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## Use of teletransmission and influence of telemedicine on enhancing healthcare quality in opinions of paramedics from the Podkarpackie Province - a pilot survey

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### Summary

**Foreword.** The paper presents new solutions in approach to telemedicine related to the development and implementation of advanced technologies. In the coming years, it is expected that technologies such as 3D imaging, telemedicine, etc., will contribute to enhancing the quality of medical care and allow faster and cheaper management of patients.

**Aim.** Evaluating the operation of the teletransmission system used by emergency medical services (ZRM) and its impact on the enhancement of medical care quality.

**Material and methods.** The survey was carried out on 50 persons employed in the emergency medical services system (PRM system) within the Podkarpackie Province. The method of diagnostic survey was employed. A questionnaire was designed in order to collect information necessary to meet the research purpose of this work. The questionnaire consists of questions regarding various views, health-related behaviours, and respondents' knowledge and awareness of ICT (information and communication technology) solutions in medicine.

**Results.** Among 50 surveyed persons, there were 30 paramedics (60%), 11 PRM nurses (PRM: emergency medical services) (22%), 8 PRM doctors (16%), and a doctor of medicine (2%). 10 of the surveyed persons were women (20%) while 40 were men (a majority of 80%). As far as age groups are concerned, 5 persons (10%) were below 25, 17 persons (34%) were between 26 and 35, 25 persons (50%) were between 36 and 45, and 3 persons (6%) were over 46 years of age. All participants work for hospital emergency wards in the Podkarpackie Province. The survey has proven that the idea of the innovative patient care based on telemedicine is strongly supported by the respondents.

**Conclusions.** In the opinion of the PRM personnel, the system operates efficiently. Teletransmission is used by the emergency medical services as a diagnostic tool and allows one to improve procedures and provides help in taking decisions related to managing patients with ACS. It contributes to enhancing quality of medical care and patient comfort. This is also a high potential area.

*Key words: advanced technologies, telemedicine, teletransmission, health protection, medical systems, improvement of medical services quality*

Wykorzystanie teletransmisji oraz wpływ telemedycyny na poprawę jakości świadczeń zdrowotnych w opinii ratowników medycznych województwa podkarpackiego – badanie pilotażowe

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**Wykorzystanie teletransmisji oraz wpływ telemedycyny na poprawę jakości świadczeń zdrowotnych w opinii ratowników medycznych województwa podkarpackiego – badanie pilotażowe.**

**Streszczenie**

**Wstęp.** Praca przedstawia nowe rozwiązania w podejściu do medycyny w związku z pojawianiem się i wdrażaniem do codziennego użytku nowoczesnych technologii. Przewiduje się, że w przeciągu najbliższych lat technologie takie jak na przykład obrazowanie 3D, telemedycyna itp. będą miały wpływ na poprawę jakości świadczonych usług medycznych pozwalając na szybszą i tańszą obsługę pacjentów.

**Cel.** Ocena funkcjonowania systemu teletransmisji stosowanego w praktyce ZRM i jego wpływ na poprawę świadczeń zdrowotnych.

**Materiał i metody.** Badaniem zostało objętych 50 pracowników systemu PRM z obszaru województwa podkarpackiego. Zastosowano metodę sondażu diagnostycznego. W celu zgromadzenia informacji potrzebnych do realizacji celu

badawczego w niniejszej pracy skonstruowano kwestionariusz ankiety. Kwestionariusz składa się z pytań dotyczących różnych poglądów, zachowań zdrowotnych, oraz wiedzy i świadomości respondentów na temat technologii teleinformatycznych w medycynie.

**Wyniki.** Na 50 osób, które wzięły udział w badaniu ratownicy medycznej to 30 osób (60%), pielęgniarki systemu 11 (22%), lekarze systemu 8 osób (16%), doktor med.(2%). Wśród badanych 10 osób to kobiety (20%), większość pracowników to mężczyźni 40 (co stanowi 80%). Przedział wiekowy do 25 lat 5 osób (10%), 26-35 lat 17 osób (34%), 36-45 lat 25 osób (50%), powyżej 46 lat 3 osoby (6%). Wszyscy uczestnicy to pracownicy SOR-u w województwie podkarpackim. Ankieta wykazała, że idea innowacyjnej opieki oparta na telemedycynie ma mocne poparcie wśród badanych respondentów.

**Wnioski.** W opinii pracowników PRM system działa sprawnie. Teletransmisja jest wykorzystana przez ZRM jako narzędzie diagnostyczne i pozwala na usprawnienie procedur, a także pomaga w podejmowaniu decyzji związanych z postępowaniem z pacjentem z OZW. Wpływa na poprawę jakości świadczeń i komfort pacjentów. Jest obszarem o wysokim potencjale.

*Słowa kluczowe: nowoczesne technologie, telemedycyna, teletransmisja ochrona zdrowia, systemy medyczne, poprawa jakości usług zdrowotnych.*

## Foreword

In the coming years, the healthcare sector will face considerable changes. In the first place, we will see evolution in expectations of patients, who owing to developments in the media and technology and ever-increasing awareness become more and more demanding and aware of their rights. In a few coming years, modern technologies will produce a digital revolution in medicine. Technologies will make a huge impact on diagnostics, transplantology and planning surgical or orthopaedic operations.

Patients and doctors will be able to compile pieces of information from different devices in order to get a complete picture showing condition of a given person.

The ageing society and growing expenses for healthcare services open up new possibilities and sources of income and at the same time drive innovative thinking and investments in research and development. As ICT solutions develop and become commonplace, global infrastructure will be more and more widely used for exchanging medical information. The notion of the telemedicine is very broad and means organized implementation of modern telecommunications technologies and ICT solutions in medicine and eHealth. Modern technologies will make it possible to faster exchange specialist information (transmission of figures as well as analogue and digital data) necessary for preventive activities, diagnosis, therapy and patient's health assessment. It is already possible to remotely diagnose patients, monitor test results and consult specialists, carry out surgeries, transmit information to data bases used in the healthcare sector as well as organize medical teleconferences and provide education to the medical community. IT solutions significantly improve the healthcare quality and access to knowledge within the continuing medical education process as well as the level of education of patients and their families. Such innovative methods, when combined with pharmacologic support of invasive treatment and advanced rehabilitation procedures, can considerably enhance the patient's life quality and accelerate their recovery, which has also a big positive impact in social and economic terms. Modern technologies change patients into aware consumers.

Initially, telemedicine was used for transmitting data related to medical imaging. The first data transmission took place in the USA in 1959 (Żurowska-Wolak M.,i wsp., 2016). Polish law does not provide any established definition of telemedicine. In common use are many different definitions. The most popular ones are: "telemedicine means transfer of medical data between distant locations using electronic means of communication in order to prevent diseases, maintain health, ensure and monitor provision of medical care to patients, educate patients and persons who provide medical care, as well as to support other healthcare-related personnel. This includes remote diagnosing, consulting and treating that may be carried out synchronously (in real time) or asynchronously (Ostrowska S, 2010). The definition accepted by the American Telemedicine Association (ATA) says that

telemedicine is a form of information exchange between two parties that is carried out using telecommunications solutions in order to improve the patient's health (Bierzuński Ł.,i wsp.,2009), According to the World Health Organization (WHO), telemedicine means “providing specialist medical services when distance is a key factor using telecommunications technologies to exchange information that is important for diagnosis, treatment, prevention, tests, consultation or medical knowledge in order to improve the patient's health (Martyniak J,2005). Telemedicine accompanied by a related notion of telepresence. It involves using advanced technologies such as virtual reality to carry out advanced medical procedures such as a treatment or operation, in the course of which remotely controlled robots and virtual reality are integrated together in order to operate surgical equipment and carry out selected surgical procedures on a patient from distant and often inaccessible locations (Deutsche Bank AG). Though there are many different definitions of telemedicine, it is possible to specify some features common to all of them. Thus, we can tell about telemedicine when data is transmitted using ICT in order to improve the patient's health. Telemedicine is a technology that allows one to provide remote healthcare and social services. Such technologies ensure providing healthcare services in the right place at the right time using tools designed to share information in the form of records, images and sounds. The Gartner's report “eHealth for a healthier Europe” specifies telemedicine as one of the most efficient tools when it comes to reducing costs and rationalizing expenses for health protection in the EU states. The report states that: “The most significant contribution to improved Availability lies with EMR/CPR and Telemedicine. Initiatives aiming to increase availability of services and better utilization of resources should evaluate the potential impact of the above-mentioned technologies” (MedGo).

In the Polish PRM System, teletransmission has been present since the beginning of the 21<sup>st</sup> century, as it was introduced into the system in 2006 (Kordasiewicz M.,2008). At present, it is a standard element used by emergency services dispatchers, the number of which is closely monitored (more than 8000 a year) (Demidowicz M., 2009, Szarpak Ł.,2010).

By 2030, one should expect a significant increase in demand for healthcare services due to the unavoidable changes in demography that result in the rise of the number of people aged 65 and more. The forecast structure of the society has been

presented by the Central Statistical Office (GUS) in "Population projection 2003 - 2030 - source: GUS "Population projection 2003 - 2030" (Główny Urząd Statystyczny).

### **Aim of the Work**

The work aims at analysing and assessing technologies (teletransmission) that contribute to enhancing the quality and broadening the range of services provided by healthcare facilities.

### **Material and methods**

The method of diagnostic survey was employed in order to collect information necessary to meet the research purpose of this work. The questionnaire developed by the author consists of questions regarding various views, health-related behaviours as well as respondents' knowledge and awareness of ICT in medicine.

The questions are structured so as to cover as wide as possible a range of the research problem and make it possible to meet the objectives of the work. The analysis was based on a survey carried out on 50 volunteers who were active paramedics, doctors, and nurses employed at emergency departments in the Podkarpackie Province and who used the Lifepack multi-purpose defibrillators for teletransmission purposes. The survey was carried out in an anonymous manner on the turn of May and June, 2015. The material was collected with the author's own questionnaire that was developed for this survey in line with the available literature. The research tool included 28 questions (general and problem-focused). In the data analysis, percentage values of answers to the questions were used. The average time of answering the questionnaire was 20-30 minutes. The paper presents selected results obtained from the survey. The statistical analysis was carried out with an Excel spreadsheet.

The questionnaire included questions covering general demographic issues such as age, sex, type of job performed and education, and then pertaining to technology available on ambulances, use and influence of the technology (teletransmission) on quality of work of medical personnel, patient's comfort, types of cooperation between doctors, personnel and specialist medical centres, and types of training courses aimed at improving professional qualifications. In order to create a complete picture of the issue at hand, conclusions drawn from own observations have been added.

## Results

Among 50 surveyed persons, there were 30 paramedics (60%), 11 PRM nurses (PRM: emergency medical services) (22%), 8 PRM doctors (16%), and a doctor of medicine (2%). 10 of the surveyed persons were women (20%) while 40 were men (a majority of 80%). As far as age groups are concerned, 5 persons (10%) were below 25, 17 persons (34%) were between 26 and 35, 25 persons (50%) were between 36 and 45, and 3 persons (6%) were over 46 years of age. All participants work for hospital emergency wards in the Podkarpackie Province.

Use of the teletransmission system and assessment of cooperation between specialists regarding ICT-based diagnostics and treatment.

The survey on using ICT-based procedures and their impact on improving healthcare services, decreasing costs and enhancing the patient's comfort. When asked about positive aspects of telemedicine (teletransmission), personnel of emergency medical services provided divergent answers with 58% of respondents claiming it as a big improvement and 42% saying it did not influence their quality of work.

Table I. Aspects of using teletransmission by emergency medical services. [author's own source].

Positive aspects of using teletransmission by emergency medical services	Distribution of answers	
	n	%
Major improvement, enhances quality of work	31	58.0%
no influence on quality of work	29	42.0%



When asked how often teletransmissions take place, 6 respondents (12%) answered “very often”, 34 respondents (68%) said “often” and 10 persons (20%) answered “rarely”. However, when asked if new equipment and technologies are needed, 28 persons (56%) answered “yes”, 2 persons (4%) answered “not needed” and 12 persons (24%) said “not sure”. Answers to the question if introducing new systems will improve internal flow of information are as follows: 36 persons (72%) said “yes”, 5 persons (19%) said “no”, and 9 persons (18%) had no opinion on the topic. In general, 42 respondents (84%) believe that improvement in the internal communication will take place while 8 persons (16%) think it will not.

In the next question respondents assessed, in varying degrees, telemedicine systems used for healthcare and provided the following answers: 32 persons (64%) rated the implemented system as “very good”, 11 persons (22%) rated it as “good”, and 7 persons (14%) gave it a “pass mark”.

Table II. Assessment of telemedicine systems in the healthcare [author’s own source].

Assessment of implemented telemedicine systems	Distribution of answers	
	n	%
very good	7	14.0%
good	11	22.0%
pass	32	64.0%

The next assessed element was the influence of teletransmission solutions on streamlining procedures and improving the patient’s health. 43 respondents (86%) answered it would streamline work and significantly contribute to improving the patient’s health while 7 persons (14%) did not share this opinion. Most respondents, i.e. 45 persons (90%), believe that development of technologies is an unavoidable and necessary element of progress in the healthcare sector and the right time has come to introduce them in order to ensure safety and reduce costs while only 5 persons (10%) presented an opposite opinion.

Table III. Time for introducing telemedicine into healthcare facilities [author's own source].

Introducing ICT solutions	Distribution of answers	
	n	%
Right moment to introduce	45	90.0%
Wrong moment to introduce	5	10.0%

Table IV. Impact of implementing telemedicine technologies on reducing costs of healthcare [author's own source].

Cost reduction	Distribution of answers	
	n	%
will occur	16	32.0%
will not occur	9	18.0%
will occur in a long time	25	50.0%

Assessment of factors such as level of education, age, position held, access to specialist training courses, and their impact on enhancing healthcare services.

In this part of the survey, emergency medical services personnel provided their opinions on the level of knowledge of advanced technologies. Acquiring new knowledge and skills as well as self-education are important elements of an efficiently operating system and additionally they are necessary to adapt personnel to new work environment. According to the respondents, in order to make full use of the new technology, namely telemedicine, in the first place it is necessary to buy new equipment (20 persons), then equip the facility with computers (16 persons) and finally provide training to the personnel (14 persons).

Table V. Improvements necessary to implement telemedicine [authors own source].

Necessary improvements	Distribution of answers	
	n	%
personnel training	14	28.0%
computerization of facility	16	32.0%
purchase of new equipment	20	40.0%

34 persons (68%) claimed that additional training was necessary, 5 persons (10%) answered it was not, and 11 persons (22%) had no opinion. Most of the respondents claim that not enough specialist training courses are available. Specialist training courses are provided according to 5 persons (10%), while 45 persons (90%) presented the opposite view. However, as far as their knowledge of telemedicine is concerned, 39 persons (78%) declared it as significant, 9 persons (18%) declared an average level and 2 persons (4%) declared a low level.

Table VI. Knowledge of telemedicine [author's own source].

Knowledge of telemedicine	Distribution of answers	
	n	%
significant knowledge	39	78.0%
average knowledge	9	18.0%
minimal knowledge	2	4.0%

When asked if topics and extent of training courses were exhaustive, 13 persons (26%) answered "yes", 31 persons (62%) answered "below expectations", and 6 persons (12%) described them as unsatisfactory. Training courses should be obligatory according to 21 persons (42%) and not obligatory according to 19 persons

(38%), while 10 persons (20%) had no opinion. Training courses are a good tool for improving professional skills in the opinion of 41 persons (82%), do not improve skills according to 1 person (2%); 8 persons (16%) had no opinion.

Table VII. Training courses in healthcare as a tool of improving skills and developing professional knowledge [author's own source].

Usefulness of training courses	Distribution of answers	
	n	%
improve skills	41	82.0%
do not improve skills	1	2.0%
no opinion	8	16.0%

Gains, obstacles and potential opportunities that accompany advanced technologies as well as using such technologies in order to ensure effective cooperation between specialists and medical centres.

Telemedicine and advanced technologies will shape, improve and affect the level of healthcare services in spite of temporary barriers and obstacles resulting from incompatibility of healthcare facilities and IT barriers. This is the prevailing opinion in medical emergency services. However, no clear answer was obtained to the question concerning implementation of telemedicine technologies as 18 persons (36%) said it was under implementation, 21 persons (42%) answered it was not, and 11 persons (22%) did not know the answer to this question. According to the respondents, the main obstacles to the development of telemedicine are, respectively, insufficient financing (24 persons/48%) and shortage of personnel (20 persons/40%). To a lesser extent, shortage of training courses (4 persons/8%) and lack of technologies (2 persons/4%) were pointed out.

Table VIII. Obstacles to the development of telemedicine at healthcare facilities [author's own source].

Usefulness of training courses	Distribution of answers	
	n	%
shortage of financing	24	48.0%
shortage of personnel	20	40.0%
lack of technology	2	4.0%
lack of training courses	4	8.0%

The opinion that in the future the remote healthcare model will be used with a great success was shared by 11 respondents (22%) and rejected by 7 persons (14%), while 32 (64%) persons answered it would be a distant future. According to 40 persons (80%), electronic access to diagnostic data is an improvement and shortens waiting time for patients, while 2 persons (4%) said it was not an improvement and 8 persons (16%) had no opinion on this subject.

Table IX. Electronic access to diagnostic data as an improvement at work [author's own source].

Access to electronic data	Distribution of answers	
	n	%
improvement	40	80.0%
not an improvement	2	4.0%
no opinion	8	16.0%

The respondents are of the opinion that ICT solutions significantly shorten medical procedures, which, in the future, will improve work organization as well as time and human resources management. This opinion was supported by 16 persons (32%) and strongly supported by 33 persons (66%), while 1 person (2%) was against it. 5

persons (10%) claim that telemedicine offers a considerable already used potential, 42 persons (84%) present the opposite opinion, 3 persons (6%) have no opinion; 9 persons (18%) think this potential is used in a proper way, 38 persons (76%) think it is not, and 3 persons (6%) have no opinion.

Table X. Telemedicine solutions as a high potential diagnostic area [author’s own source].

Telemedicine as potential	Distribution of answers	
	n	%
high potential	5	10.0%
no potential	42	84.0%
no opinion	3	6.0%

**Discussion**

Medical technologies as a developing area are accepted by doctors and patients alike, who even expect them to offer new possibilities and become more widespread. In this context, it is particularly important for the medical community to gain and expand knowledge and practical skills related to telemedicine solutions, ICT, and other advanced technologies. International efforts and increasing funding for this area seem justified as studies exist that give scientific evidence for efficiency and effectiveness of these methods. They may give time savings, e.g. owing to access to existing data bases with current test results, and at the same time allow one to improve quality of healthcare services. It is also worth noting that, in time, communication between the patient and doctor will be improved, which in turn will contribute to improvement of quality of healthcare services, faster diagnosis and treatment as well as early identification of many dangerous diseases. Patients will gain access to many healthcare services at home, including monitoring, online medical consulting or making appointments with various specialists over Internet. Efficiently operating systems will enhance accessibility of healthcare, shorten queues to doctors and offer faster access to emergency medical aid provided with better equipment, which again will result in improving medical procedures as well as the patient’s comfort and safety. Apart from advantages, there also exist barriers that one

may face in an attempt to more widely integrate telemedicine into the everyday medical practice. In the first place, problems may appear when it comes to using a computer or a more advanced mobile phone, particularly in case of elderly and vision-impaired patients. Additionally, the telemedicine system requires computerized surgeries and attracts license fees for software, which may raise objections among financial managers at healthcare facilities and even patients, if no clear evidence is given for the improvement in results. In order to operate efficiently, the system needs more accessible specialists, better trained staff and improved communication between them. It should be stressed that in many cases even the cutting-edge solutions are not able to replace visiting a doctor as such direct contacts and conversations are necessary to thoroughly examine the patient and not only selected parameters of his/her health, and additionally they are needed to build good relations and trust between the patient and the doctor.

There are also increasingly more service providers on this market. As a result of integration between wireless communication technologies and medical devices as well as between healthcare and social services, new businesses are established. Promising market opportunities also stem from changes in the model of healthcare and the silver economy (economy that caters for needs of elderly people and takes their needs into account) (Stowarzyszenie Inicjatywa Mobilności Pracy).

## **Conclusions**

1. ICT-based cooperation in diagnosis and therapy has been identified as a high-potential and promising area.
2. Telemedicine and advanced technologies will shape and affect the level and quality of services of both the current and future healthcare sector.
3. Factors such as the level of education, age, position held, access to specialist training courses, and cooperation between providers of advanced technologies have impact on enhancing healthcare services, as well as positively influence level of such services and lead to better use of time and resources.
4. Introducing and spreading of technologies has also an economic aspect and will lead to the reduction of costs of medical procedures in a short time.
5. As it results from the survey, opportunities offered by advanced technologies have not been used so far because of fact that too few specialists are involved in

the system and additionally they are not properly arranged in terms of time and distance.

6. In system terms, when IT, organization and equipment factors are taken into account, healthcare services are not yet ready for a wider implementation of cutting-edge technologies.
7. In general, the "remote model" of healthcare has been identified as a high-potential area of a breakthrough importance.
8. The survey has proven that the idea of the innovative patient care based on data transmission is strongly supported by the respondents.

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