

Distance Learning Methods in Continuing Education of Paramedics

Piotr Leszczyński¹, Anna Charuta¹, Joanna Gotlib²,
Barbara Kołodziejczak³, Magdalena Roszak³, Tamara Zacharuk⁴

¹ Department of Emergency Medicine, Institute of Natural Science, Siedlce University of Natural Sciences and Humanities, Poland

² Department of Education and Learning Technologies, Medical University of Warsaw, Poland

³ Department of Computer Science and Statistics, Poznan University of Medical Sciences, Poland

⁴ Institute of Humanities, Siedlce University of Natural Sciences and Humanities, Poland

Abstract. The process of continuing education of paramedics is based on gaining educational credits during five-year educational periods. One of the forms of self-improvement are Internet-based educational programs. The lack of regulations concerning the organizational and technical aspects of e-learning made the authors attempt to analyze the phenomenon. The aim of the article is to present an initial analysis of the role of online educational programs in comparison with other forms of professional training of paramedics. One in three respondents has recently used one of the methods of distance learning. Despite the low awareness of the effectiveness of e-learning, almost 70% of the interviewees expressed a positive opinion about it and over 50% were willing to use such forms in the future. The respondents preferred online trainings in the asynchronous version, containing audio-visual materials and providing the possibility to obtain a certificate issued to the participant after completing the course. The demand for topics in the area of professional training included mainly the fields of Drug Therapy, electrotherapy, electrocardiogram (ECG) evaluation, medical segregation, and help in delivery in pre-hospital conditions. Modern forms of distance learning do not make it possible to acquire practical skills, yet their role in professional training of paramedics is still significant. According to the authors, online educational programs constitute an effective complement to traditional training through the performance of tasks in a mixed form, known as blended-learning.

Introduction

Emergency medical services in Poland and throughout the world. The first initiative aiming at preparing a legal basis, offering training and allowing people who were not doctors to work at emergency ambulance ser-

vices was undertaken in the second half of the 20th century. At that time, research showed that pre-hospital resuscitation may be as effective when given by trained staff as when it is conducted by a qualified doctor, whose process of education is significantly longer and more costly. For this reason, a training entitled “Mobile Intensive Care Paramedic” was conducted in Harbour General Hospital in Los Angeles in 1969. Thirty firefighters were invited to participate in over 1000 hours of lectures, 180 hours of clinical classes and 480 hours of practical hospital training (Lewis et al., 1971). Those were the first paramedics in the world, who were gaining more and more qualifications in subsequent years, which enabled them to conduct invasive procedures that could initially be performed only by doctors or nurses (Rutkowski et al., 2016).

As far as Poland is concerned, the first act concerning State Medical Rescue (SMR) was passed in 2001; however, it did not determine any specific activities that could be performed by paramedics themselves (Aleksandrowicz, 2011). On September 8, 2006, an amendment to the Act on SMR was passed. The act introduced several new systemic solutions, including the establishment of the so-called system units: hospital emergency department (ED), basic units (BU), specialized (S) Emergency Medical Service (EMS), and Helicopter Emergency Medical Service (HEMS). The Basic Units (BU) has since consisted of paramedics and/or nurses, without a doctor. The described division took into account the fact that Basic Unit managers were given full responsibility due to the fact that they were enabled to perform medical procedures independently, as determined in a subsequent regulation (Leszczyński & Wejnarski, 2015). Still, the act did not still regulate the scope of activities paramedics were allowed to perform.

It was Minister of Health’s regulation of December 29, 2006 on detailed description of life saving activities that can be undertaken by the paramedics (Journal of Laws of 2007, No. 4, pos. 33) that determined the scope of medical procedures that could be carried out independently by paramedics. The regulation was amended on April 26, 2016 (Journal of Laws of 2016 pos. 587). At that time, paramedics were allowed to work as medical dispatchers, conduct educational classes in first aid and conduct paramedic activities such as mountain or ski rescue, as part of fire prevention units, mine rescue, and water rescue services, among others (Journal of Laws of 2015 pos. 1887).

Systems of paramedic education in Poland. The history of paramedic education in Poland started in the 1990s. Following the example of the Anglosphere, a curricular basis for the paramedic profession was created, completed on May 22, 1992. The document included, among others, the

educational goals that should be achieved by paramedics. By order of the Minister of Health and Social Welfare and the Minister of Education, the prepared document was accepted for trial implementation. The elaborations formed the basis on which education commenced on September 1, 1992 at Polish Red Cross Medical Vocational School in Poznań (Medyczne Studium Zawodowe im. PCK w Poznaniu), the first educational institution to train paramedics in Poland. After 2 years of learning, the first graduates were awarded the professional title of paramedics (Leszczyński et al., 2015a).

In 2000, before the Act on the State of Medical Rescue was passed, Medical University of Silesia launched undergraduate courses dedicated to paramedic education. Soon other universities, including those in Łódź and Bydgoszcz, opened similar faculties. According to the then current legal system, to become a paramedic one had to graduate from a paramedic faculty of a university or have a post-secondary paramedic diploma. Obtaining medical education at the post-secondary level was no longer possible since 2012/2013. It appears that graduates of medical post-secondary schools and medical undergraduate studies have the same professional qualifications, which leads to numerous controversies (Rębak, 2011). The only privileges paramedics with higher vocational qualifications have result from their having a Bachelor's Degree.

Professional training of paramedics. Pursuant to the Act of September 8, 2006 on State Medical Rescue, a paramedic has the right and obligation to improve their professional skills using various forms of trainings (professional development courses, seminars, self-education). The Act of the Minister of Health of June 14, 2007 on Professional Training of Paramedics (Journal of Laws No. 112, pos. 775) defined each form, allocating an appropriate number of educational points to each of them. A paramedic is assigned a professional activity form and is obliged to obtain at least 200 points within a five-year-long education period, including a 30-hour advanced development training that will result in obtaining 120 points. The courses are to be run by centers authorized by Centre of Postgraduate Medical Education. The first period of education started on January 1, 2008. The accepted forms of self-education include:

- preparing and giving a lecture or preparing a scientific poster,
- participating in training meetings,
- taking part in congresses, conventions, conferences, and scientific symposiums,
- participating in training workshops organized by employers,
- participating in online educational programs,
- publishing a book or a scientific article.

Both in Poland and abroad, paramedics working in the system of pre-hospital emergency medicine in the several years of studies have to acquire knowledge and skills necessary to appropriately identify and manage conditions threatening to life and health (Ball, 2005). For this purpose, knowledge of emergency medicine has to be updated and developed through continuing education. Research suggests that paramedics in Poland do not approve of obligatory professional training, which forces them to collect points in order to complete the chosen educational forms (Rębak et al., 2012). It should be emphasized that the majority of this professional group must organize their time themselves, in addition to taking care of transportation and accommodation, including covering all costs connected with their participation in trainings.

E-learning in emergency medicine. There is a large number of new offers of improvement in the area of professional education addressed to paramedics available on the Internet. These are conducted online as part of online education programs and are allocated 5 points each. Pursuant to the law, the other 80 points (complementing the 120 points achieved during the 30-hour practical course approved by Centre of Postgraduate Medical Education) may be obtained during the educational period without leaving home. There are no legal regulations concerning detailed requirements for paramedics. It was assumed that training should be accepted by Emergency Province Consultant. Postgraduate education in the form of e-learning is run by private companies (for example Linmed, Grupa Ratownictwa Medycznego K1, Mat-med) as well as magazines (e.g. *Medycyna Praktyczna*, *Na Ratunek*). The benefits concerning this form of self-education include the opportunity to save time, the individualization of the learning process, and the reduced cost of learning (Póljanowicz et al., 2014; Roszak et al., 2013). The barriers of e-learning of medical staff described in Polish and foreign literature are lack of financing for the courses, lack of ability to manage the course due to low ICT competence, insufficient technological resources on the part of the course recipient, badly planned trainings, and the perceived need to learn in a face-to-face context (Childs et al., 2005; Ghasemi et al., 2016; Kołodziejczak & Roszak, 2017; Philippa, 2016). Forms of distance learning have both their advantages and disadvantages. Undoubtedly, the benefits concern the low costs of system operation, as the main expenses include preparation of materials, their implementation and updates (Roszak & Kołodziejczak, 2017). Organizational costs, such as those connected with the teacher, printing, distribution of materials, travel and accommodation, are minimized (Dąbrowski, 2008). The prepared course may be used many times (Roszak & Kołodziejczak, 2017; Roszak et al., 2015).

A student can take part in the course from any place and at any time using a personal computer. They can learn to communicate with the lecturer, play multimedia files and solve interactive tasks. Among the drawbacks of e-learning is the absence of direct contact between the student and the lecturer, which may lead to a lack of direct supervision over the process of learning or knowledge evaluation (Leszczyński et al., 2016).

Distance education consists of synchronous and asynchronous learning. The former is conducted in real time, and the trainer has control over the process of learning. In the case of the latter, educational materials are provided regardless of the place and time whereas communication between the teacher and the student takes place via such tools as e-mails, discussion forums, virtual seminars, computer simulations, or interactive essays (Heba, 2009). The form consisting in combining the real-life aspects of learning (i.e. traditional ones) and online education (i.e. virtual classes) are implemented increasingly frequently. The interactive process of education enables the creation of specific relations between the lecturer and the student / participants of the training. The classes which are run in a distance way through the Internet and include periodic meetings with the teacher are called blended-learning (Rzeźnik, 2006). Traditional trainings, supported by e-learning, are well thought of by students, which is why they are widely used in an increasing number of universities and educational institutions, including medical ones (Leszczyński et al., 2015b; Półjanowicz et al., 2014; Roszak et al., 2015).

Materials and Methods

The authors made an attempt to analyze continuing education undertaken by professionally active paramedics. The aim was to conduct an initial analysis of the role of online educational programs as an element of self-education in comparison with other forms of professional development.

The research was conducted from May to June 2017. The applied method was a diagnostic survey and the tool was an own online questionnaire (Google Forms), which enabled people to take part in the survey on a 24-hour basis. An additional benefit of the chosen form of the survey was its clarity, the possibility to use open questions as well as single and multiple choice questions, drop-down lists with answers, and automatic indication of points that have not been filled in (Figure 1). 103 paramedics took part in the research (29 female and 74 male). Participation was random, voluntary and anonymous. The survey consisted of 17 questions, 7 of which

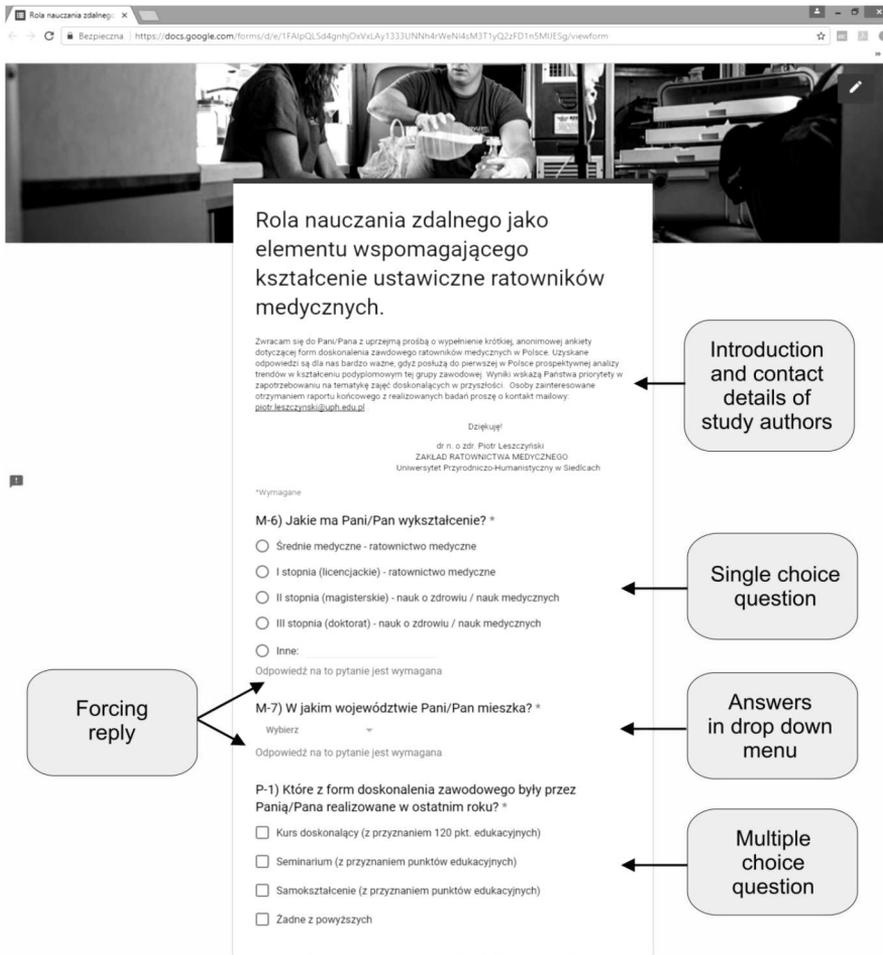


Figure 1. Functionalities of the own online questionnaire

concerned sociodemographic areas of emergency medical services while the other 10 questions were connected with issues covering the subject matter. Some of the questions were prepared in the close and semi-open forms, which made it possible for the participants to complete them with their own ideas.

Statistical Analysis

The analyzed data is presented as medians and interquartile ranges or absolute numbers and/or percentages, as appropriate. The ordinal data or data that did not follow a Gaussian distribution were analyzed with the

Mann-Whitney U test or the Kruskal-Wallis test, and the Dunn's post-hoc test. Categorical data was analyzed with the χ^2 test or the Fisher-Freeman-Halton test. All results were considered significant at $p < 0.05$. Statistical calculations were performed using STATISTICA 12.0 PL (Stat-Soft Polska, Kraków, Poland) or StatXact 9.0 (Cytel Inc., Cambridge, MA, USA).

Results

Professionally active paramedics took part in the research, the majority of whom were males (71.8%). The average age of the respondents was 32 ± 6.5 years. The length of service was 7.4 ± 4.5 years. The vast majority of participants (54.4%) mentioned Emergency Response Team as the main workplace. Detailed percentages of the respondents' workplaces are presented in Figure 2.

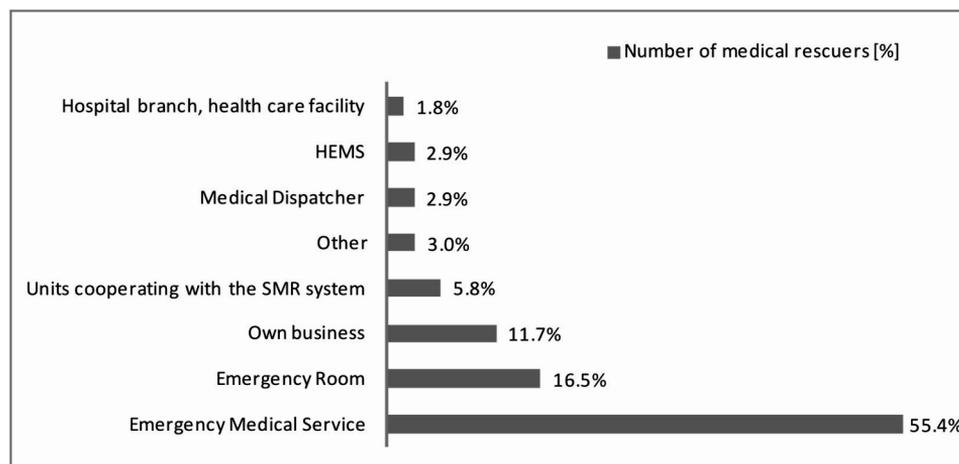


Figure 2. Percentages of the surveyed paramedics concerning their workplaces

The majority of the respondents (55.3%) were from the Masovian Voivodeship (Figure 3). As many as 29.1% had secondary medical education, 45.6% completed undergraduate studies (BA), 23.3% were graduates of MSc studies, while 2% of those surveyed were awarded the academic degree of Doctor of Medical Science or Doctor of Health Sciences. More than half of the respondents held managerial positions (50.5%).

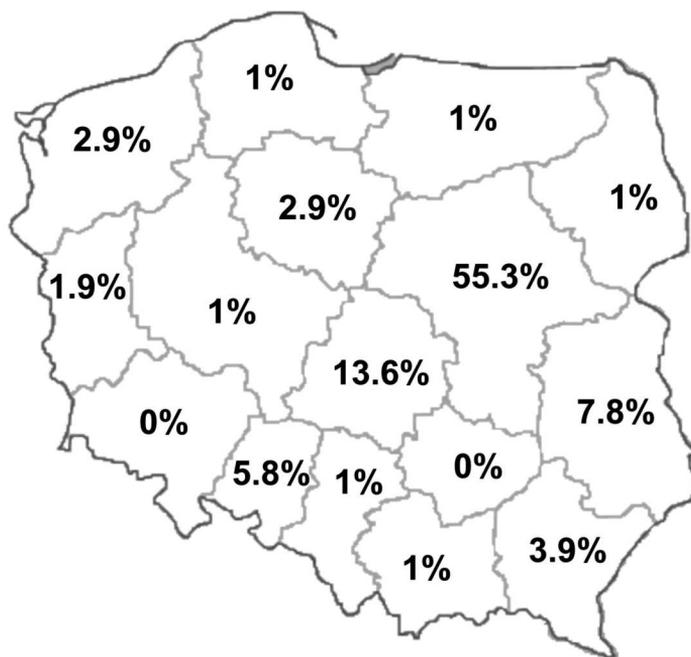


Figure 3. Distribution of the number of the surveyed paramedics according to the place of residence

Completed forms of professional development. In the year before the survey, paramedics took part in self-education the most frequently (64.1%). Moreover, they participated in seminars (40.8%) and a 30-hour professional course assigned 120 educational points (31.6%). Some of those surveyed did not choose any form of continuing education (13.6%).

As far as the category of self-education is concerned, paramedics chose mainly practical training workshops (62.1%), whereas working on scientific publications was the least interesting in their view (4.9%). A detailed summary of the completed forms of self-education are presented in Figure 4.

The main topics of professional development of paramedics included medical rescue activities (80.6%). Only 8.7% of the respondents developed their skills in the field of communication (e.g. international alphabet, GCS, radio communication). The obstacles concerning self-education mentioned in the survey included lack of time (83.3%) and high costs (83.3%). The respondents also indicated problems with transportation to the place of training (31.4%), inconvenient dates and times of the courses (31.4%), content not corresponding with expectations (11.8%), and conditions and organization of classes inadequate from the respondents' point of view (8.8%).

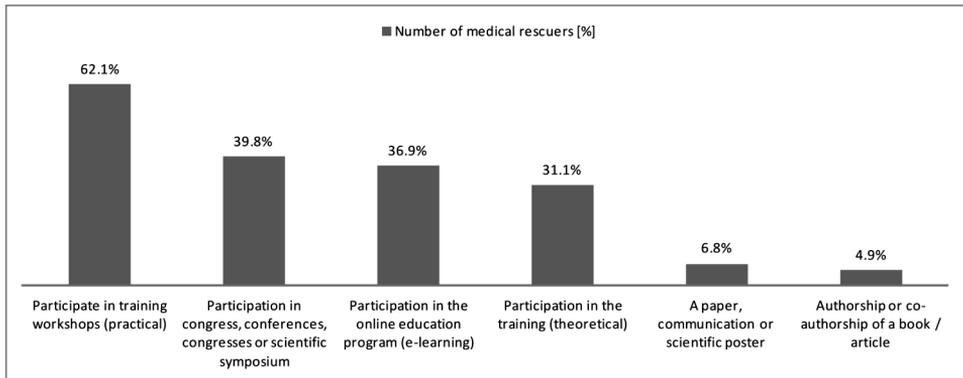


Figure 4. Forms of self-education chosen by paramedics in the previous year

Distance learning as a form of professional development. The participants of the survey were willing to choose online sources and seek information in audio/video recordings (72.8%), on social networking sites (46.6%), in courses on e-learning platforms (43.7%), mobile applications (38.8%), webinars (13.6%), games and computer simulations (6.8%) or even the virtual world, for example Second Life (3.9%). A five-point Likert scale (-2, -1, 0, 1, 2) was used to evaluate the effectiveness of e-learning in emergency medicine, in which -2 meant “strongly disagree” while 2 denoted “strongly agree”. As many as 69.9% of the respondents stated that e-learning education is effective in emergency medicine (items 1 and 2) and only 7.8% had a completely opposite opinion (items -1 and -2). A significant percentage of the paramedics (22.3%) did not specify their opinion (item 0). In conclusion, the median was 1, interquartile range: 0–2. The respondents also expressed their opinion concerning the features that an effective e-learning course should possess (Figure 5). The three most important ones were: the possibility to obtain a certificate of completion, permanent access (24/7) to the course contents (asynchronous learning) and an optimal cost of the course. The least common answers included: a strictly determined duration of the lesson (synchronous learning), a note system in the user panel, and access to conversations and comments (e.g. forums or chats).

When asked about e-learning trainings planned for the nearest future, the majority of the paramedics responded “YES” or “DEFINITELY YES”, which showed that they were willing to participate (62.1%). A group of 29.1% of those surveyed was not sure whether they would use that form of self-education. Only 8.7% of the respondents rejected the possibility to participate in an e-learning form of self-development choosing either the answer “NO” or “DEFINITELY NOT”.

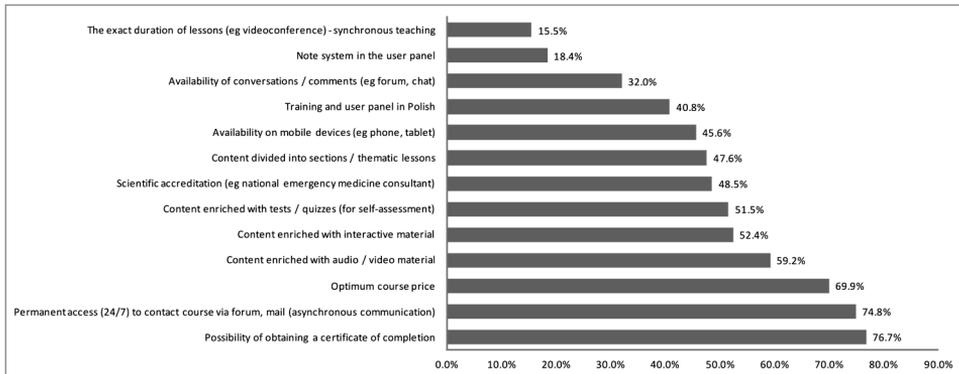


Figure 5. Conditions that should be fulfilled to call an e-learning course an effective one (number of respondents in %)

Paramedics also indicated subjects of trainings they would like to attend in the future. Figure 6 presents 10 topics that were mentioned most frequently as part of the planned continuing education.

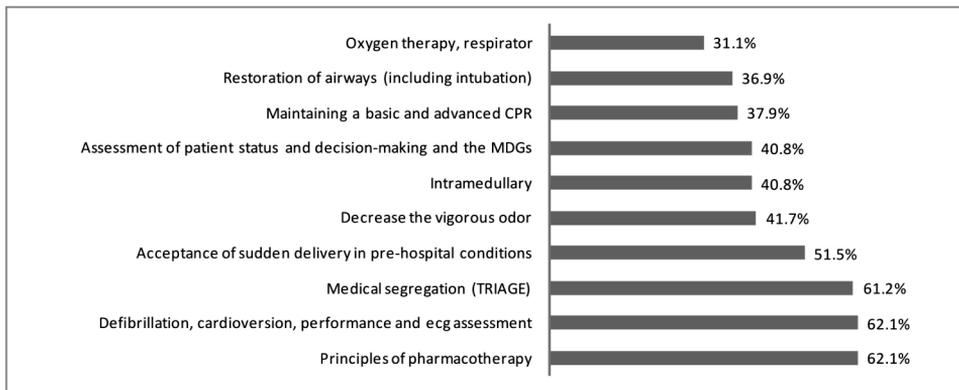


Figure 6. Topic ranges, according to paramedics' interests, as part of professional development (number of respondents in %)

In order to conduct a comparative analysis, variables were grouped in two categories. Workplace-based grouping of variables is presented in Table 1 whereas education-based grouping is presented in Table 2. Statistical analysis did not show any differences ($p > 0.05$) in the opinions of the respondents concerning the planning of their participation in e-learning courses between the 4 groups in question, divided according to workplace ($p = 0.11$; the Kruskal-Wallis test).

Table 1. Variables grouped on the basis of workplace

Class	Count	Cumulative Count	Percent	Cumulative Percent
Emergency Medical Service, Air Ambulance	60	60	61.9	61.9
Emergency Room	19	79	19.6	81.4
Own business	12	91	12.4	93.8
Units cooperating with the SMR system	6	97	6.2	100.0

Table 2. Variables grouped on the basis of education

Class	Count	Cumulative Count	Percent	Cumulative Percent
Secondary medical – emergency medicine	29	29	28.4	28.4
1 st degree (Bachelor’s degree) – emergency medicine	47	76	46.1	74.5
2 nd degree (MSc.) – health sciences / medical sciences	24	100	23.5	98.0
3 rd degree (PhD) – health sciences / medical sciences*	2	102	2.0	100.0

* Class omitted in the analysis

No differences were found between the four surveyed groups in terms of the already completed forms of continuing education ($p = 0.08$; the Fisher-Freeman-Halton test). However, a relationship between the workplace and participation in seminars was discovered ($p = 0.007$; the Fisher-Freeman-Halton test), i.e. people working in Emergency Response Teams took part in this form of development more frequently than others. Moreover, paramedics who worked in units cooperating with the SMR system participated in conferences, congresses and symposiums more often ($p = 0.052$; the Fisher-Freeman-Halton test, p value at the limit of statistical significance).

Among those surveyed who indicated the aforementioned workplace, there is a significant relationship between the workplace and the chosen topics of continuing education, i.e. topics aimed at “rescue systems” ($p = 0.025$; the Fisher-Freeman-Halton test) and “Units cooperating with the SMR system” ($p = 0.078$; the Fisher-Freeman-Halton test, p value at the limit of statistical significance). On the other hand, paramedics conducting their own business activity chose topics connected with pharmacotherapy ($p = 0.002$; the Fisher-Freeman-Halton test) more frequently than others, whereas paramedics on duty in Emergency Response Teams selected

classes concerning psychological support more often ($p = 0.004$; the Fisher-Freeman-Halton test).

Another analysis concerned variables divided into two groups on the basis of holding managerial positions. No significant differences between the groups were found ($p > 0.05$) concerning the choice of forms of continuing education ($p = 0.44$; Mann-Whitney U test) or the opinion about the effectiveness of e-learning ($p = 0.20$; Mann-Whitney U test). However, the group of people holding managerial positions ($p = 0.020$; the χ^2 test) participated in seminars (51.9%) more frequently, in comparison to those not holding such positions (29.4%).

Attention was also paid to the relationship ($p = 0.018$; the Fisher-Freeman-Halton test) between the respondents' level of education (MSc degree) and self-education through authorship or co-authorship of books and scientific articles.

Discussion

The job of a paramedic is strongly focused on workplace (Emergency Response Teams, Hospital Emergency Department), connected with the system of State Medical Rescue. The process of pre-diploma education aims at preparing health care specialists who will be able to start work as a paramedic directly after obtaining a BA degree. Representatives of the medical community (doctors and nurses) have to acquire additional specialization to be on duty in the SMR system. Therefore, in order to improve the level of the knowledge and practical skills acquired in the course of academic studies, opportunities for effective professional development of paramedics should be available.

The conducted research provides certain data indicating the advantages and disadvantages of the current system of continuing education aimed at the analyzed professional group. The majority of the surveyed paramedics (83.3%) reported problems related to their participation in professional trainings such as lack of time and the high costs they need to cover themselves, which suggests a lack of support on the part of the employers. Paramedics participated in seminars the least frequently, whereas various self-education forms that gave them the possibility to individually choose the topics and the completion period were chosen the most frequently. Regardless of education, practical training was selected most often (62.1%) whereas publishing scientific articles (4.9%) was the least popular form, which was significantly correlated with holding the MSc degree.

The legislator provided “online educational programs” as one of the elements of self-education of paramedics. The research showed that e-learning was one of the three most frequently selected forms of professional training in the previous year. The available publications indicate that digital resources are used in higher education more and more commonly and students are more interested in obtaining knowledge from the Internet in the course of self-education (Gutmann et al., 2015). “E-learning” is a commonly mentioned notion, usually defined as education via the Internet. Its scope is broadening and comprises any activities that influence the process of learning with the use of various IT technologies (Szablowski, 2009). There is little research concerning the effectiveness of e-learning in emergency medical services, despite the large number of both free and commercial online courses (Della Corte et al., 2005; Ghasemi et al., 2016; Haile-Mariam et al., 2005; Leszczyński et al., 2017). There are single papers describing an effective use of blended learning in resuscitation education where theoretic knowledge is acquired in the course of individual online learning, whereas practical exercises are done using traditional methods with a teacher (Thomson et al., 2011).

Paramedics who participated in the research were hesitant towards the issue of the effectiveness of e-learning and their own participation in similar programs in the future. Although almost 70% of the respondents expressed a positive opinion, as many as 20% did not provide a clear answer. The authors assume that the reason for the hesitancy concerning the possibilities connected with modern techniques of distance learning in medicine is the lack of information campaigns devoted to recognition of knowledge obtained in this manner (certificates) and the fear of a new educational form that requires to possess some IT skills.

Paramedics clearly indicated (74.8% of the respondents) that the most convenient e-learning form in their view was asynchronous education. An equally important positive aspect of the type of online course was the price of training and the possibility of obtaining a certificate of completion. Participants of the research feel the need to enrich the contents with audio/video materials, interactive tests, and self-evaluation tests. This is consistent with the results of other authors’ research, which claim that the effectiveness of education, including distance learning, largely depends on the form in which knowledge is communicated (Kołodziejczak et al., 2014). Humans learn most effectively through action, being active in a discussion group, and through the application of audio-visual methods (Leszczyński et al., 2015b). In this context, using modern teaching materials and information technologies offers the opportunity to activate students. One of the benefits of multimedia

education in teaching and learning is making an impact on several senses. By using behavioral measures, the language of images, sounds and symbols, a student acquires knowledge “in a multimode way” (Bednarek & Lubina, 2008). Various medical information can be found on the Internet; however, it does not always constitute a reliable educational material, especially those resources that are publicly available and free (Zschorlich et al., 2015). Therefore, it is advisable that only reliable sources should be used, such as scientific publications or materials written or edited by verifiable specialists in a given area, and to make sure that electronic educational materials are of good quality.

The demand for topics of professional training of paramedics mainly includes the fields of Drug Therapy, electrotherapy, electrocardiogram (ECG) evaluation, medical segregation, and help in delivery in pre-hospital conditions. The respondents also indicated topics such as tension pneumothorax, intraosseous access, evaluation of the patient’s condition, basic and advanced cardiopulmonary resuscitation (CPR), emergency airway management, and oxygen therapy. Hence, the topics mentioned above are among the first to be covered during trainings, as part of continuing education.

The role of distance learning in the professional development of paramedics is considerable, even though it does not allow them to acquire manual skills. According to the authors, online educational programs constitute an effective complement to traditional trainings.

The job of a paramedic involves a great deal of responsibility and is time-consuming, which often makes it impossible for paramedics to participate in a wide selection of post-diploma courses. For this reason, professionally active paramedics seek forms of development that will allow them to complete and refresh their knowledge in a given thematic field, online courses being an ideal solution.

Therefore, trends in postgraduate online education in emergency medicine should take into account the necessity to:

- limit the duration of training and adjust it to a prospective recipient (for example, an unlimited access to the Internet, 24/7),
- effectively select trainings, monitor real needs on the job market, and carry out pedagogical supervision,
- work out solutions to improve the effectiveness and quality of trainings (Harden, 2006), and make it possible to obtain a certificate confirming that knowledge was gained.

The effectiveness of distance learning in emergency medicine has been confirmed by numerous scientific reports; however, there is an insufficient amount of research in the field of paramedic education. Thus, it is advisable

that observations in the field should be continued and to select the most effective and satisfactory e-learning techniques from among the existing ones (Leszczyński et al., 2017; Shu-Sheng, 2008).

Conclusions

The conducted survey research allows us to draw the following conclusions:

- Paramedics take part in legally imposed professional trainings, particularly in various self-education forms;
- Out of all the available self-education forms, the surveyed paramedics chose practical classes, conferences / scientific conventions and online educational programs most frequently;
- The effectiveness of remote teaching as part of continuing education of paramedics is evaluated by the paramedics in a positive way;
- The significant problems as far as participation in professional development is concerned are its high costs and the lack of time;
- The thematic scope of trainings suggested by the surveyed paramedics is strictly connected with paramedic activities that are performed by paramedics independently.

Although participation in an online educational program is ranked third (36.9%) among the available self-educational forms by the surveyed paramedics, the popularity and demand for this form of education will be growing, according to the authors. This is a result of dynamic changes on the job market requiring workers to improve their skills constantly and frequently, or else change profession. Moreover, online courses that cater to participant expectations – among which there are unlimited access (24/7) to educational materials in an attractive form (interactive and multimedia), an optimal price of the course, lack of additional costs, an unlimited number of participants, and the possibility to obtain a certificate after course completion – have an advantage over other forms of education, with the exception of practical trainings. The solutions that may increase the effectiveness and professionalism of online educational programs in medicine include: standardization of the content of education, course financing plans, integration of e-learning with the higher education system, blended-learning, and open licenses of appropriate software and technologies. The positive evaluation of remote teaching by respondents is a good sign as far as changes to be implemented in the future are concerned.

The results of the research carried out under the research theme No. 244/08/S were financed from the science grant granted by the Ministry of Science and Higher Education

R E F E R E N C E S

- Aleksandrowicz, I. M. (2011). Status prawny ratownika medycznego – wybrane problemy. *Prawo i Medycyna*. Retrieved from: <http://www.prawoimedycyna.pl/index.php?str=artykul&id=1022>
- Ball, L. (2005). Setting the scene for the paramedic in primary care: a review of the literature. *Emergency Medicine Journal*, 22(12), 896–900.
- Bednarek, J., & Lubina, E. (2008). *Kształcenie na odległość. Podstawy dydaktyki (pp. 109)*. Warszawa: PWN.
- Childs, S., Blenkinsopp, E., Hall, A., & Walton, G. (2005). Effective e-learning for health professionals and students-barriers and their solutions. A systematic review of the literature-findings from the HeXL project. *Health Information and Libraries Journal*, 2 (Suppl. 2), 20–32.
- Dąbrowski, M. (2008). Analiza pomiaru efektywności kosztowej procesów e-learningowych. *E-mentor*, 5(27).
- Della Corte, F., La Mura, F., Petrino, R. (2005). E-learning as educational tool in emergency and disaster medicine teaching. *Minerva Anestesiologica*, 71(5), 181–195.
- Ghasemi, N., Falsafi, P., Asl Aminabadi, N., Negahdari, R., Bahramian, A., Khodadoust, K. (2016). E-Learning in Medical Sciences Education: A Comprehensive Literature Review. *Paripex – Indian Journal of Research*, 5(1), 107–109.
- Gutmann, J., Kühbeck, F., Berberat, P. O., Fischer, M. R., Engelhardt, S., & Sarikas, A. (2015). Use of learning media by undergraduate medical students in pharmacology: a prospective cohort study. *PLoS One*, 10(4): e0122624.
- Haile-Mariam, T., Koffenberger, W., McConnell, H. W., & Widamayer, S. (2005). Using distance-based technologies for emergency medicine training and education. *Emergency Medicine Clinics of North America*, 23(1), 217–229.
- Harden, R. M. (2006). Trends and the future of postgraduate medical education. *Emergency Medicine Journal*, 23(10), 798–802.
- Heba, A. (2009). Nauczanie na odległość – wczoraj i dziś. *Nauczyciel i Szkoła*, 3–4(44–45), 145–152. *Górnośląska Wyższa Szkoła Pedagogiczna im. Kardynała Augusta Hlonda w Mysłowicach*.
- Kołodziejczak, B., & Roszak M. (2017). ICT competencies for academic e-learning. In K. Kostolányová (Ed.), *Information and Communication Technology in Education ICTE2017*. Conference Proceedings (pp. 8–16). Czech Republic: University of Ostrava. Retrieved from: <https://konference.osu.cz/icte/dokumenty/2017/proceedingsICTE2017.pdf>

- Kołodziejczak, B., Roszak, M., Kowalewski, W., & Ren-Kurc, A. (2014). Educational multimedia materials in academic medical training. *Studies in Logic, Grammar and Rhetoric on Logical, Statistical and Computer Methods in Medicine*, 39(52), 105–121.
- Leszczyński, P., & Wejnarski, A. (2015). Prospektywna ocena systemu edukacji i metod ewaluacji kwalifikacji zawodowych ratowników medycznych. *Forum Oświatowe*, 1(53), 121–136.
- Leszczyński, P., Charuta, A., Klepacka, M., Sholokhova, D., Bakalarski, P., & Rejent, P. (2016). The Effectiveness of distance learning in advanced cardiac resuscitation – a pilot study. *Emergency Medical Service*, III, 4, 244–249.
- Leszczyński, P., Charuta, A., Łaziuk, B., Gałązkowski, R., Wejnarski, A., Roszak, M., & Kołodziejczak, B. (2017). Multimedia and interactivity in distance learning of resuscitation guidelines: a randomised controlled trial. *Interactive Learning Environments*. doi: 10.1080/10494820.2017.1337035
- Leszczyński, P., Gotlib, J., Gałązkowski, R., Wejnarski, A., & Świeżewski, S. (2015a). Analiza obszarowych i kierunkowych efektów kształcenia na kierunku Ratownictwo Medyczne w Polsce. *Przegląd Naukowo-Metodyczny. Edukacja dla bezpieczeństwa*, 4(29), 215–226.
- Leszczyński, P., Gotlib, J., Kopański, Z., Wejnarski, A., Świeżewski, S., & Gałązkowski, R. (2015b). Analysis of Web Based Learning methods in emergency medicine: Randomized Controlled Trial. *Archives of Medical Science*. doi: <https://doi.org/10.5114/aoms.2015.56422>
- Lewis, A. J., Hermer, A. J., Bebout, C., & Criley, J. M. (1971). Experience with a Paramedic Mobile Intensive Care Unit. *Annals of Internal Medicine*, 74(5), 836. doi: 10.7326/0003-4819-74-5-836.2
- Philippa, G. (2016). Continuing professional development for paramedics: A systematic literature review. *Australasian Journal of Paramedicine*, 13(4).
- Półjanowicz, W., Roszak, M., Kołodziejczak, B., & Kowalewski, W. (2014). Using virtual learning environment as a key to the development of innovative medical education. *Studies in Logic, Grammar and Rhetoric. Logical, Statistical and Computer Methods in Medicine*, 39(52), 123–141.
- Rębak, D. (2011). Ratownik medyczny – kontrowersje na temat przygotowania zawodowego. *Studia Medyczne*, 21(1), 79–83.
- Rębak, D., Głuszek, S., Nowak-Starz, G., & Markowska, M. (2012). Potrzeba ustawicznego kształcenia ratowników medycznych na tle innych zawodów regulowanych. *Problemy pielęgniarstwa*, 20(2), 201–210.
- Rozsak, M., & Kołodziejczak, B. (2017). Building a course with multimedia resources – the working time analysis on the example of the pathophysiology course. In M. Hrubý (Ed.), *Distance Learning, Simulation and Communication*. Conference Proceedings (pp. 161–170). Brno, Czech Republic. Retrieved from: <http://dlsc.unob.cz/data/DLSC%202017%20Proceedings%20Selected%20papers.pdf>

- Roszak, M., Kołodziejczak, B., Półjanowicz, W., Bręborowicz, A., Ren-Kurc, A., & Kowalewski, W. (2015). E-learning portal tools for medical education. *Studies in Logic, Grammar and Rhetoric. Logical, Statistical and Computer Methods in Medicine*, 43(56), 177–193.
- Roszak, M., Kołodziejczak, B., Ren-Kurc, A., Kowalewski, W., & Bręborowicz, A. (2013). Repetitions and summaries in distance learning materials. Learning Content Development System (LCDS). *E-mentor*, 1(48), 40–46.
- Rutkowski, A., Chmielewski, J., & Szpringer, M. (2016). Kształcenie pracowników zespołów ratownictwa medycznego w Polsce. *Edukacja Ustawiczna Dorosłych*, 3(94), 56–62.
- Rzeźnik, M. (2006). Nauczanie w klasie wirtualnej i tradycyjnej – porównanie. W M. Dąbrowski & M. Zajac (Eds.), *E-learning w kształceniu akademickim* (pp. 129–135). Fundacja Promocji Akredytacji Kierunków Ekonomicznych.
- Shu-Sheng, L. (2008). Investigating students' perceived satisfaction, behavioral intention, and effectiveness of e-learning: A case study of the Blackboard system. *Computers & Education*, 51(2), 864–873.
- Szablowski, S. (2009). *E-learning dla nauczycieli*. Warszawa: Wydawnictwo Fosze.
- Thomson, N. M., Campbell, D. E., & O'Leary, F. M. (2011). Teaching medical students to resuscitate children: an innovative two-part programme. *Emergency Medicine Australasia*, 23(6), 741–747.
- Zschorlich, B., Gechter, D., Janßen, I. M., Swinehart, T., Wiegard, B., & Koch, K. (2015). Health information on the Internet: Who is searching for what, when and how? *Zeitschrift für Evidenz, Fortbildung und Qualität im Gesundheitswesen*, 109(2), 144–152.