Telemedicine as an opportunity for improving the professional activity of medical specialists working in the emergency medical centres and emergency medical affiliate

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Abstract. Telemedicine allows highly specialized medical advice to be provided in case of emergency medical assistance, when there is no doctor in the Emergency Medical Affiliates (EMA) teams or it is necessary to have specialized medical advice. To study, analyze and summarize the opinion of the medical specialists working in the EMC, related to the effectiveness of telemedicine for improving the quality of their professional activity. The study was conducted through a direct anonymous survey in of 2019 with 50 medical specialists working in the Emergency Medical Centers and the EMA in Bulgaria. The study found out: the respondents believe that introducing telemedicine in pre-hospital emergency care will improve the quality of care, the respondents think that it will improve the work in EMC/EMA, located in remote areas and small villages; for of medical professionals telemedicine will be very effective while transporting a patient in the absence of a doctor at EMC/EMA; of the respondents indicate that they have performed activities requiring a higher professional status than theirs, and in such cases telemedicine would have helped; According to the respondents telemedicine will be most effective in the following emergency statuses: heart attack, birth, poisoning, pediatric patients, trauma and geriatric patients.

1. Introduction
Telemedicine allows medical specialists evaluating, diagnosing and treating patients remotely using information and telecommunication technologies. Telemedicine is an evolutionary discovery that is increasingly becoming an important part of medical science and practice.

Although the terms telemedicine and telehealth are often used interchangeably, there are some differences.

Telemedicine includes medicine, telecommunications, information technologies and education, aiming diagnostics, treatment, consultations and training. It provides qualified medical assistance at any place and at any time, and it is essentially a remotely practiced medicine. R. Mark introduced this term in 1974 (according to other sources, first introduced it Thomas Bird in 1970). It covers a variety of telecommunications and information techniques used in healthcare, as well as in different clinical fields. There are dozens of definitions of telemedicine, depending on the degree of detailing the characteristics and the content of the technologies and trends involved.

The main tasks of telemedicine are - preventive health care, reducing the cost of medical services, servicing remote areas and promoting the level of medical care. [9]
The term telehealth includes a wide range of technologies and services for patients’ care and improvement of the healthcare system in general. Telehealth is different from telemedicine, because it refers to a wider range of remote health services than telemedicine. Telehealth has been used to assist the management of non-critical presentations in rural and remote emergency departments and the outputs. [1]

While telemedicine refers especially to remote clinical services, telehealth may refer to remote non-clinical services, such as training of suppliers, administrative appointments and continuing medical education in addition to the clinical services. According to the World Health Organization, telehealth includes “Supervision, Health Promotion and Public Health Care”.

Telemedicine involves the usage of electronic communications and software to provide clinical services to patients without a personal visit. Telemedicine technology is often used for consequent visits, treatment of chronic disease, geriatric care, prescribing medicaments, consultations with specialists and many other clinical services that can be provided remotely through certain video and audio links. The development and utilization of various software products and applications for the improvement and widespread usage of Telemedicine represents a modern comprehension of the healthcare systems. [2], [3]

The introduction of new virtual care technologies (including Telehealth and Telemedicine) expands rapidly and leads to a number of challenges, related to health policy and health systems planning worldwide. [4]

![Figure 1. Model of telemedicine](image)

Information and communication technologies have great potential to cope with the challenges, faced by the medical specialists working in emergency help centers, in providing affordable, effective, high quality healthcare services.

Telemedicine uses information and communication technologies to overcome geographical barriers and to improve the access to health services. This is especially useful for small and remote settlements with predominantly elderly population and groups of people who traditionally suffer from lack of access to healthcare.

Information and communication technologies used for improving the health care can be expensive. In fact, the most commonly cited barrier for telemedicine implementation worldwide is the perception that the price is too high.

Medical Information System (MIS) - a complex of technologies and methods for planned collection, processing, analysis, archiving and dissemination of medical data and information.
The purpose of information systems in medicine is to objectify and automate the entire information process while minimizing errors, to refine and accelerate the decision making, to regulate the information exchange vertically and horizontally, as well as to facilitate the routine activities of the medical staff. Other important objective is the improvement of interconnectedness of the system with its environment. In that respect, information networks and Telemedicine virtually revolutionize the archiving and retransmission of vast data sets and multimedia.

MIS pursues the following main tasks:

• classification of information; processing by uniform standards; achieving objectivity, comparability and adaptation in operating modes; information usage through classifiers - resources, statistics, diagnostics, attestation, health insurance, research and training.
• standardization of medical information retrieving methods (work file – Electronic Medical Record).
• data entry processes automation through technical/ technological means and equipment (clinical and paraclinical).
• information encoding and control through PC designing of dialog menus; guaranteeing of uniform standards.
• building of Databases; establishing connections with other Databases through software-designed access for different users and transition to integrated Databases.

Artificial intelligence evolves further and will be able, through mathematical algorithms, to perform clinical practices such as diagnosing diseases much faster and with greater accuracy than any physician.

Undoubtedly, information technology and mathematical algorithms will play a vital and increasing role in healthcare.

Dehumanization is among the problems of modern medicine. Patient's treatment is positively influenced by the patient-doctor relationship. Defining a diagnosis, even instantaneous, is not sufficient. It is the personal relationships, conversations, decisions and actions that ultimately lead the patient to improved health. The future of medicine is in healthcare, aided by information technology.

Patient-oriented information systems improve health information management and help with diagnosis and treatment [5]

Information systems to benefit patients and to assist physicians and medical teams have been constantly developed and refined. The Telecare Medicine Information System helps to improve the care for elderly and vulnerable patients by providing access to healthcare services via Internet or mobile networks. [6], [7]

The Telecare Medical Information System (TMIS) allows operative and convenient communication between patients at home and doctors at clinical center via the medical server. To address the shortcomings of the single medical server, a new architecture for accessing multiple healthcare services is developed, based on the TMIS and using cryptographic one-way hash function, AVISPA. [8]

Therefore, the remote medical center server plays a crucial role in the sustainable provision of quality healthcare services in Telemedicine. [9]

Voice recognition software is among the modern advances in assisting medical practice. The technology actively monitors the conversations between patients and physicians during the medical examination and automatically transcribes clinically relevant review points. Thus, it reduces the time doctors spend in manually entering data into their electronic health record systems, especially while patients are in the room, so allowing them to spend more time with their patients. These are the activities that could and should be automated through algorithms to offer more time, empathy and human approach towards patients.

The algorithms application should be considered for the benefit of physicians and patients. Algorithms may be the solution we need to make our time with patients more clinically efficient than ever.

Among the key problems in Bulgaria for providing the population with medical care that meet the criteria of accessibility, justice, quality and costs is the shortage of medical specialists. Telemedicine, as a part of modern information and communication technologies, supports the work of the medical
specialists for exchanging information in the process of providing emergency medical help and it is a type of decision to achieve the goals mentioned above.

For the last twenty years, the number of doctors, paramedics and nurses working in the Emergency Medical Centers (EMC) and Emergency Medical Affiliates (EMA) has been steadily decreasing. In remote areas and small settlements, the problem of shortage of doctors is almost widespread. In more than half of the EMC/EMA-s, the staff often consists of a paramedic and a nurse or just a paramedic.

The use of information technology in emergency care increases efficiency, improves the quality of care, and reduces mortality. At the Emergency Centers, the use of the integrated application of MIS and WiMAX information and communication technologies is a fast, safe and patient-oriented convenience. This system consists of a health care center, emergency hospitals and ambulances. Through WiMAX, patients' physiological data is transmitted to the emergency room where physicians can provide immediate emergency treatment instructions online via video and audio. WiMAX technology enables the creation of active emergency medical services. [10]

Access to all patient health information, including imaging and counseling, is helpful for physicians in treating patients. [11], [12], [13]

At the end of 2008, the National Emergency Call System Law was established with an unitary European emergency number - 112 and the Republic of Bulgaria also introduced the unitary European emergency number (UEEN) - 112. This high-tech system provides quick and free access to all emergency services. The system optimizes response time and improves coordination between different services.

In the emergency medical system, any moment of delay in an emergency, such as late arrival of an ambulance, significantly reduces the patient's chance of survival. The use of specially designed RFID applications is suitable for managing by ambulance dispatchers over a huge range. [14]

The use of sensors that report changes in the patient's condition in real time is very important in an emergency. [15]

Up-to-now, telemedicine has not been introduced in our country as a possible way of providing qualified medical assistance from distance at any place and at any time.

2. Objective
To study, analyze and summarize the opinion of the medical specialists working in the EMC and EMA, related to the effectiveness of telemedicine for improving the quality of their professional activity.

3. Materials and methods
Preliminary interviews were conducted with medical specialists working in the EMC and EMA. On this basis, a questionnaire was developed, which examined the opinion of medical specialists from the Emergency Medical Centers and the Emergency Medical Affiliates, through a sociological method. The study was conducted through a direct anonymous survey in the third quarter of 2019, with 50 medical specialists. The results were processed with Microsoft Office Excel 2016

4. Results and discussion
According to the analysis of the data about the benefits of introduction of telemedicine in the pre-hospital emergency medical care in the Republic of Bulgaria, the following was found in „Figure 1“: 90% of the surveyed medical specialists responded positively, 6% of them could not assess. It is noteworthy that none of the respondents answered negatively. This leads us to the conclusion that the introduction of telemedicine in pre-hospital emergency medical care in the Republic of Bulgaria will improve the quality of work of the medical specialists.
Figure 2. The opinion of the respondents, related to the impact of telemedicine on the quality of pre-hospital emergency medical care in Bulgaria

To the question whether the work in EMC/EMA-s in the remote areas and small settlements with predominantly elderly people, will be improved with the introduction of telemedicine, the answers are very indicative again, namely:
According to 76% of respondents, the work in EMC/EMA-s in remote areas and small populations will be improved, 64% of the medical specialists have responded that during the transportation of the patient in the absence of a doctor in the EMC/EMA-s through the direct transmission of the patient’s vital signs by the doctor-specialist, the medical experts will receive accurate instructions how to stabilize the patient, only 1% of them have responded negatively;
The data in „Figure 2“ shows that 52 % of all medical professionals surveyed indicate that in the course of performing their professional duties they have happened to do activities requiring higher professional qualification than theirs and in such cases telemedicine would have helped them, to 34% of them it has not happened;

Figure 3. Case of activities requiring higher professional qualification

The study found that the introduction of telemedicine would improve the work of medical specialists in the following emergency situations: heart attack (70%), 34% in childbirth and poisoning, pediatrics (32%), trauma (30%), geriatric patients (20%), alcohol and drug abuse (12%), and 4% indicated hypertension and rhythm conducting disorders, geriatric care, etc.
The analysis of the results of questions „Figure 3“ examining the opinion of the medical staff to what extent the number of medical specialists working in the EMC and EMA and the organization of work influences the quality of health care of the population.

![Graph showing opinions on optimality of structure, organization of work, and number of medical specialists in EMC/EMA.]

**Figure 4.** Opinions of the respondents, related to the optimality of the structure, organization of work and the number of medical specialists in the EMC/EMA

The data shows that the medical specialists are not unitary on this issue. More than half of them - 54% think that the structure, work organization and the number of medical specialists in EMC/EMA are not optimal for qualified healthcare of the population, 28% cannot estimate, 14% of all indicate that are optimal and 4% say that there is no staff available for this. According to most respondents, the insufficient number of medical specialists in the staff can be compensated to the maximum extent with the introduction of telemedicine.

The interpretation of the cited data can be multifaceted, but one conclusion is firm: the medical specialists need to introduce telemedicine in pre-hospital emergency medical help in the Republic of Bulgaria in order to improve the quality and effectiveness of health care.

Ranking of indicators, related to the effectiveness of the communication between the emergency staff and the physician in the Regional Coordination Center (RCC) of EMC, the Emergency Ward physician (EW), or the doctor in the specialized ward and the need of introducing telemedicine, in order to improve this effectiveness, shows a high dynamics.

It is found out by the data that 62% of the medical specialists surveyed think this communication is ineffective. 32% of them consider it effective and 6% do not assess it.

Analyzes give reason to believe that communication between different medical specialists will be improved and will be more effective with the introduction of telemedicine.

The summarized results of the study, related to the benefit of patients with the introduction of telemedicine in pre-hospital emergency medical care in the Republic of Bulgaria is eloquent and indisputable.

It can be assumed that the data is expression of adequacy, compared to the current condition of pre-hospital emergency medical care and the need of introducing telemedicine in our country.

### 5. Inference

The research allows us making the following conclusions:

- The development, utilization and continuous improvement of information products for the managing, tracking and monitoring of the patient's health as well as the telecommunication with physicians, enhances the quality of health care, provided to patients.
• Telemedicine is an opportunity for improving the professional activity of the medical specialists working in the centers for emergency medical help, optimizing the organization and management of the work of the medical specialists in the EMC/EMA, as well as compensating the shortage of medical staff. all this establishes real preconditions for improving the effectiveness of their activity in general.

• Working out long-term strategic plans for development and deployment of telemedicine in emergency medical care at national level will help to sort out some problems in remote areas and small settlements.

6. Conclusion
The research allows us making the following conclusion:
• The introduction of telemedicine in emergency medical care will contribute for more accurate primary diagnostics and for improving the quality of medical care. This will provide patients with guaranteed access to qualified medical care and a better chance to reach the hospital alive.

• Telemedicine in emergency medical care will be very useful not only for patients and for medical specialists working in emergency medical help centers, but it also provides them with the opportunity for good coordination, certain environment for practicing the profession, and improving their professional activity, in general. Color illustrations

• The targeted development of increasingly sophisticated medical information systems will provide the highest level of quality medical service to a wide range of patients.

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