

# The influence of changes in the form of physician postgraduate residency training on their ability to perform post-traumatic examination as an emergency procedure

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## ABSTRACT

**Introduction:** Post-traumatic examination methods have been developed for the easier and more efficient management of trauma patients. Performed according to a scheme, post-traumatic examination must be well-learned and repeatedly practised. Training for this has radically changed in recent years in Poland.

The aim of this study was to compare the effectiveness of 2 different forms of physician postgraduate residency training by assessing how well trainee physicians carry out post-traumatic examinations.

**Materials and methods:** The study involved 2 groups of trainee physicians who were tasked with performing a full post-traumatic examination on simulated patients. Group I consisted of 81 physicians who had taken part in postgraduate residency training in 2011, and group II was comprised of 63 trainee physicians who had undergone such training in 2015. A Laerdal MegaCode Kelly manikin was employed in the project. All simulated patients

had the same external injuries and vital function parameters.

**Results:** None of the physicians in group I correctly carried out all 4 procedures for preliminary assessment (consciousness, airway patency, breath, and blood circulation), and only 7.14% managed to correctly perform 3 of these procedures. In group II, all 4 procedures were executed correctly by 9.52% of the physicians, and 3 procedures by 14.29% ( $p < 0.001$ ). Quick post-traumatic examination was performed correctly by 4.76% of the physicians from group II but by none of the physicians from group I ( $p < 0.05$ ).

**Conclusions:** In both groups of trainee physicians, the ability to recognize a life-threatening situation and to perform a post-traumatic examination was inadequate. Postgraduate residency training in both its previous and present form did not guarantee a satisfactory knowledge in this subject.

**Keywords:** emergency medicine; post-traumatic examination; postgraduate trainee physicians; effects of education.

## INTRODUCTION

A good knowledge of how to deal with patients who have sustained severe injuries, as well as the ability to use this knowledge in practice, determines how effective the results of a post-traumatic examination are. Patient management is crucial at each stage of the diagnostic and therapeutic process, especially in emergency medical treatment at the site of an accident. Giving medical aid before taking patients to hospital starts with an assessment of the accident site and mechanism of injury, an evaluation of basic vital functions, and a post-traumatic examination. First aid from a qualified practitioner, emergency medical treatment, and emergency medicine are crucial in life-threatening situations, regardless of whether the threat is caused by the consequences of an injury or a sudden cardiac arrest triggered by other factors. A lack of such skills can result in a delayed recognition of respiratory and/or cardiac arrest, and in administering cardiopulmonary resuscitation. In the situation of an imminent threat to the patient's health and/or life, all diagnostic and therapeutic decisions must be made very quickly. Therefore, the skills needed to provide medical aid must be well ingrained and repeatedly practiced.

Postgraduate residency training plays an important role in the process of a physicians' education, during which graduates of medical universities gain professional independence. Up until 2012, a 12-month residency training program consisted of partial training in the fields of internal diseases, surgery, gynecology and obstetrics, and pediatrics. It was supplemented with a 30-h course in emergency paramedic services, including 15 h of seminars and 15 h of practical training. Four years ago, the form of postgraduate residency training radically changed and trainee physicians were required to work in a hospital emergency department for 1 month. The whole 12-month residency training was then crowned with a 2-day theoretical course in emergency paramedic services.

The aim of this study was to compare the influence of 2 different forms of physicians' postgraduate residency training on the effects of teaching emergency medicine, on the basis of their ability to carry out post-traumatic examination as an emergency procedure of choice. This skill was selected to verify the quality of the participants education because of how multifaceted it is. Post-traumatic examination consists of 3 parts which must be performed one by one in the same order. These are: the assessment of the accident site and the mechanism of an

injury, preliminary evaluation of the patient's state, and quick post-traumatic examination according to a scheme. Since the monitoring of 4 basic vital functions (consciousness, airway patency, breath, blood circulation) are a fundamental part of post-traumatic examination, the 2nd purpose of this study was to check if the trainee physicians had the skills needed to identify an imminent threat to life and whether they had the ability to perform basic life-saving procedures before the completion of their postgraduate residency training.

## MATERIALS AND METHODS

The project involved 144 trainee physicians shortly before they completed postgraduate residency training. Two groups of physicians were tested depending on when their postgraduate residency training took place. Both groups were analyzed in the last month of their postgraduate residency training, preceding the beginning of the course in emergency medical paramedic services, just before the final exam. Group I consisted of 81 trainee physicians who completed postgraduate residency training in 2011, and group II was comprised of 63 physicians who finished the training in 2015. All participants were graduates of the same program at the Pomeranian Medical University in Szczecin. The aim of the study was to verify the physicians' ability to perform preliminary emergency management of patients who had sustained numerous serious and life-threatening injuries as a result of an accident. All participants were randomly assigned to 1 of 3 scenarios. The simulated patients were: (1) a woman aged 25, knocked down by a car; (2) a man aged 30, battered with a baseball bat; and (3) a man aged 40 who had fallen from the 2nd floor of a building.

The Laerdal MegaCode Kelly manikin was employed in the project. Despite different injury patterns, each of the simulated patients had the same injuries, resulting in identical parameters of vital functions and external injuries. These were: unconsciousness, no reaction to stimuli (U from AVPU scale – alert, verbal, pain, unresponsive), 6 breaths per min, a pulse of 140 beats per min, a pulse wave perceptible on both the carotid and ulnar arteries, overfilled carotid veins, no respiratory murmur in the right side of the chest, a tympanic percussion note in the right side of the chest, an unstable pelvis on palpation, a fracture of the right shin, and a laceration on the back. The participants' task was to perform a full post-traumatic examination following the scheme, starting with the correct assessment of the accident site in terms of the threats posed to the emergency team, and evaluation of the mechanism of injury. The next element was preliminary examination of the patient's state, which included approaching an injured person and stabilizing his head with their hands; assessing the level of consciousness according to the AVPU scale; restoring airway patency; measuring breath, and feeling the pulse.

The execution of all components of post-traumatic examination according to the scheme were also taken into consideration: examination of the head, neck, chest, abdomen, pelvis, lower and upper limbs, and back. The participants were

also to identify injuries which were critical for the person's life, among them right-sided pneumothorax, unstable pelvic ring fractures, fractures of both shin bones, and a laceration on the back. Another element gauged in this study was the physician's ability to provide patients with emergency medical treatment essential for their safety. For these types of injuries, this involved: putting on a cervical collar to stabilize the cervical spine, providing the correct oxygen therapy (active oxygen therapy with the use of a self-reinflating bag with a reservoir of oxygen), maintenance of airway patency by means of mandibular protrusion and/or pharyngeal intubation, decompression of pneumothorax, carrying patients on a separable-type scoop stretcher, putting patients on a spinal board, fastening patients to the spinal board with stabilizing belts, and fitting head stabilizers. These emergency procedures should be performed in this order.

Attention was also paid to the execution of medical procedures regarded as unnecessary in the initial stage of giving aid. They included measuring blood pressure with a manometer, neurological examinations beyond assessing the level of consciousness, and preparation of the vascular access or intratracheal intubation. These procedures should be done at the successive stages of medical assistance. The results were analyzed statistically by means of Statistica PL version 10.0 (StatSoft Inc.), USA (2011, [www.statsoft.com](http://www.statsoft.com), AXAP502C295820AR-K license). In this study we analyzed dichotomous qualitative (or discrete) variables. Differences between the groups, expressed as a difference of fraction, were analyzed using Pearson's  $\chi^2$  test for independence, McNemar's test for paired data, and the fraction comparison test. The level of statistical significance was set at  $p < 0.05$ .

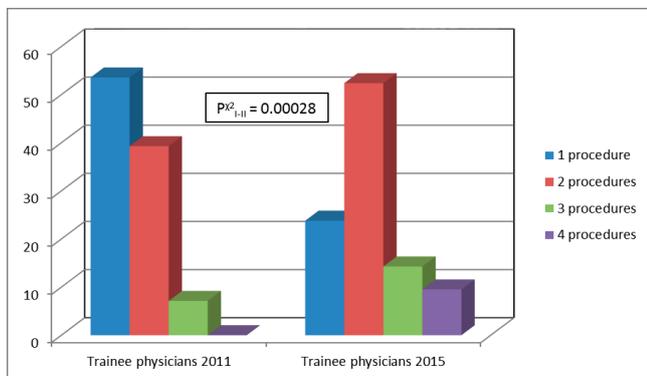
## RESULTS

Before the completion of postgraduate residency training, the participants were not able to properly assess the accident site in terms of their own safety, the number of injured individuals, and the need for additional means and forces. The accident site was only evaluated by 14.29% of the trainee physicians in group I and 19.05% in group II ( $p = 0.44$ ).

The procedure of stabilizing the head of an injured person with one's hands was correctly performed by 7.14% of group I and 4.76% of group II ( $p = 0.55$ ). The level of consciousness was properly assessed according to the AVPU scale by 28.57% of group I and 61.90% of group II ( $p = 0.00005$ ). Restoration of airway patency was performed by 14.29% of group I and 33.3% of group II ( $p = 0.00616$ ). All trainee physicians in both groups assessed breath correctly. Feeling the pulse, which was the last stage of quick evaluation of basic vital functions, was carried out correctly by 10.71% of group I and by 14.29% of group II ( $p = 0.51$ ).

Figure 1 illustrates the ability of both groups to perform particular elements of the assessment of vital functions. The assessment of the patient's state includes 4 procedures that should be carried out in a certain order. None of the 81 trainee

physicians in group I performed all 4 procedures correctly (0%). Three procedures were adequately performed by 7.14% of the participants, 2 procedures by 39.29%, and 1 procedure by 53.57%. Group II achieved better results. All 4 procedures were performed by 9.52% of the participants, 3 procedures by 14.29%, 2 procedures by 52.38%, and 1 procedure by 23.81% ( $p = 0.00028$ ).



**FIGURE 1.** The ability of both groups to perform particular elements of the assessment of vital functions

This positive change in the quality of the training was not observed in the following parts of the post-traumatic examination. Table 1 shows the proportions of the trainee physicians in both groups who performed particular elements of the quick post-traumatic examination correctly. The element of quick post-traumatic examination that both groups found most difficult was the examination of the neck and the back which consists of 8 elements. Quick post-traumatic examination was correctly performed by 4.76% of the trainee physicians in group II and none of the trainee physicians in group I ( $p = 0.04717$ ).

**TABLE 1.** The ability of both groups to perform particular elements of quick post-traumatic examination

No.	Examination	Trainee physicians 2011 – group I	Trainee physicians 2015 – group II	Statistical result $P^{2_{I-II}}$
1	Head	46.43%	28.57%	0.02790
2	Neck	14.29%	19.05%	0.43950 NS
3	Chest	17.86%	28.57%	0.12340 NS
4	Abdomen	50.00%	19.05%	0.00012
5	Pelvis	64.29%	52.38%	0.14614 NS
6	Lower limbs	55.56%	33.33%	0.00793
7	Upper limbs	37.04%	33.33%	0.64480 NS
8	Back	0.00%	4.76%	0.04717
The mean proportion of the physicians who performed all elements of post-traumatic examination		35.71%	27.38%	

At the next stage of the study, we compared the groups in terms of their execution of successive essential emergency medical procedures. A cervical collar was put on by 89.29% of the trainee physicians in group I, and only 42.86% in group II ( $p = 0.000001$ ). The correct oxygen therapy was used by 71.43% of group I and 47.62% of group II ( $p = 0.00337$ ). A right-sided pneumothorax was accurately diagnosed and decompressed by 39.29% of group I and 33.3% of group II ( $p = 0.46$ ). Sixty point seventy one percent of group I and 33.30% of group II carried the patient on a separable-type scoop stretcher ( $p = 0.00101$ ). Putting patients on a spinal board, fastening them with belts, and immobilizing their heads with side stabilizers was carried out by 75% of the trainee physicians in group I and 38.10% in group II ( $p = 0.00001$ ). The mean proportion of trainee physicians who performed the required emergency procedures were 67.14% of group I and 39.05% of group II. So-called unnecessary treatment procedures were performed by 75% of the trainee physicians who did postgraduate residency training in 2011 and only 9.52% of those who did this in 2015 ( $p = 0.000001$ ).

## DISCUSSION

The scheme for post-traumatic examination has been developed to make the management of trauma patients easier and more efficient. It shows how post-traumatic examination should be conducted step-by-step and what emergency procedures should be employed. A fundamental part of post-traumatic examination is the assessment of basic vital functions (consciousness, airway patency, breath, and blood circulation). This methodology not only makes it possible to verify the method of carrying out post-traumatic examination, but also to test the ability to recognize a direct threat-to-life and perform necessary life-saving procedures [1]. In this study, evaluating the physicians' ability to perform post-traumatic examinations served as a pretext for comparing the impact of 2 different forms of physicians' postgraduate residency training.

The task of the physicians in both groups was to conduct a full post-traumatic examination, according to the scheme, on a manikin simulating a randomly chosen patient. Medical simulations, which reconstruct a specific physiological process complicated by a disease or an injury, are a common modern teaching method. The simulation scenario is dictated by the type of complication. The role of the patient is played by a manikin on which all procedures that are normally conducted on a living person can be performed. Simulation is thus not only a method of learning, but also of checking the ability to provide emergency treatment with no risk of harm to the patient if the procedure is performed incorrectly [2]. The common application of simulators in training programs was preceded by the use of various types of manikins in clinical exams (objective structured clinical examinations – OSCE) [3]. According to Ali et al., high-quality simulators can substitute human beings as models of injured people [4]. Taking into account the wide variety of medical procedures that can be explained and taught through simulators, their role shouldn't be underestimated [5, 6, 7, 8].

Despite different injury patterns, each of the simulated patients had the same injuries resulting in identical parameters of vital functions and external injuries in the post-traumatic examination. Each of the simulated patients required the same emergency medical treatment. Differences in the age and sex of the injured had no influence on the course of examination and interpretation of the results.

From the point of view of emergency management efficiency, a large proportion of the participants made critical mistakes. The most serious of them included: a failure to assess consciousness, airway patency, breath, and pulse during the preliminary evaluation of the patient's state; opening the pelvis during examination of its stability; not applying the right oxygen therapy; a lack of immediate stabilization of the cervical spine with hands and then with a well-matched, stiff, cervical collar; a lack of decompression of a tension pneumothorax; and putting the patient on a spinal board using a rolling method and without using a separable-type scoop stretcher. In the preliminary assessment of the patient's state, including the evaluation of the level of consciousness, airway patency, breath and pulse, the physicians whose postgraduate residency training was conducted in accordance with the new program statistically significantly more often assessed basic vital functions accurately. This positive change in the training was not observed in the case of further parts of the post-traumatic examination. Although all participants assessed breath, most of them did not precede it with the restoration of airway patency, or utilised the head tilt maneuver instead of mandibular protrusion. Non-performance of airway patency restoration might have resulted from a fear of tilting the head back in trauma patients, combined with the inability to use mandibular protrusion as an alternative technique. Only 7.2% of the trainee physicians in group I and 4.8% in group II stabilized the patients' heads immediately after approaching them. After the breath examination, many physicians diagnosed cardiac arrest and started cardiopulmonary resuscitation, although in this scenario, the patient's breathing rate was 1 breath per 10 sec. In this situation, individuals with a medical education should feel the pulse, and only then decide on the next therapeutic steps. Unfortunately, the pulse was only taken by 10.7% of the trainee physicians in group I and 14.3% of those in group II. Other participants made therapeutic decisions exclusively on the basis of a breath assessment. Providing first aid in such a way is only acceptable when it is administered by lay people without any medical education.

Another problem was a lack of ventilation for the patient (a self-reinflating bag with a reservoir was not used). In several cases, group II physicians made the decision to transport their patients to hospital as quickly as possible just on the basis of breath assessment. This meant that a proper examination of the patient was not conducted, ventilation was not provided and life-saving procedures were not implemented. In a real life situation, this would result in the patients' death before they were even placed into the ambulance. More than half of the participants did not start oxygen therapy, immobilize the cervical spine with a collar, put the patient on a spinal board,

or use a separable-type scoop stretcher. Some trainee physicians even had problems with operating a separable-type scoop stretcher, namely with splitting and sliding it under the patient. Summing up, the physicians whose postgraduate residency training was based on the new rules, presented markedly poorer skills at the assessment of the accident site and the mechanism of injury, the choice of leader, and in the quick post-traumatic examination. These observations are difficult to explain. It seems that the changes in the program of postgraduate residency training should noticeably improve the physicians' skills and ability to perform the elements of emergency management. Trainee physicians working in a hospital's emergency department for 1 month should have a better theoretical and practical knowledge for the provision of life-saving procedures.

Naturally, the question then arises as to whether there are any factors that could justify such unsatisfactory results. The fact that simulated events took place in a classroom and an injured person was represented by a manikin, may have influenced the participants' attitude to the task. On the other hand, the teaching of emergency medicine is based on training on technically advanced manikins in simulation laboratories worldwide. Thus, it is probable that those who have not performed medical procedures on manikins during their education will not be able to perform them in their professional duties either. If fundamental elements of post-traumatic examination are neglected or performed incorrectly, the results can include improper examination of a patient, false conclusions drawn from the data, and failing to undertake crucial life-saving procedures. It can be said that on the basis of our study, postgraduate residency training does not give a guarantee of educational success in its previous nor its present form. Therefore, it is necessary to search for new solutions. It seems that trainee physicians, during their postgraduate residency training, should take part in refresher courses in the field of basic and advanced resuscitation techniques used on adults and children [9]. Organizing training in the field of post-traumatic examination in a way that allows participants to achieve good educational effects is confirmed by the study of Li et al. and Jawaid et al. An extension of the training program with an additional course, refreshing previously taught contents, noticeably improves both theoretical and practical exam results [10, 11]. Nevertheless, as Grzeškowiak et al. claim, even physicians specializing in anesthesiology and intensive therapy have highly insufficient resuscitation skills despite the fact that they take part in refresher courses [12].

## CONCLUSIONS

1. What draws attention to both groups of trainee physicians is their inability to recognize a direct threat-to-life, and to perform first aid and post-traumatic examination procedures correctly. Postgraduate residency training does not give a guarantee of educational success in its previous nor its present form.

2. The methodology of teaching first aid from a qualified practitioner, emergency medicine, emergency medical treatment, and the organization of education during 1-month postgraduate residency training programs in the field of emergency medicine must be improved.

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