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The level of knowledge of paramedics from Podkarpacie Province about the use of simulation in training

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Abstract

Introduction: Medical Simulation allows to improve knowledge, skills and social competences in undergraduate and post-graduate training in medical professions in a shorter time than traditional education. **The aim** of the paper was to assess the level of knowledge of paramedics on the use of medical simulation during undergraduate education in the field of emergency medicine. **Material and Method** The study was conducted from January to June 2014 among 60 paramedics from the Podkarpackie Province aged over 21. The research tool was the questionnaire developed by the authors. **Results** Men dominated in the study (18% women and 82% men). The most numerous group were the youngest subjects, i.e. between 21 and 30 (76%), and the smallest group was the oldest, i.e. over 40 (7%). The study demonstrated the relationship between respondents' responses regarding the use of patient simulators during university or postsecondary training and their self-assessment in terms of improved practical skills and their positive effect on the communication of paramedics with patients. Self-assessments of paramedics in terms of the increase of their practical skills through medical simulators correlated with the suitability of these skills in daily work and the impact on communication of medical rescue teams. **Conclusions** The medical simulation is used in the education of the students of medicine, but it is also of great importance in terms of modern teaching in emergency medicine, nursing, obstetrics in under and postgraduate education.

Keywords: medical simulation, level of knowledge, paramedics, medical simulation, teaching paramedics

Introduction.

Simulation is a technique used in education to develop skills and experiences of learners through fully interactive and reliable reproduction of conditions and situations based on specially prepared scenarios reflecting real events encountered in clinical practice [1]. The classes prepared that way are designed to create an appropriate teaching situation that helps students develop critical thinking skills and decision making [2,3]. Medical simulation is according to the current state of knowledge the best method of education. In September 1959 Marx et al. described the first case of practical application of simulated conditions in medicine [3,4]. In 1960, the Norwegian company Laerdal Company started the production of *"Resusci Anne"* mannequins to train resuscitation. The use of computer controlled mannequins used to educate medical students in the 1960s, has been described. Later, simulation of operating theatre conditions for anesthesia training was conducted by Gaba and De Anda of Stanford University School of Medicine [3,6] [Figure 1].

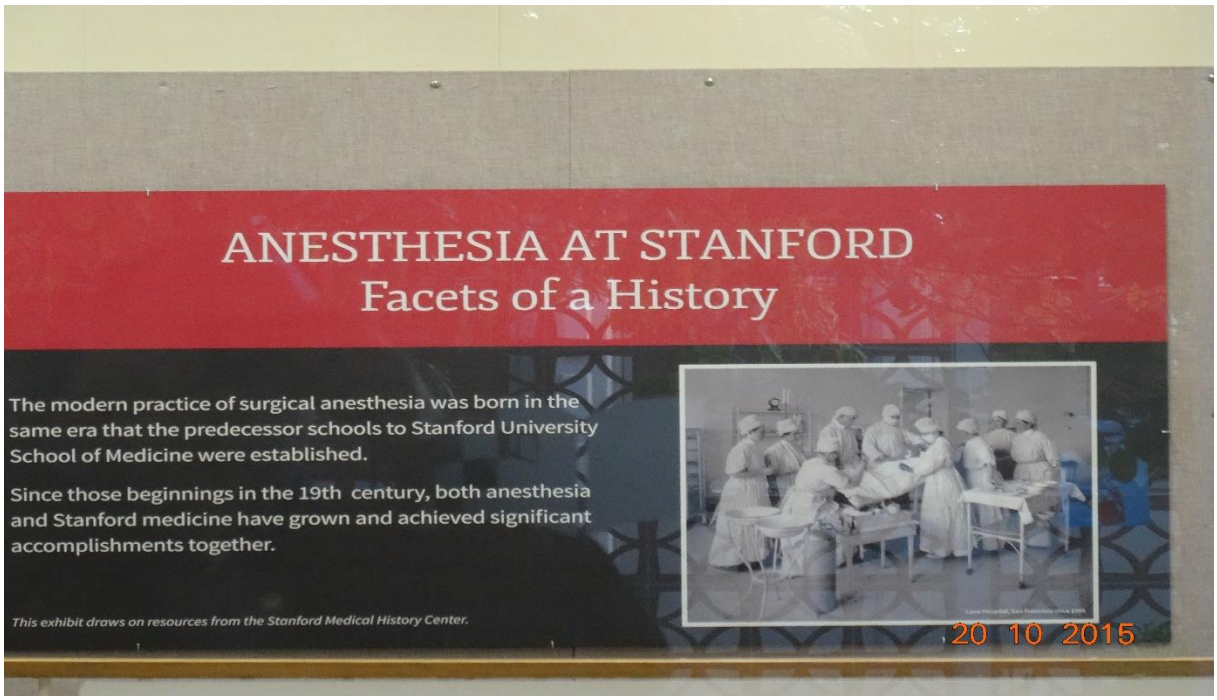

Fig. 1 Photo from authors' collection, taken during the internship at Department of Emergency Medicine, Stanford University, School of Medicine in 2015. The photo was taken in the historic Room of Medical Simulation, Stanford University.

Purpose of the study

The aim of the paper was to assess the level of knowledge of paramedics from Podkarpackie province on the use of medical simulation in the training of future paramedics.

Material and methods

The study was conducted from January to June 2014 among 60 paramedics from the Podkarpackie Province aged over 21. This age was defined as the lowest, enabling to work as a paramedic after completion of the required schools, i.e. by 2015 - 2-year post-secondary school, and currently - 3 year undergraduate studies. The research was conducted among

professionally active men and women. The detailed characteristics of the study group in terms of age and sex is presented in Table 1.

Table 1. The characteristics of the surveyed paramedics in terms of age

Age	**o**	**%**
21 ÷ 30 yrs	46	76
31 ÷ 40 yrs	10	17
Over 40 yrs	4	7

Sex	**o**	**%**
women	11	18
men	49	82

The research was carried out using the diagnostic survey method with a questionnaire developed by the authors distributed among the respondents personally (in a traditional way). Prior to the research we obtained informed consent of the respondents to participate in the experiment. The questionnaire was anonymous. It comprised of 19 single-choice closed questions, divided into four categories - tab.2.

Table 2. Questions included in the questionnaire

Category	**Tested features**
Sociometric data	Sex, age, place of work, recently completed school / studies.
Professional experience	Professional experience as a paramedic, being trained by means of medical simulation, conducting training with medical simulators.
Own opinions on medical simulation	Encounter with the term "medical simulation", the meaning of medical simulation in training, the effectiveness of medical simulation in comparison to traditional teaching methods, the influence of medical simulation on medical education of paramedics, evaluation of time spent on medical simulation during own training, efficiency of medical simulation equipment during the classes, the usefulness of the skills gained through medical simulation in professional work.
Self-assessment	Increase of practical skills with medical simulators; own knowledge on the possibilities of using medical simulation in education, importance of medical simulation in systematization of knowledge; importance of medical simulation in relations of medical rescue teams, importance of medical simulation in communication with patients.

Statistica 10 PL licensed by Rzeszów University was used for statistical analysis. Collected data were of qualitative nature, therefore, non-parametric tests: Chi-square and Chi-square with Yates correction (for expected numbers >5) were used for the statistical analysis to determine the presence or absence of a relationship between the features. In case there were grounds for rejecting the null hypothesis H0 on the independence of features, the strength of their relationship was determined assuming significance level of $\alpha = 0.05$. The power of the relationship was determined using Φ_{xy} coefficient for contingency tables sized 2×2. The scale describing the strength of the relationship was used to describe and interpret correlation significance. (table 3)

Table 3. The scale describing the strength of the relationship between features

The value of correlation coefficient	Description in words
$\Phi_{xy} = 0,0$	Non-correlated variables
$0 < \Phi_{xy} < 0.1$	Very weak correlation
$0.1 \leq \Phi_{xy} < 0.3$	Weak correlation
$0.3 \leq \Phi_{xy} < 0.5$	Moderate correlation
$0.5 \leq \Phi_{xy} < 0.7$	Strong correlation
$0.7 \leq \Phi_{xy} < 0.9$	Very strong correlation
$0.9 \leq \Phi_{xy} < 1.0$	Almost perfect correlation
$\Phi_{xy} = 1,0$	Perfect correlation

In determining the correlations, due to the small numbers expected in the contingency tables, answer variations were joint in questions concerning: age of the respondents, professional experience as a paramedic, opinions of the respondents on the validity of using medical simulation in education, effectiveness of the simulation compared to traditional teaching methods, the influence of simulations on paramedics education, the appropriate selection of time of training using medical simulators on the practical skills of the respondents, the systematization of knowledge, the self-assessment of the level of knowledge about training possibilities using medical simulators as well as the impact of training with medical simulation on communication among medical rescue teams and rescue team communication with patients. The results of the questionnaire were analysed statistically in terms of frequency of selection of answer variations by the respondents and relation of answers and its strength.

Results

The characteristics of the study group

Men dominated in the study group (18% women and 82% men). The most numerous group were the youngest subjects, i.e. between 21 and 30 (76%), and the smallest group was the oldest, i.e. over 40 (7%). ¾ of the respondents worked in the Hospital A&I Department or in the Ambulance station and the remaining 25% in other work facilities. Among the respondents, 55% had diploma of undergraduate studies, while the remaining 45% had post-secondary medical education. The majority of the respondents had from 1 up to 10 years of professional experience (53%), the smaller percentage (35%) had shorter seniority in the medical profession, and only 12% were those with more than 10 years of professional experience. Almost all the respondents (97%) came across the term "medical simulation" before during education or at work. They also believed that the use of medical simulation as one of the teaching methods of paramedics was the most justified (92%), and only 5% disagreed, and 3% had no opinion on it. They were also convinced (79%) that the method of medical simulation was far more effective than traditional teaching methods in comparison to expository methods. 8% of the respondents disagreed with this statement and 13% had no opinion on this issue. It can be observed that the above results were also related to the fact that 82% of the respondents noticed the positive effect of medical simulation on medical education. As in the previous case, only 8% was against and 10% did not respond to this issue. Such a high awareness of the importance of medical simulation in education was probably due to the fact that vast majority of the respondents (83%) used patient simulators during their academic or post-secondary school education, and only 17% had no contact with such an educational method. Among those who had contact with medical simulators, 55% of the respondents claimed that the time spent on didactic classes using medical simulators was too short, 40% thought it was sufficient and only 5% would shorten the time spent on this

training method - fig. 2. In spite of this, 65% of the respondents claimed that medical simulation equipment was not always in order during the training and only 35% said that there were never any technical problems with simulators.

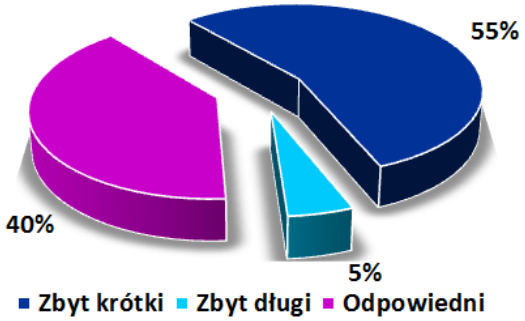

Fig. 1. Time spent on classes with the use of medical simulators

77% of paramedics trained with medical simulation believed that their practical skills increased as a result of the use of medical simulators, and only 8% said it did not matter, while 15% of the respondents did not respond. In addition, almost half of the respondents (49%) used medical simulators to conduct classes, trainings or demonstrations, while 51% did not conduct such classes or used other teaching methods. According to 76% of the respondents, practical skills acquired during training with medical simulators are useful in everyday work, and only 7% opposed, while 17% did not address this problem. The respondents rated their level of knowledge on using medical simulation as a training method as average - majority of the responses (55%), 35% declared that their knowledge was high, and only 10% rated it as low. One reason for introducing simulations into the education of future paramedics was that training with simulation greatly influences the systematization of the knowledge of the paramedics - 78% of the respondents claimed so, and 15% believed that this effect was only average. According to only 7% of the respondents, this did not matter much. Another reason for using medical simulation was its positive effect on communication among medical rescue teams (Figure 3a) and positive influence on communication between paramedics and patients (Fig. 3b). Paramedics highly valued the relationship of training with medical simulation on communication among medical rescue teams (62%) and to a smaller extend, but also high, its impact on the relationship between paramedics and patients (47%). The average importance of simulation was expressed by 25% and 43% respectively, while the absence or weak relation was declared by 13% and 10%, respectively.

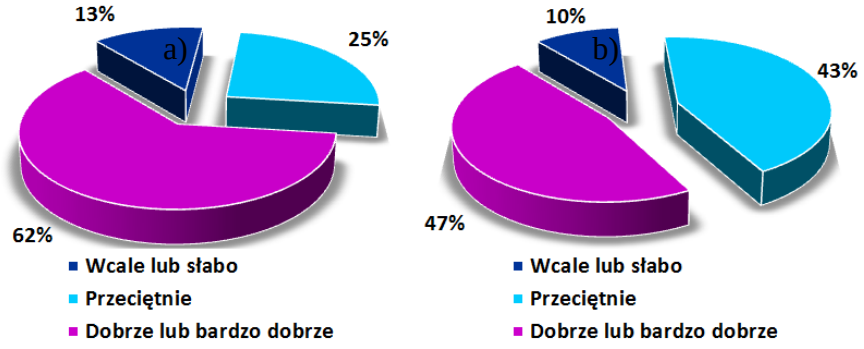

Fig. 2. Influence of training with medical simulation on: a) communication among medical rescue teams, b) communication of paramedics with patients.

The relationship between the increase of the practical skills as a result of the use of medical simulators and the subjects' opinion about the effectiveness of training using medical simulation compared to traditional methods and the usefulness of knowledge acquired that way and skills in everyday professional work (Fig.4) were observed. The average and high dependencies were respectively$\Phi = 0{,}48$ at $p = 0{,}00094$ and $\Phi = 0{,}67$ at $p = 0{,}00000$. These conclusions were justified statistically.

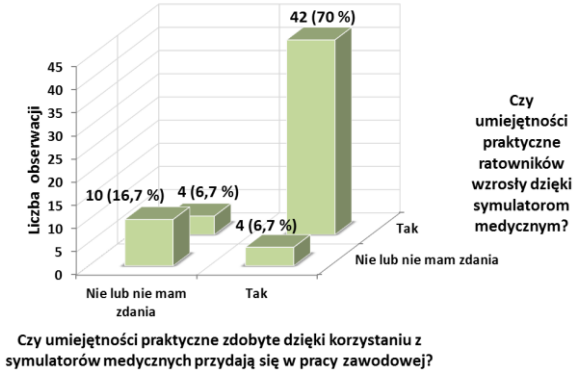

Fig. 3. Histogram of the number of respondents interviewed on the usefulness of practical skills acquired on the medical simulators in their professional work, in relation to the increase of practical skills of a paramedic thanks to didactic method.

Histogram presents the number of responses of interviewed subjects on the usefulness of practical skills acquired on the medical simulators in their professional work, in relation to the increase of practical skills of a paramedic thanks to this didactic method. Correlation coefficients of average strength amount to respectively – $\Phi = 0{,}39$ at $p = 0{,}00950$ and $\Phi = 0{,}42$ at $p = 0{,}00381$. The results were statistically significant. Correlations were found between the self-assessment of the paramedics in terms of the increase of their practical skills through medical simulators, the suitability of these skills in daily work and their impact on communication among medical rescue teams. Correlation coefficients were calculated respectively – $\Phi = 0{,}63$ at $p = 0{,}00001$ and $\Phi = 0{,}54$ at $p = 0{,}00002$. In both cases a high correlation was found and the results were statistically justified.

The relationship between the influence of training with medical simulation on communication among medical rescue teams and the influence of this method of training on the communication of paramedics with patients was calculated. Correlation coefficients of high strength amount to $\Phi = 0{,}60$ at $p = 0{,}00000$. The result was statistically significant. There was a correlation between using simulators during academic or post-secondary education and the paramedics' assessment of this method as being more effective than traditional teaching methods. Calculated dependency amounted to $\Phi = 0{,}31$ at $p = 0{,}04977$. This was statistically justified, correlation of average power. The relationships between paramedics' self-assessments regarding the increase of their practical skills as a result of using medical simulators during education, and the influence of simulation on communication among medical rescue teams and the influence of simulations on communication between paramedics and patients were determined. The results were calculated respectively – $\Phi = 0{,}38$ at $p = 0$, 00385 and $\Phi = 0{,}36$ at $p = 0$, 00367. In both cases average correlation was found and the results were statistically justified.

There was a correlation between the respondents' responses on the impact of medical simulation on systematization of knowledge and its influence on communication among medical rescue teams. The correlation coefficient was $\Phi = 0.42$ at $p = 0.00360$, which means the average power of dependence. These conclusions were justified statistically.

The dependency of the respondents opinions on the suitability of training with medical simulators in professional work, and its influence on the communication between paramedics and patients were confirmed. The correlation coefficient was $\Phi = 0.29$ at $p = 0.02622$, which indicates a weak and statistically valid correlation.

Discussion

Since the late 1980s, intensive development of tools and techniques in Simulation Based Education (SBE) has been observed. The new generation of patient simulators are developed on computerized mannequin robots offer extraordinary opportunities to obtain clinical proficiency without the danger of causing complications. On the one hand, new technical possibilities and, on the other, the emergence of non-traditional didactic methods have contributed to an increase in the number of different varieties of SBE that can be classified into five main groups: (I) *Mannequin-based simulators*; (II) *Partial or complex task trainers*; (III) *Screen-based computer simulators*; (IV) *Standardized patients* and (V) *Virtual reality environment* [7]. These SBE forms may be used in the various stages of education, taking into account the specificity of the curriculum. In addition, SBE methods can be individually selected, depending on the financial capacity and available infrastructure of the academic centre.

In 1999 Small et al. wrote on the use of SBE in group training for rescue teams [8] being one of the first who described the use of SBE in education in the field of medical rescue. In subsequent years, papers were published, i.e. on students and lecturers' attitudes towards SBE and first recommendations on planning and implementation of this method for education of paramedics [9,10]. The change in the model of higher education in Poland, which introduced the obligation to apply the educational outcomes-oriented learning system, made it necessary to develop new study curricula. Due to the fact that the paramedic's profession is not a regulated profession, every medical education institution running a course in emergency medicine had to build an original curriculum with a detailed description of the learning outcomes contained in syllabuses. An essential element of education planned that way is an appropriate system for assessing students' achievements [3.11]. British and American standards related to the quality of medical education (e.g. the guidelines of Accreditation Council for Graduate Medical Education Outcomes Project) place great emphasis on the proper way of assessing student's achievement in the field of knowledge, and above all the skills acquired during the course of studies [12,13, 14]. Therefore, there is a need to develop good tools not only for teaching but also for evaluating the learning outcomes. Hence Simulation-based Teaching are developed simultaneously to simulation methods and techniques applied in educational assessment, i.e. Simulation-based Assessment (SBA) [7]. The SBA concept has its origins in the early 1980s, when Objective Structured Clinical Examination (OSCE) was used for the first time in the evaluation of clinical competencies, using role players. The adaptation of OSCE in the assessment of medical rescue skills was related to technical progress, particularly in the field of computers and software. Mannequin-based simulation is the most commonly used method in SBA, which allows to reproduce very realistic and very complicated clinical situations. Educational measurement can be multifaceted in this case, and the student's assessment is of great didactic value, because it allows to diagnose weaknesses in the assessed skills [15]. These undoubted advantages distinguish SBA from traditional competency assessment methods, giving first and foremost objective, reliable and accurate assessment of competencies. In addition, an interesting proposal for the use of SBA was presented by Gisondi et al., who proposed the use

of simulation techniques in assessing the behaviour of resident physicians in solving ethical dilemmas [3,16]. This might be the argument against opponents of simulation in medical education, who point out that this method distances the future physician or paramedic from a patient, thus losing the humanistic element in the learning process. Many variables, such as correct tasks completion, reduced number of errors, reduced response times, more efficient use of training time confirm the advantages of simulation techniques and demonstrated good quality of SBE in relation to traditional teaching [3,17,18,19]. Also in the field of competence assessment, recently published papers allow to consider SBA as a high quality educational measurement tool in emergency medical care [3,20-24]. The wide range of possibilities for evaluating complex competencies makes simulation methods highly recommended by the Residency Review Committee for Emergency Medicine [7]. It should also be emphasized that the SBA can be used in both formative assessment and summative assessment similarly to traditional methods of measuring educational outcomes, the SBA requires appropriate standardization and normalization of assessment. SBE is currently a platform for integrating traditional and modern teaching techniques. There is a growing body of evidence on the effectiveness of simulation techniques and at the same time more and more medical specialities have the opportunity to test different forms of SBE in practice. According to Mc Laughlin et al., it is expected that the standard in medical education will be the use of validated SBE and SBA methods in the same way as those currently used in the aviation or military industry [3,7]. Introduction of advanced simulation techniques for pilot training several years ago has resulted in a dramatic reduction in aircraft incidents and catastrophes and has led to the introduction of similar methods for medical education. Today's high-level simulators use virtual reality while training. Preliminary reports highlight the exceptional utility of the next generation of computerized mannequins known as the Human Patient Simulator (HPS) or RPS (Realistic Patient Simulator) used to teach difficult medical procedures. It is envisaged that, especially in the field of emergency medicine, the use of simulation will be common in both the academic and postgraduate education. Technological advancement and software development creates new conditions for a realistic and virtual learning environment, which should foster effective education for future paramedics [3]. Medical simulation is a very dynamically developing field of medical education related to simulation technology. This is a broad term used both for the use of standardized patients (actors) to learn interview and physical examination, simple simulator mannequins (intubation, intravenous injection) and the most technically advanced human simulators [11]. The most important task of medical simulation is education and improvement of patient safety [11]. Initially, the attitude to simulations was very sceptical considering that the patient could not be mapped. However, the achievements of this field in the last decade have denied this thesis. Currently, complicated human simulators can realistically cough, show pain, vomit with artificial food and bleed with artificial blood, causing real stress in medical staff and need to act without delay. All this is intended to be able to help the needy more efficiently without making mistakes in the real world with real patients [11].

Conclusion

The medical simulation is used in the education of the students of medicine, but it is also of great importance in terms of modern teaching in emergency medicine, nursing, obstetrics in under and postgraduate education.

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