of patients before surgery (13).

4.5. Military pharmacies in the USA

In the United States, the operation of military pharmacies is regulated by the laws of the Ministry of Defense, military regulations and the law on drug control. The right to the services of these pharmacies has: active members of the army and their families, retired military staff and their family members and widows of military heroes. Each military pharmacy contains in its documentation a form or list of medicines available in the pharmacy, which is periodically updated. Not all medicines are always available in military pharmacies. Most drugs owned by military pharmacies are generic equivalent drugs that have the same chemical composition and the same dose but are from different manufacturers. The ban on dispensing medicines may refer to certain medical specializations, such as some medications may be limited to cardiology only. In certain circumstances when the drugs on the list are not adequate, drugs off the list may be prescribed. For this individual patient, pharma-
cies have the right to keep small quantities of that medicine in order to be available to him (14).

The TRICARE Pharmaceutical Program is a government program in the United States that is contracted to operate military pharmacies. Military pharmacies mostly have stocks of medicines for 90 working days and receive prescriptions from military and civilian doctors. This program also enables the delivery of medicines to the homes of soldiers who are in active service. Most of these services are those drugs that are used for chronic conditions, e.g., high cholesterol, high blood pressure. The network of military pharmacies today consists of 57,000 of them in the world in various military bases. This program also regulates the process of mixing multiple components to make a specific drug to ensure its effectiveness and safety (15).

The War Veterans Department has developed the concept of mobile pharmacies that are designed to make medicines available to veterans during natural disasters such as floods and hurricanes. Mobile pharmacies are housed in steel trailers and stored in special places in the state to be accessible to veterans in the event of weather disasters (16).

4.6. Historical development of ship mobile pharmacies

Especially during the 19th century, the classic tasks of pharmacists who worked with the navy and colonies were to research everything scientific, study wildlife (flora and fauna), meteorology and climatology, analysis of minerals, agricultural and industrial substances, water and food quality control, general control of hygiene (vector of elimination, disinfection and sterilization), and study of diseases caused by microorganisms (11).

Until 1776, navy pharmacists were under the supervision of a doctor. Since then, their importance will increase in proportion to the number of discoveries of numerous tropical and exotic medicinal substances. The first Pharmaceutical Inspector of the Navy in France was appointed in 1798 (11). The advanced medicine and pharmacy that developed on land, greatly affected the health care at sea. The constant incidence of communicable diseases, poverty and inadequate nutrition, insecurity of navigation and long voyages are the main reasons why seafarers often became ill and exposed to injuries at work (17).

The history of sailing is as long as the history of mankind. It is believed that in the past, until about the 14th and 15th centuries, they sailed only along the coast, and rarely on longer voyages. With the introduction of the compass in navigation, at the end of the 15th century, conditions were created for long voyages. Like the health of any community, the health of the shipping community depends on a number of factors such as housing, nutrition, drinking water, waste-water disposal, lighting, heating, cooling, waterway safety, disease and vector control, hygiene and health care. In addition to physical limitations, the health status on board is greatly influenced by interpersonal relationships between groups (crew and passengers) and within individual groups (18). Such a situation required that the problem of health protection on ships be solved in accordance with the then principles of medicine and pharmacy (17). The development of medicine and pharmacy over the centuries has had an impact on health care on ships and seaports.

Numerous documents testify that the ancient Greeks and Romans already had doctors on larger ships who treated sick and injured sailors and soldiers. It was the Romans who built the first hospitals for sailors and had doctors on board, the so-called duplicarii, so named because they had double pay for their extremely hard work on the ship. The ancient Romans built the first hospitals for sailors, and established Lex Didio according to which a sick sailor in the first port was to be disembarked and provided with care. With the collapse of the Roman Empire, this practice disappeared and states mostly dealt with the problem of quarantine (18). From then until the 14th century, there is no information about ship doctors and their activities on ships. It is believed that there were no doctors on ships at that time (17).

In the Middle Ages, Lex Didio reintroduced Eleanor of Aquitaine, the wife of Louis VII and Henry II. Her first husband became ill on the ship during the Crusades and no one could provide him with help and care, so she renewed the law in the Oleron Rules collection. During the Crusades, the Crusaders disembarked the wounded in Templar hospitals and re-embarked them on their return (17). The fifteenth century was a turning point in maritime medicine. In addition to Dubrovnik, two other sailor powers appeared, Venice and the Ottoman Empire. The first doctors appeared on the ships, carrying medicines, ointments and medical supplies. According to the preserved documents, the Grand Council in Venice in 1522 for the first-time appointed doctors on ships to provide assistance to the crew and passengers, and in 1411 a decision was made that each ship had to have one surgeon in addition to a doctor (17). When the disease appeared, they immediately tried to isolate the patients so that the infection would not spread, and to alleviate the condition of the patients with certain medications. Each ship had to have its own ship's pharmacy, which housed funds to treat and provide assistance to the wounded. Ship's pharmacies were supplied according to the regulations that applied to the operation of pharmacies on land (18).

As early as the 15th century, there was a doctoral service on ships in England, which in 1512 took the form of an organized health service. At the end of the 16th century, a Ship Council was established in England with four doctors, who supervised the health and hygiene of ships. Until 1843 in England, doctors on ships worked on a contract basis, but after that year English ships received full-time doctors, which contributed to raising the expertise and reputation of ship doctors. Infectious diseases were a special danger on ships, so it was necessary to do everything to prevent or treat sailors, soldiers and passengers. Therefore, each ship had to have its own ship's pharmacy in the form of a chest or cupboard in which funds were kept for treatment or to provide assistance to the wounded. Of such agents, musk, amber, nutmeg and aloe are mentioned, which were used to purify the air. Surgeons made special patches that were used to treat wounds, but also for seasickness. They made various ointments to treat eczema, which contained essential oils. For similar purposes, medicines obtained from medicinal plants were used, e.g., cubeba (lat. Piper cubeba—Indonesian tropical plant from the pepper family), zingiber (lat. Zingiber officinale—ginger), Agaricus (name...
of the genus fungus) and others. Mandrake and teriyaki (composed mainly of animal serums) were used on ships, the most prized medicine of all time, used against almost all diseases, especially infectious and heart diseases. Spain already had organized health care on ships in the 16th century. Ship's pharmacy was run by a pharmacist who had at his disposal 6,000 ducats for the purchase of medicines, medical supplies and other accessories, and the purchase of medicines was completely left to him (17). Figure 3 shows a list of medicines purchased in 1884 in a Dubrovnik pharmacy for a ship's pharmacy.

The first provision that legally regulated the naval health service, and which included regulations for pharmacies, was the Edict of Empress Maria Theresa of 1774, historically known as the Political Edict for the Merchant Navy (Figure 4) (18).

This edict legitimized all regulations that had been used in maritime medicine until then. Empress Maria Theresa’s edict on ship pharmacies from 1774 was quite general and did not specify exactly which medicines must be kept on ships, so in 1875 the Austrian Ministry of Trade passed a new ordinance on the organization of ship pharmacies. According to this ordinance, all maritime merchant ships, small coastal and long voyages, had to have a ship's pharmacy. The shipowner had to procure a box of medicines, and the supervision of it was entrusted to the captain and the doctor, if the ship had it. On a ship without a doctor, surgeon, or pharmacist, a box of medicine was in the captain’s quarters. It had to be locked, and the key was kept by the ship’s captain. On ships without a doctor, first aid was provided by a captain or an officer designated by him. These persons had to possess basic knowledge of pharmacy and medicine. The medicines that the ship's pharmacy had to have were kept in special chests (boxes) (Figure 5) (18).

The size of the box, and the type and amount of medication depended on (18):
- Ship size,
- Number of crew and passengers and
- Duration of voyage.

On a ship without a doctor, surgeon, or pharmacist, a box of medicines was in the captain's quarters; the chest had to be locked, and the key was held by the ship's captain. The captain also performed the function of a doctor
and pharmacist—he dispensed medicines to one of the crew members who had the duty of a paramedic. Each drug had its own number and its own place in the crate. There was also a regulation on the action and use of drugs. The person preparing the medication had to be an expert. The necessary substances had to be fresh and of good quality. It had to be a purgative (means of cleansing the intestines, regulating stool and digestion), diuretics (means of promoting urination), emetics (means of vomiting), astringents (means of tightening tissues, blood clotting), febrifuge, hypnotics (means of sedation) and means for combating venereal diseases. In addition, it was necessary to have larger quantities and various types of ointments and other means to treat wounds, because injuries on ships were frequent. From galenic pharmacy to spagiric drugs, agents from pharmaceutical chemistry.

New funds appeared on the market that needed to be included in the rather static lists of medicines that every ship’s pharmacy had to have. All of this will lead to special lists of marine medicines called Pharmacopoea maritima. A semi-annual inspection of medicine boxes on long-distance coastal vessels was also mandatory. In the 18th century, professional literature on maritime medicine and ship hygiene appeared in some Western European countries. The first book with instructions to captains on how to treat sick or injured people, along with a list of tools used for prevention and treatment, was published by Dr. Sarval 1847 in Trieste under the name Il Capitano marittimo istruito nella medicina. It describes the most common diseases and injuries at work, including instructions for maintaining hygiene and instructions from pharmacotherapy (17).

At the International Congress in 1851 in Paris, dedicated to the current issue of health conditions on ships and the health education of seafarers, it was decided to publish a special manual on maritime hygiene in each country. In the Habsburg Monarchy, this was entrusted to Dr. Giacich, who at that time began teaching navy medicine at the Military Academy in Rijeka. However, as very few quality papers have been published on this topic until then, Dr. Giacich conceived his manual according to his own intuition based on rich practical experience. The work was quickly completed and published in 1858 under the title "Lezioni mediche per i naviganti" (Medical Lessons for Sailors). Aware of the specific conditions on a ship, the author systematically and extensively lists numerous potentially harmful causes for health, and points out that they can be overcome only by a seafarer with high psychophysical qualities that are achieved primarily by preserving and improving personal and collective health. In terms of prevention, he pays great attention to instructions on storing food and water, and maintaining personal hygiene. The second part follows instructions on procedures for wounded and acute illness. Due to the specifics of the situation, it is no longer just first aid, but "small medicine"—the most that a layman can provide. How much is Dr. Giacich in the course of current world medical achievements, for example with antisepsis, shows his thoughts on microbes and a positive attitude towards carboic acid—at that time the most reliable means, which finds a place in every handy ship’s pharmacy (19).

4.6.1. Ship’s pharmacy

According to the regulations, the ship’s pharmacy should be located in a separate room, next to the doctor’s office, in order to have a direct connection with the rooms where the patients are accommodated. Also, some ships that do not have to have a mandatory doctor’s office must have a medicine cabinet. The locker must be locked, and there must be a list of medicines on it. Records of the medicines consumed are kept, the quantity of the medicine consumed and the quantity of medicine left in the medicine cabinet / box are recorded (20).

The ship’s pharmacy keeps ready-made medicines that contain psychoactive controlled substances, the name and surname of the patient who received the medicine, the date of application and the diagnosis, i.e., the reason for using a drug containing a psychoactive substance. The inspection of the ministry in charge of health affairs, which inspects the ship’s pharmacy, keeps records on the quantities of finished psychoactive drugs that are stored in the ship’s pharmacies, in accordance with the law. When inspecting the ship’s pharmacy, i.e., the medicine cabinet / box, it is checked whether it is equipped with medicines and medical equipment in accordance with the category of navigation, the amount of medicine used, whether medicines and medical equipment are stored properly, and whether expiration dates are respected. drugs (20).

4.6.1.1. The most common medicine in ship’s pharmacies

Therapeutic groups of drugs on board are (20):

**Drugs with action on the cardiovascular system:** cardiac stimulators, adrennergics, dopaminergics and cardiac glycosides, vasodilators for the treatment of heart disease, diuretics, antihemorrhages (uterotonics) if there are women on board, antihypertensives.

**Drugs with action on the digestive system:** drugs for the treatment of peptic ulcer (H2 receptor antagonists, proton pump inhibitors and antacids), antiemetics and drugs to combat nausea and vomiting, laxatives, antidiarrheals, intestinal antisepsics and drugs for the treatment of hemorrhoids.

**Analgesics and antispasmodics:** analgesics, antiinflammatory drugs, strong analgesics (be sure to keep medicines under lock and key and keep records)

**Drugs with action on the nervous system:** anxiolytics, neuroleptics, drugs against seasickness, antiepileptics.

**Antiallergics and drugs for the treatment of anaphylactic shock:** antihistamines for systemic use, glucocorticoids for systemic use.

**Medicines with action on the respiratory system:** medicines for obstructive airways diseases (antiasthmatics), antitussives (medicines for suppressing dry cough), medicines for treating colds and sinuses.

**Medications to treat systemic infections:** systemic antibiotics (only if a doctor is on board), antibacterial and urinary antisepsics, uroantiseptics, antiparasitics, intestinal antinfecives, antitetanus vaccine, and immunoglobulins.

**Medicines for rehydration and energy intake:** rehydration solutions.

**Medicines for external use:** with effect on the skin (antisepsics and disinfectants, antibiotic ointments, antifungal, medicines for the treatment of wounds and ulcers), medicines for the treatment of burns, medicines for the...
treatment of eye diseases, antibiotic ointments and drops, anti-inflammatory drugs, combination of anti-inflammatory and anti-infectious agents, diagnostics, otologists, dental preparations and local anesthetics.

Controlled drugs are drugs that are evaluated for their harmful effects after being used inappropriately. They are divided into three categories (21):
1. Class A includes heroin, morphine and opium.
2. Class B includes barbiturates and codeine.
3. Class C includes, among other drugs, anabolic steroids.

All drugs should be purchased in normal packages, preferably in individual dosage packages. Medical instructions must be in English or in a language understood by the ship’s crew (21). Expired medicines must be withdrawn as soon as possible, and no later than three months after their expiry. It should be noted that some countries impose fines if ships enter their territory and the pharmacy contains expired medicines (21). Table 3 shows the minimum contents of one first aid kit.

3. Class C includes, among other drugs, anabolic steroids.

Alcohol 70% 100 mL 1 pc
Acetylsalicylic acid tbl. 20×500 mg 2 boxes
Paracetamol tbl. 20×500 mg 1 box
Glyceryl trinitrate aerosol 1 box
Loratadine tbl. 10×10 mg 1 box
Tobramycin ung. 3.5 g 1 box
Sulfadiazine silver ung. 50 g 1 box
Oral rehydration solution 1 pc
Cotton od 50 g 1 pc
Sterile compresses of 10 pcs 1 pc
Gauze 1 m 1 pc
Gauze ½ m 1 pc
Calico bandage 5×5 cm 5 pcs
Calico bandage 8×5 cm 3 pcs
First aid bandage type 2 1 pc
Elastic bandage 8×5 1 pc
Microscope 2.5×9.1 1 pc
Plaster 10×8 2 pcs
Hansaplast a 10 2 pcs
Triangular scarf 100×100×140 1 pc
Scissors 1 pc
Safety pin 4 pcs

Table 3. The minimum contents of first aid kit

4.7. The importance of pharmacy in the navy

Pharmaceutical services in the U.S. Navy began when a Navy pharmacist was defined as a person assisting a medical officer or as a member of the Navy who has pharmaceutical duties. For a short time, the Navy also had its own production, which was called the Navy Drug Production Laboratory. Since then, Navy pharmacists and pharmaceutical technicians have played a significant role in medical care on Navy ships. The primary goal of pharmacy in the Navy is to provide a cost-effective and high-quality pharmaceutical service. The facilities on board provide pharmaceutical and medical assistance, small navy ships have a small medical clinic that dispenses medicines. Medicines are dispensed by the person in charge, who may be a pharmaceutical technician. The U.S. Navy also has two ships with over 1,000 hospital beds. They are designed to help the navy and the military by providing emergency medical care. They are equipped with operating rooms, a laboratory, a radiology department, and a large pharmacy staffed by pharmacists and pharmaceutical technicians. These ships are kept on standby and can be put into circulation within a few days. Pharmaceutical services do not differ much from those in civilian hospitals and clinics (16).

4.8. International rules on health care

Sailing safety can only be improved by developing international rules of conduct at sea. In the middle of the 19th century, the first international treaties related to navigation safety and health care appeared. Such a document from 1863, the Rules of the Nautical Road, was adopted by more than 30 countries. The World Health Organization, WHO, adopted the standard of medical care on ships and in 1967 published the first International Medical Guide for Ships, a manual that is an example of medical care on ships and has been translated into 50 languages. This handbook has been published in three editions so far (last in 2007). The content recommends medicines for the ship’s pharmacy, their use, doses for adults and precautionary measures, and special emphasis is placed on medicines for ships carrying dangerous goods. The list of drugs is kept by generic names or brand names. Each package of the drug must be marked with a generic name, unit dose and expiration date. If the label on the medicine is illegible, or if the contents of the package cannot be determined, the medicine must be destroyed. Supervised drugs (narcotics) must be kept closed in a special compartment, it is recommended in the safe with the captain (18).

Tasks of pharmacists authorized to supply ship pharmacies (18):
- Monitoring the supply of medicines to ships to ensure their effectiveness;
- Monitoring of medicines and their labeling with appropriate data;
- Conducting training of captains and ship’s staff;
- Advising shipping companies and captains on equipping ship pharmacies;

Pharmacists are also advisors in the preparation of national regulations and national policy for the supply of ship’s pharmacies.

4.9. Ship’s pharmacies from Dubrovnik sailing ships

Among the most attractive and valuable are two ship’s pharmacies: a pharmacy from an unknown sailing ship of the Dubrovnik Republic from the 18th century and from the Dubrovnik sailing ship “Rado”, of the Drobac family, from the 19th century. They are also the oldest preserved ship’s pharmacies in the Republic of Croatia (22).

4.9.1. Ship’s pharmacy from an unknown sailing ship of the Republic of Dubrovnik

Ship’s pharmacy is located in an oak box of larger dimensions, of massive workmanship. The chest has thin metal carrying handles on both sides. There is another separate box in the box, which takes up about a third of the depth of the larger box. When that box is taken out, there is a secret compartment under it in which dangerous drugs are
stored—poisons and narcotics. Of the glass bottles in which the medicines were kept, only ten of them have survived. The bottles are of different shapes, from cloudy, greenish and yellowish glass. Some bottles are quite elongated and have recesses on the sides for easier handling (Figure 6). This is the oldest ship’s pharmacy in the Republic of Croatia, it dates from the 18th century, and according to the data, it arrived from the town of Luka Šipanska and belonged to the Masdina family. The pharmacy is proof that the captain took care of the health of his crew (22).

*Ship’s pharmacy from the Dubrovnik sailing ship Rado*

It can be said that this pharmacy is convenient in every sense due to its dimensions. Although the box is quite small, its contents are rich and it could hold more than 70 types of medicines. Interestingly, this box had more medications even in number and content than was then prescribed. The drugs were classified as prescribed. Volatile drugs were stored in tin cans, powders and liquids in glass bottles with ground caps, ointments, extracts, cerates (wax balms, fats, oils) in porcelain pots, and teas and similar substances in cardboard boxes. The anterior septum, which can be completely pulled out, is also the richest in drugs, which are classified into six rows. In the first two rows were glass square bottles with a ground stopper, some of which have been preserved with the inscriptions: *Sal Seignet,* *Pulv. work. Rhei,* *Pulv. nitri,* *Sulfur precipit.,* *Pulv. Cremor tartar,* *Calomel.* But over these inscriptions on some bottles, we find labels with the inscriptions: *Natr. Salicyl.,* *Natr. Bromates,* *Natr. Sulf.,* *Aspirin,* *Mgn. Sulph.,” which means that other medicines were kept in the originally labeled bottles, which the head of the ship’s pharmacy considered necessary. In the third row, all porcelain vessels are preserved, with accurately written signatures, and they are ointments: *Ung. aromat., Theriac, Extr. Ratahn extr. Centauri min., Ung. Hydrarg., Cerat ad Labiam, Roob Sambuci, Ung. Simplx.* There is also a drawer where teas with inscriptions were kept: *Herba Manth. crisp., Spec. emollient, Spec. aromatice, Red. valerianae, Flor. cham. vulg., Flor. tiliae Lichen caraghen in Spec. althaeae.* These labels are written very neatly, but they are not pharmaceutically correct, so we can conclude that they were written by a sailor and not a pharmacist. Seven blue cardboard boxes are preserved in the same compartment. Each has a label with the handwritten name of the drug: *Species Althaeae, Radiae Valerianae, Lichen caraghen, Flores Tiliae, Species emollintes, Herba Menthae Crisp., Species aromatice—these drug names are written pharmaceutically correctly, which means they were written by a pharmacist, and this probably in the pharmacy where they were purchased (22).

5. DISCUSSION

Mobile pharmacies are organizational structures that serve to supply medicines to a remote community or are stationed on ships or as such exist during war conflicts, in order to provide appropriate first aid to soldiers. Archaeological evidence shows that the Egyptians and Romans were the first to use medical boxes containing medicines and medical supplies. At the beginning of the 16th century, ship and military surgeons encouraged the development of mobile pharmacies, and in that period, they were also owned by rich nobles, when they went on trips. Since then, their development has begun. Mobile pharmacies were covered with fish skin, and later oak and walnut wood was used to make them. Mahogany, rosewood and walnut became popular in the 1800s. Since 1820, military mobile pharmacies have had brass handles. Also, in addition to mobile pharmacies, manuals for lay people were written. In the middle of the 18th century, instructions for the use of its preparations came with the mobile pharmacy, but a consultation with a qualified doctor was certainly recommended. The establishment of mobile pharmacies is regulated by the legal framework of the state on whose territory it is established. Only legally approved drugs and preparations are available in it. The accessories that were in the medical boxes were standardized after some time. It usually included hand scales and weights, lancets, although bloodletting or minor surgery without the presence of a qualified doctor was not recommended, marble or ceramic tiles, a spatula, a mortar and pestle, to prepare and mix the ingredients, a combination of two slurries dissolved in water used as a remedy for indigestion, blisters, a long flexible device used in case food would get stuck in the esophagus, silver nitrate. Compared to today’s counterparts, pharmacists throughout history, especially during the wars, have been more concerned with obtaining a drug of appropriate quality, dealing with confusing mass units and relatively complex formulations. Pharmacists from this period did not tell patients much about their prescriptions. Several key drugs that were needed in large quantities during the war were: chloroform and other anesthetics, painkillers (opium and alcohol) and quinine to treat malaria, and the controversial mercury-containing calomel. Each of these
drugs had significant side effects and their dosing was based on the mechanisms of error and experience gained during administration. Although the death rate was higher for soldiers wounded on the battlefields, Polish hospitals provided health care in all possible advanced ways. Medical staff on the battlefields gave first aid by giving whiskey to cushion the impact and morphine, if necessary, for pain. War pharmacists were expected to produce a therapeutically acceptable combination although he had never encountered some of the substances and amounts prescribed in prescriptions before.

Since shipping was very lucrative, but also risky, one of the main prerequisites for successful sailing was a healthy crew. The sick or wounded sailor had to be cured as soon as possible, because the sick crew member was only a burden. In such circumstances, the existence of a ship's pharmacy on ships was once crucial. The number of crew members on sailboats has always been strictly streamlined, meaning that sailboats have never been loaded with more people than necessary. Such a situation was dictated by the economic calculation. A smaller number of sailors for the shipowner meant significant savings on food, salary, and, most importantly, ship space. Until 1776, navy pharmacists were under the control of a doctor. Since then, their importance will increase in proportion to the number of discoveries of numerous tropical and exotic medicinal substances. Like the health of any community, the health of the shipping community depends on a number of factors such as housing, nutrition, drinking water, wastewater disposal, lighting, heating, cooling, waterway safety, disease and vector control, hygiene and health care. Ship's pharmacies were supplied according to the regulations that applied to the operation of pharmacies on land. The first provision that legally regulated the maritime health service, and which included regulations for pharmacies, was the Edict of Empress Maria Theresa of 1774, historically known as the Political Edict for the Merchant Navy. This edict legitimized all regulations that had been used in maritime medicine until then. Empress Maria Theresa's edict on ship pharmacies from 1774 was quite general and it did not specify exactly which drugs must be kept on ships, so in 1875 the Austrian Ministry of Trade passed a new ordinance on the organization of the ship pharmacy. Merchant ships, small coastal and long voyages, had to have a ship's pharmacy. The shipowner had to procure a box of medicines, the supervision of which was entrusted to the captain and the doctor, if the ship had one.

The World Health Organization, WHO, adopted the standard of medical care for ships and in 1967 published the first International Medical Guide for Ships—a manual that is an example of medical care for ships and has been translated into 30 languages. This handbook has been published in three editions so far (last in 2007). The content recommends medicines for the ship's pharmacy, their use, adult dosage and precautionary measures, and special emphasis is placed on medicines for ships carrying dangerous goods. Each package of medicine in a mobile pharmacy must be marked with a generic name, unit dose and expiration date. Mobile pharmacies have a long historical tradition. Archeological evidence shows that even the ancient Egyptians and Romans owned medical chests with medicines and medical aids. There is not much information about the importance of these pharmacies until the beginning of the 16th century, when ship and military doctors encouraged the development of large mobile boxes. The greatest need for them was felt during the wars, where the injured soldiers needed to be provided with appropriate assistance as soon as possible. In the middle of the 18th century, manuals began to be printed that came with a mobile pharmacy, the contents of which explained how to use the preparations and, of course, recommended that the help of a qualified doctor be sought. The need for mobile pharmacies also developed on ships.

Throughout history, many laws have been enacted to own a pharmacy on board, and the World Health Organization has enacted a standard of medical care on ships and issued a medical guide to ships. The manual is an example of medical care on ships and has been translated into more than 30 languages. It recommends medicines for the ship's pharmacy, their use, doses for adults, precautionary measures, and special emphasis are placed on medicines for ships carrying dangerous goods. Each package of medicine in a mobile pharmacy must be marked with a generic name, unit dose and expiration date. Mobile pharmacies have enabled a larger number of available aids, improved public health, which meant fewer epidemics, and diseases relhygienic conditions. They were used until the beginning of the 20th century, and then they were replaced with first aid boxes.

6. CONCLUSION

Mobile pharmacies have a long historical tradition. Archeological evidence shows that even the ancient Egyptians and Romans owned medical chests with medicines and medical aids. There is not much information about the importance of these pharmacies until the beginning of the 16th century, when ship and military doctors encouraged the development of large mobile boxes. The greatest need for them was felt during the wars, where the injured soldiers needed to be provided with appropriate assistance as soon as possible. In the middle of the 18th century, manuals began to be printed that came with a mobile pharmacy, the contents of which explained how to use the preparations and, of course, recommended that the help of a qualified doctor be sought. The need for mobile pharmacies also developed on ships.

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