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SUCCESSFUL ONE-LUNG VENTILATION USING THE VIVASIGHT-EB BRONCHIAL BLOCKER TUBE FOR AN EMERGENCY LUNG INJURY. A SIMULATION PILOT DATA

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ABSTRACT

INTRODUCTION: The ability to perform endotracheal intubation is one of the basic skills that paramedics should demonstrate. However, in some cases where lung or bronchial injuries have occurred, it may be necessary to separate the lung by attaching a bronchial blocker and ventilating single lung.

The aim of the study was to evaluate the effectiveness of bronchial protection with VivaSight-EB bronchial blocker tube and one-lung ventilation by paramedics in conditions of simulated lung injury.

MATERIAL AND METHODS: The study was a prospective randomized cross-over simulation trial in which 27 paramedics took part. In the study, paramedics performed endotracheal intubation with ETVIEW SL and then introduced a VivaSight-EB bronchial blocker and one-lung ventilation. The bronchial protection procedure took place in two scenarios: (A) normal airway; (B) difficult airway. VivaSight-EB bronchial blocker introduction time (T1) and one-lung ventilation time (T2) and the efficacy of the procedure were analysed.

RESULTS: The efficacy of endotracheal intubation with ETVIEW SL tube was 100% during both Scenario A and Scenario B. The efficacy of endotracheal intubation with ETVIEW SL tube was 100%. The effectiveness of the first attempt to protect the bronchi with a bronchial blocker was 26% for both scenarios and the total effectiveness of bronchial protection was 100% in both cases. Time T1 for endotracheal intubation was 18sec for Scenario A (IQR; 16.5–25) and 20 sec for Scenario B (IQR; 17–25). The time to perform one-lung ventilation (Time T2) in scenarios A and B was 43 sec (IQR; 38–62.5) vs. 43.5 sec (38–65).

CONCLUSIONS: The simulation study confirmed the research hypothesis that the paramedics were able to perform one-lung ventilation using the ETVIEW-Blocker® bronchial blocker tube after a short training.

KEY WORDS: one-lung ventilation; paramedic; airway management; emergency medicine; lung injury; bronchial blocker

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INTRODUCTION

Traumatic injury to the tracheobronchial tree or lungs requires prompt, accurate diagnosis for optimum surgical treatment [1, 2]. However, under the

conditions of a medical emergency team, one of the key elements is the airway management in such a patient. Endotracheal intubation and ventilation of both lungs in case of bronchial or lung injury may

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adversely affect the haemodynamic of the patient, including multiple effects including the pneumothorax enlargement [3]. In this case, one-lung ventilation while blocking the other may be helpful.

One-lung ventilation during thoracotomy can be achieved via two basic techniques [4, 5]: use of a double-lumen endotracheal tube (DLT) consisting of an endotracheal and an endobronchial lumen allowing independent single-lung ventilation [6, 7]; or use of an endobronchial blocker (EBB) such as the Arndt blocker, which allows lung collapse distal to the occlusion [8, 9]. It has been recently demonstrated that DLT and endobronchial blocker are similar in their efficacy to achieve lung isolation for elective thoracic surgery [10]. In case of respiratory failure in pre-hospital conditions, endotracheal intubation is used, therefore the use of an endotracheal blocker may be more useful and easier to control by paramedics than intubation using a double-channel tube — which in the hands of personnel without adequate experience — may bring more complications than benefits to the patient [4]. A bronchial-blocker device consists of a small balloon that is purposefully inflated within the proximal portion of the main bronchus to isolate one of the lungs under bronchoscopic guidance. EBBs can be placed to achieve lung separation and may offer several advantages to patients with cardiac disease [11], or lung trauma [12]. The most significant advantage is the decrease in hemodynamic stress. Because the EBB is inserted through a single lumen tube, it is less stimulating than the insertion and manipulation of a double-lumen tube. Endobronchial blockers can be advantageous in patients with difficult airways or abnormal tracheobronchial trees.

An example of a bronchial blocker that can be used in prehospital conditions — on the event site — is the ETVIEW system. The ETVIEW SL endotracheal tube is a single lumen tube with an integrated camera that transmits images from the end of the distal endotracheal tube to the monitor attached to the endotracheal tube via a fibre optic cable. Thanks to this, a person performing endotracheal intubation in real-time can see the image from the end of the tube and is, therefore, able to perform endotracheal intubation more effectively — even in difficult Airways [13–15]. In case of one-lung ventilation using EBB, the endotracheal tube is inserted deeper than in the case of standard endotracheal intubation - in order to visualize the tracheal bifurcation, then during the insertion of the bronchial blocker it

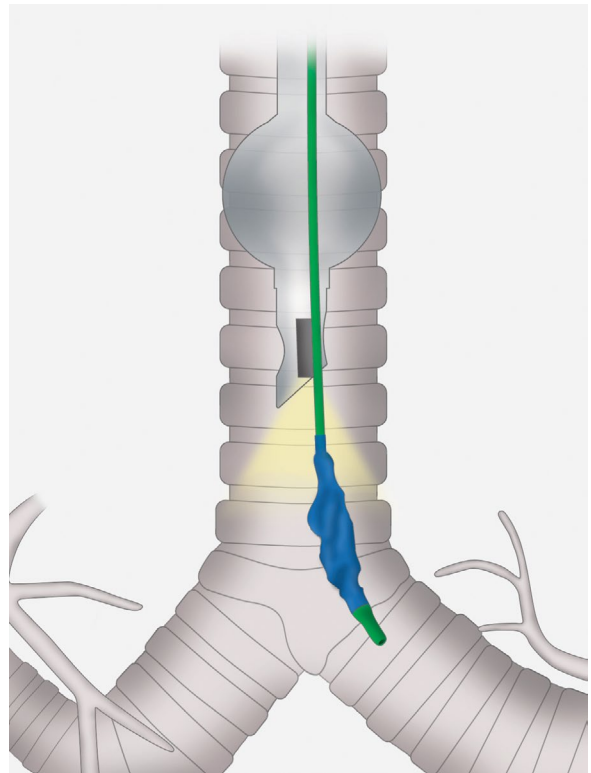


FIGURE 1. Coaxial placement of endobronchial blocker

is possible to monitor in real-time the movement of the blocker and insert it to the appropriate depth into the specific bronchi (Fig. 1).

The aim of the study was to evaluate the effectiveness of bronchial blocker tube and one-lung ventilation by paramedics in the conditions of simulated lung injury. The research hypothesis is that after a short training period, paramedics are able to perform one-lung ventilation using the ETVIEW-Blocker® bronchial blocker tube.

MATERIAL AND METHODS

The study was designed as a prospective randomized cross-over simulation study. The study protocol was approved by the Institutional Review Board of the Polish Society of Disaster Medicine (Approval no. 42.03.2019.IRB). Voluntary written informed consent was obtained from each participant. The data of this study were collected in May 2019. 27 paramedics with at least 1-year clinical experience participated in the study. None of the study participants had previous experience in intubation using bronchial blockers.

Each paramedic was given a standardized demonstration of EZ-Blocker® bronchial block-

er tube insertion. They were then allowed time (30 min.) to practice the one lung-ventilation on s Laerdal Airway Management Trainer (Laerdal, Stavanger, Norway). All intubations were performed using a 7.0 mm cuffed single-lumen tracheal tube (ETView Ltd., Misgav, Israel).

During the target study, the subjects had to perform endotracheal intubation and then insert a bronchial blocker into the left bronchial tube, secure the blocker and ventilate with one lung using a self-inflating bag. Intubation was performed in two scenarios:

- A) Scenario A — normal airways;
- B) Scenario B — difficult airways. In order to simulate difficult airways, the simulator tongue was inflated with air in order to obtain intubation difficulties at the level of Cormack-Lehane 3 grade.

SimMan 3G (Laerdal, Stavanger, Norway) was used to simulate a patient with an injured lung and was placed on a flat surface. Both the order of participants and methods were random, using Research Randomized (Fig. 2).

Measurements

The time to endotracheal intubation (Time T1), was defined as the time from the grasping the endotracheal tube to the inflation of the cuff sealing the endotracheal tube. T2 time was the time from grasping the intubation tube through the insertion of the bronchial blocker into the left bronchial tube, protection of the blocker until the first attempt to ventilate the right lung with the use of a self-inflating bag. The effectiveness of the procedure of introducing the bronchial blocker was considered a failure if it could not be accomplished within 150s

or in three attempts. Subjective evaluation of ease of use using a visual analogue scale score ranging from 1 (extremely easy) to 100 (extremely difficult) and overall success rate of intubation. Vocal cord visualization was assessed by using Cormack & Lehane classification [16].

Statistical analysis

Statistical analysis was performed using the Statistical version 12.0 for Windows (StatSoft, Tulsa, OK) software. Data are presented as number (percentage), mean \pm standard deviation (SD), or median (IQR, interquartile range), as appropriate. Nonparametric tests were used for the data that did not have a normal distribution. All statistical tests were 2-sided. The Wilcoxon test for paired observations was used to compare the different times and to determine the statistical difference for each group. McNemar test was used to evaluate the differences in intubation success rates. Cormack-Lehane grade and ease of procedure score were evaluated using the Stuart-Maxwell test. A p value < 0.05 was considered significant.

RESULTS

Twenty-seven paramedics completed this study. Participants had a median of 3 years' experience (range from 1 to 8 years). No paramedic had prior experience of using ETView endotracheal tube as well as ETView bronchial blocker. all participants, However, had clinical experience with direct laryngoscopy.

The detailed specification of the parameters is presented in Table 1. The efficacy of endotracheal intubation with ETView SL tube was 100% during

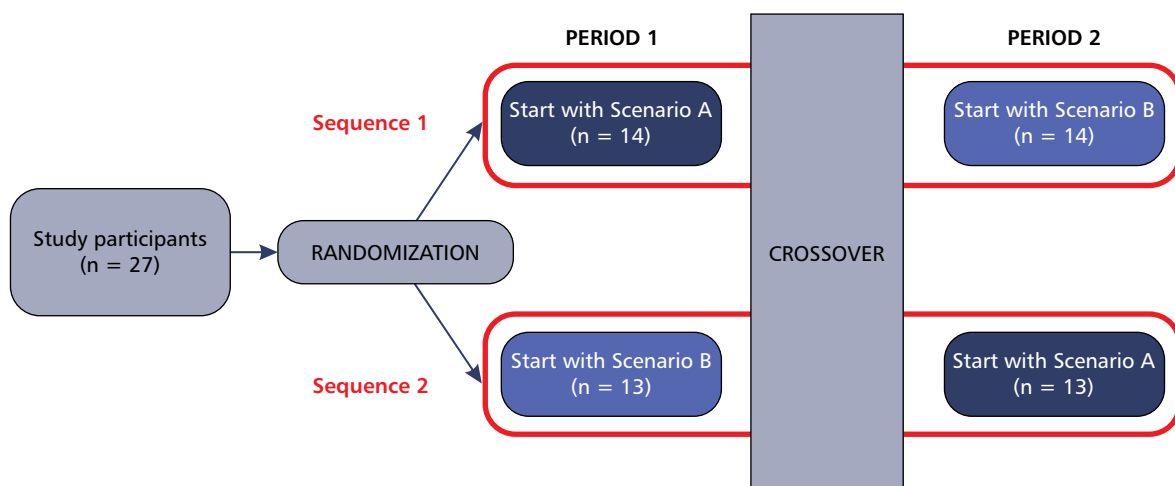


FIGURE 2. Randomization flow chart

Table 1. Comparison of study parameters

Parameter	Scenario A	Scenario B
Time T1 — time to success intubation [s]	18 (16.5–25)	20 (17–25)
Time T2 — time to one-lung ventilation [s]	43 (38–62.5)	43.5 (38–65)
Effectiveness of endotracheal intubation	27 (100%)	27 (100%)
The total efficiency of the procedure	27 (100%)	27 (100%)
Effectiveness of bronchial protection attempts		
1	26 (96.3%)	26 (96.3%)
2	1 (3.7%)	1 (3.7%)
3	–	–
Cormack-Lehane grade		
1	27 (100%)	25 (92.6%)
2	–	2 (7.4%)
3	–	–
4	–	–
Ease of procedure	35 (30–50)	37 (30–55)

both Scenario A and Scenario B. The efficacy of endotracheal intubation with ETVIEW SL tube was 100%. The effectiveness of the first attempt to protect the bronchi with a bronchial blocker was 26% for both scenarios and the total effectiveness of bronchial protection was 100% in both cases.

Time T1 for endotracheal intubation was 18 sec for Scenario A (IQR; 16.5–25) and 20 sec for Scenario B (IQR; 17–25). The difference in T1 intubation time was not statistically significant ($p = 0.644$). The time to perform one-lung ventilation (Time T2) in scenarios A and B was 43 sec (IQR; 38–62.5) vs. 43.5 sec (38–65; $p = 0.857$).

Cormack-Lehane grade in both scenarios was comparable and showed no statistically significant differences ($p = 0.638$).

The ease of performing the procedure assessed on the VAS scale in Scenario A was 35 points (IQR; 30–50) and was slightly simpler to perform than in Scenario B — 37 points (30–55; $p = 0.212$).

DISCUSSION

Pre-hospital airway management is one of the key skills personnel working in medical rescue teams should have [17–19]. To the best of the authors' knowledge, this study is an innovative study that demonstrates for the first time the effectiveness of

bronchial protection by means of a bronchial blocker and one-lung ventilation.

In the case of high-energy injuries, where lung injuries or bronchial rupture occurred, it may be helpful to isolate the damaged lung and ventilate with one-lung ventilation, similarly as it is often the case during thoracic surgery or cardiac surgery.

In the study, both normal and difficult airway conditions, endotracheal intubation using an ETVIEW SL integrated endotracheal tube was 100% effective. ETVIEW SL is one of the types of video laryngoscopes. The effectiveness of this method is confirmed by numerous publications. In Gawlowski et al. [20], as in the case of Kurowski et al. [13] intubators were able to intubate with ETVIEW SL after a short training session with high efficacy in various emergency scenarios. Also, studies conducted by Truszczyński et al. [14] indicate high efficacy of ETVIEW intubation under normal conditions, chest compression during simulated cardiopulmonary resuscitation or cervical spine immobilization.

The median intubation time in the study ranged from 18 to 20 seconds depending on whether the intubation procedure was performed under normal or difficult airway conditions. Truszczyński et al. [14] recorded intubation time of 19.5 seconds under normal airway conditions and 23.5 seconds under cervical spine immobilization. A comparable time was also obtained by Madziara et al. Using ETVIEW intubation in face-to-face intubation of a patient trapped in a vehicle [21].

The insertion of the blocker, the subsequent inflation of the sealing cuff and the attempted single lung ventilation were obviously associated with a longer time, but it is worth mentioning that in clinical conditions when desaturation occurs, it is possible to oxygenate the patient using an intubation tube — before the insertion of the blocker. The effectiveness of the insertion of the blocker under visual control — which is allowed by the use of ETVIEW tubes — allowed paramedics to perform the procedure of isolating the left bronchus with 96.3% efficiency during the first attempt. The total effectiveness of this procedure in both normal and difficult airways was 100%.

It is also worth noting that despite the difficulties associated with tongue oedema and thus intubation conditions defined by an independent anaesthesiologist at grade 3 of the Cormack-Lehane Scale, the problem of difficult airways was eliminated with direct laryngoscopy using the ETVIEW tube. This is an

unquestionable advantage of video laryngoscopes, which are particularly useful in conditions of difficult glottis visibility such as cardiopulmonary resuscitation, cervical spine immobilization, tongue oedema or many other life-threatening conditions requiring emergency endotracheal intubation.

The conducted research has both strengths and weaknesses resulting from the nature of the conducted research. An unquestionable limitation of the conducted study is the fact that it was carried out in the conditions of medical simulation and not real medical activities with the use of real patients. However, as numerous studies show, medical simulation allows for full standardization of performed medical procedures and multiple possibilities to perform them without exposing patients to injuries resulting from performed procedures [22–24]. Another limitation of the study is the fact that only paramedics are included in the study, however, as indicated in the title itself, this is a pilot study and currently there are ongoing activities aimed at extending the target group to physicians, including anaesthesiologists, as well as increasing the study group and adding other research scenarios, including simulating airway bleeding in order to confirm the effectiveness of the camera lens flushing system used in ETVIEW [25, 26].

The choice of paramedics as a pilot group was deliberate and dictated by the fact that they rely on their skills and knowledge in the field of airway management. The conducted study also has strong points, such as randomized cross-over research, as well as the use of one of the most advanced adult patient simulators during the study.

CONCLUSIONS

The simulation study confirmed the research hypothesis that the paramedics were able to perform one-lung ventilation using the ETVIEW-Blocker® bronchial blocker tube after a short training.

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THE QUALITY OF DEATH AND DYING OF PATIENTS UNDER AT-HOME PALLIATIVE CARE, EVALUATED BY FAMILY AND FRIENDS OF THE PATIENT

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ABSTRACT

INTRODUCTION: In Poland, there are no studies on the quality of dying and the moment of death. Studies described in the literature involve mostly the quality of life, care and treatment. Results of public surveys show that people have a lot of expectations of both the process and the moment of death. People pay attention to more and more widely known phenomenon of “good death and quality of dying”, especially in patients whose prognosis is not positive and the causative treatment process was terminated. The main objective of the work was to research the quality of the process of dying, and the moment of death within patients in terminal state, that were under free, at-home palliative care.

MATERIAL AND METHODS: Study material was gathered with a validated, translated into polish language, anonymous sheet QODD — The Quality of Dying and Death. The group of recipients are families and friends who took care of a dying patient, who was taken care of by a Home Hospice Centre of the Congregation of Marian Fathers in Warsaw. Research material was being gathered since the beginning of 2016–2018. The original QODD questionnaire consists of 31 questions, although modified versions with 17 questions exist. The questionnaire with 31 questions was used in the research.

RESULTS: 150 questionnaires were collected (150 deceased people). The vast majority, i.e. 78 (52%) of the group were women, the remaining percentage of 72 (48%) were men. The patients very often controlled the situation they were in, were able to independently consume a meal. In most cases they did not feel dyspnoea, which is a measurable indicator of symptom control and improves the quality of life. Very frequently the patients were not at peace with death, but in most cases, they did not feel fear. Very frequently spent time with spouses, close ones and children. In most cases, the patients did not want to talk about the funeral ceremony but mostly they got to say goodbye to their loved ones. In most cases the patients never felt the need to hurry the process of death, but they also did not want to use life-supporting options. Regardless of their awareness of death the patients still had a purpose in life.

CONCLUSIONS: There are a lot of advantages coming from the research. They can be separated into two areas: Medical: improving the quality of life, ability to contract benefits as a result of an evaluation of the care process in at-home palliative care.

Research: comparison of the quality of dying in patients of at-home palliative care with stationary care, comparison of individual providers among each other, researching the quality of death within various illnesses, researching the quality of death and dying in children.

KEY WORDS: home palliative care; quality of death; dying in dignity; end of life

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INTRODUCTION

In Poland, at-home palliative care is reimbursed for adult patients in cases of all tumours, illnesses caused by the human immunodeficiency virus, circulatory insufficiency, respiratory failure, repercussions of inflammatory neurological diseases, systemic lapses of the neurological system and decubitus ulcers [1]. At a home hospice, the patient is being provided with free nursing care no less frequently than two times a week, visits of psycho-oncologists and physiotherapists, social worker if needed. If the patient is interested, a clerical visit is also provided if needed [2]. The equipment needed for care and treatment of the patient is rented free of charge. Material assistance can also be provided in some cases. It is versatile and complex care directed at mitigating the symptoms of a progressive disease. In Poland, a view predominates that home hospice is just for patients in advanced stages of the disease, while in other countries it is being implemented within different stages of treatment, especially in patients with a serious prognosis [3].

MATERIAL AND METHODS

The study material was gathered with a validated, translated into polish language, anonymous sheet QODD — The Quality of Dying and Death. The group of recipients are families and friends who took care of a dying patient, who was taken care of by a Home Hospice Centre of the Congregation of Marian Fathers in Warsaw. Research material was being gathered since the beginning of 2016–2018. The original QODD questionnaire consists of 31 questions, although modified versions with 17 questions exist. The questionnaire with 31 questions was used in the research [4].

Inclusion criteria

The study group consists of deceased, adult patients (over 18) qualified for at-home palliative care contracted by the National Health Fund, regardless of the diagnosis. The respondents of a questionnaire survey are the caregivers of the deceased persons. It does not have to be an adult, because often the process of taking care of a terminally ill patient lays on children of the patient if they don't have a spouse or if the spouse is not able to resign from their career.

Exclusion criteria

Patients who remained unconscious at least 7 days before death were excluded from the research. Pa-

tients who could not verbally communicate a month before death were not excluded. The second excluded group were patients who went to a stationary hospice or a hospital more than 7 days before death. The third excluded group were patients whose death occurred less than 7 days after admission to the home hospice.

QODD — The Quality of Dying and Death

Questions are divided into 3 groups:

- Has the incident occurred within the last 7 days of the patient's life, and if the patient could not communicate in the last 7 days/the last month of their life?
- Has the incident happened?
- Has the incident happened any time before death?
- Score 0–5:
 - 0 — never
 - 1 — occasionally
 - 2 — every once in a while
 - 3 — frequently
 - 4 — very frequently
 - 5 — all the time

Imprints

There are two imprints included in the questionnaire: one applies to the person filling out the questionnaire, and the other one to the deceased patient. Applying to the person filling out the QODD — sex, age, education, employment type (medical, non-medical), place of residence. Applying to the deceased patient who was cared for by the home hospice- sex, age, education, place of residence, type of illness (cancerous, non-cancerous), time spent in care of the home hospice (in weeks), time from patients death to filling out the questionnaire (in weeks). Questions regarding the patient are grouped into sections: symptoms and personal control, preparing for death, moment of death, course of the disease, connection with family and an overall attitude. For 28 out of 31 questions the respondent answers in 0–5 scale, where 0 stands for never; 1 — occasionally; 2 — every once in a while; 3 — frequently; 4 — very frequently; 5 — all the time. The last 3 are yes or no questions.

Symptoms and personal control:

- How often did the patient feel pain?
- How often did the patient have control over what is happening?
- How often did the patient have a chance to independently ingest food?

- How often did the patient control emiction and defecation?
- How often did the patient feel dyspnoea?
- How often did the patient have enough energy?

Preparation for death:

- Did the behaviour of the patient show that the patient was at peace with death?
- Did the patient feel the fear of death?
- Was the patient concerned about the family's fear?
- Did the patient have any financial obligations related to the treatment?
- Did the patient have a clerical visit?
- Did the patient talk about the funeral ceremony?
- Did the patient take part in funeral preparations?
- Did the patient say their goodbyes to the family?
- Did the patient take part in important events?
- Did the patient get rid of negative feelings?

Moment of death (yes or no):

- Did the patient die at home?
- Were the patient's loved ones present in the moment of death?
- Was the patient aware in the past minutes of life?
- Family
- Did the patient spend time with their spouse/partner?
- Did the patient spend time with their kids?
- Did the patient spend time with extended family and/or friends?
- Did the patient spend time alone?
- Did the patient spend time with animals?

The course of medical care:

- Did the patient have conversations about end of life with the doctor?
- Did the patient feel the need to expedite the death?
- Did the patient feel the need to or wanted to avoid life-supporting treatments?

Overall attitude:

- Did the patient smile and laugh?
- Did the patient express their feelings?
- Did the patient have a goal in life?
- Did the patient have high self-esteem and did they respect themselves?

Statistical analysis

In order to answer the research questions, statistical analyses were carried out using the TIBCO Statistica 13.3 software. With its use, basic descriptive statistics were analysed along with Shapiro-Wilk tests as well as correlation analysis using Pearson's r

and Spearman's ρ , Student's t -test analysis for independent samples, one-way analysis of variance in the intergroup diagram. The classic threshold $\alpha = 0.05$ was considered the level of significance.

RESULTS

150 questionnaires were collected (150 deceased people). The majority, i.e. 78 (52%) of the group were women, the remaining percentage of 72 (48%) were men. Most of the respondents are women between the age of 30 and 50. Higher education dominates. Most of the people perform a non-medical profession and live in a city. Within patients in palliative care, men with secondary education and living in the city were dominating. Within the deceased, the diagnosis of cancer prevails. The patients very often controlled the situation they were in, were able to independently consume a meal. In most cases, they did not feel dyspnoea, which is a measurable indicator of symptom control and improves the quality of life. Very frequently the patients were not at peace with death, but in most cases, they did not feel fear. Very frequently spent time with spouses, close ones and children. In most cases the patients did not want to talk about the funeral ceremony but mostly they got to say goodbye to their loved ones. In most cases the patients never felt the need to hurry the process of death, but they also did not want to use life-supporting options. Regardless of their awareness of death the patients still had a purpose in life.

Relationship between the quality of death and dying and the patient's age

It was decided to verify the research hypothesis that there is a relationship between the quality of death in dying patients under palliative home care and their age. To this end, a number of correlation analyses were performed with the Pearson's r ratio, comparing the patient's age and the results of individual QODD subscales: Symptoms and personal control, Family, Moment of death, Course of medical care, Preparation for death, Holistic approach.

It turned out that there is a statistically significant, weak, negative correlation between age and the results of the Symptoms and Personal Control and Family subscales. In addition, there is a statistically significant, weak, positive correlation between age and the results of the Preparation for Death subscale.

This means that older patients present worse quality of death and dying in terms of disease symp-

toms and personal control, as well as family relationships while showing better preparation for death.

In the remaining subscales, no statistically significant correlation with age was noted. This means that the quality of death and dying in this regard was not related to the patient's age. The results are shown in Table 1.

The relationship between the quality of death and dying and the time spent in the home hospice

It was decided to verify the research hypothesis that there is a relationship between the quality of death in dying patients under palliative home care and the time spent in the home hospice. To this end, a number of correlation analyses were performed with the Spearman coefficient, comparing the time spent in the home hospice (in weeks) and the results of individual QODD subscales: Symptoms and personal control, Family, Moment of death, Course of medical care, Preparation for death, Holistic approach.

In none of the subscales there were statistically significant correlations with the time spent in the home hospice. This means that the quality of death and dying was not linked to the time spent in the care of the home hospice. The results are shown in Table 2.

Quality of death and dying depending on gender

Subsequently, it was decided to answer the research question of whether men and women under palliative home care differ from each other in quality of death and dying. For this purpose, both sexes were

compared in terms of the results of individual QODD subscales: Symptoms and personal control, Family, Moment of death, Course of medical care, Preparation for death, Holistic approach. Student's t-tests were carried out for independent tests.

It turned out that men in the study presented significantly higher results for the Family subscale than women — it means that the quality of death and dying in men in this respect was significantly better than in women. The strength of the observed relationship, measured by Cohen's d factor, proved to be high.

However, as regards the remaining QODD subscales, the quality of death and dying did not differ significantly between the two sexes. The results are shown in Table 3.

DISCUSSION

In recent years, the problem of the process of dying and its quality has become a subject of particular interest not only to representatives of medical sciences, philosophers, psychologists, but also to all people. Many people have begun to ask themselves whether a person who suffers must suffer [5]. The problem of the quality of dying is, good death, the will of the end of life is more emphasized by foreign than Polish researchers [6]. Although palliative care in Poland is flourishing, death itself is still marginalized. Perhaps this is due to the author's own experience that modern education of medical staff treats the patient's

Table 1. Relationship between age and quality of death and dying

		Age
Symptoms and personal control	r Pearsona	−0.184
	P	0.024
Family	r Pearsona	−0.206
	P	0.012
Moment of death	r Pearsona	−0.101
	P	0.217
The course of medical care	r Pearsona	−0.008
	P	0.923
Preparation for death	r Pearsona	0.176
	P	0.031
Holistic approach	r Pearsona	−0.100
	P	0.223

Table 2. Relationship of time spent at home hospice with the quality of death and dying

		Time spent in the home hospice
Symptoms and personal control	ρ Spearmana	−0.001
	P	0.988
Family	ρ Spearmana	0.014
	P	0.862
Moment of death	ρ Spearmana	0.013
	P	0.878
The course of medical care	ρ Spearmana	0.119
	P	0.147
Preparation for death	ρ Spearmana	0.096
	P	0.242
Holistic approach	ρ Spearmana	0.032
	P	0.702

Table 3. Quality of death and dying by gender

	Women (n = 78)		Men (n = 72)		t	p	95% CI		d Cohena
	M	SD	M	SD			LL	UL	
Symptoms and personal control	45.90	16.89	46.53	18.13	-0.22	0.826	-6.30	5.04	0.05
Family	43.33	13.45	50.67	13.36	-3.35	0.001	-11.66	-3.00	0.73
Moment of death	57.26	33.93	64.35	29.78	-1.35	0.178	-17.37	3.20	0.29
The course of medical care	71.71	23.96	77.59	20.21	-1.62	0.108	-13.02	1.25	0.34
Preparation for death	41.44	14.24	39.69	12.23	0.80	0.425	-2.53	6.01	0.17
Holistic approach	59.81	18.61	57.08	17.70	0.92	0.361	-3.13	8.58	0.20

death as a failure. In the age of advanced technology the death limit is prolonged. However, the moment comes that it cannot be remedied [1]. The author's research coincides with international literature. Home palliative care, i.e. the one most comfortable for the patient, reduces pain, shortness of breath, reduces overwhelming pain [3]. It often allows one to finish life as if the patient wanted it [7]. It allows one to talk about death, the very process of passage, funeral. It allows to spend time with the loved ones, but also with pets. patients dying with dignity paradoxically improve their quality of life that is left to them. The family, palliative care team, allows to experience the loss calmly and consciously — by continuing care after the patient's death [8].

There are a lot of advantages coming from the research. They can be separated into two areas:

- medical: improving the quality of life, ability to contract benefits as a result of the evaluation of the care process in at-home palliative care,
- research: comparison of the quality of dying in patients of at-home palliative care with stationary care, comparison of individual providers among each other, researching the quality of death within various illnesses, researching the quality of death and dying in children.

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ANALYSIS OF QUALIFIED FIRST AID PROCEDURES FOR INJURIES IN THE ACTIVITIES OF THE STATE FIRE SERVICE IN LUBLIN IN 2016–2018

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ABSTRACT

INTRODUCTION: The State Fire Service (SFS) medical activities are conducted at the level of qualified first aid (QFA). This is a lower standard than emergency medical services (EMS) implemented by The Polish EMS, however, the number of QFA procedures available to firefighters allows them to conduct effective medical operations in both life-threatening and traumatic and non-traumatic life.

The aim of the study is a comparative analysis of QFA procedures for injured trauma.

MATERIAL AND METHODS: Medical activities of the SFS in Lublin were analysed, from which events and procedures regarding injuries to injured persons and rescuers themselves during activities over a three-year period (i.e. in the years 2016–2018) were separated. In order to analyse the collected results, medical procedures concerning only injuries were identified, which are the most numerous group of procedures. For the purposes of analysis, the procedure was divided into two groups: (1) injuries – burns; (2) injuries.

RESULTS: In 2016, $n = 133$ trauma procedures were implemented among all medical activities. In 2017, $n = 330$ trauma procedures were implemented among all medical activities, while in 2018 $n = 245$ trauma procedures were implemented. In 2016, burns affected people with an average age of 56 ± 14 years, in 2017 — 51 ± 21 years, and in 2018 — 49 ± 19 years. The average for a total of three years of people with burns was 39 ± 19 years.

CONCLUSIONS:

1. Traffic events (accidents, collisions, deductions) constitute the largest number of local threats.
2. QFA procedures well suited to current threats, officers of SFS Lublin in the examined period used 20 out of 22 QFA procedures, including most of the procedures regarding injuries.

KEY WORDS: State Fire Service; qualified first aid; injuries — burns; injuries; firefighters

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INTRODUCTION

The State Fire Service (SFS) medical activities are conducted at the level of qualified first aid (QFA). This is a lower standard than emergency medical

services (EMS) implemented by The Polish Emergency Medical Services (EMS), however, the number of QFA procedures available to firefighters allows them to conduct effective medical operations in

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both life-threatening and traumatic and non-traumatic life [1, 2].

The entities of the National Rescue and Firefighting System (NRFS) when they first implement medical procedures, significantly improve the prognosis of people at risk, and in the case of trauma victims they start the golden hour standard [3, 4].

Officers of the SFS, being at the place of call, are the first to provide the QFA, then draw up medical records of the assistance provided. In situations when medical rescue teams (MRT) units are in place first, or commutes to the event equally with the NRFS deputies, the MRT members direct the medical action, decide on implemented EMS and keep medical documentation. In this situation, NRFS officers carry out auxiliary medical activities at the MRT's request or order, without creating an additional QFA card. The exceptions are events in which firefighters use equipment from their sets (dressings, hydrogels, the set is oxygen therapy). Then the card is inserted to confirm the wear of the equipment. On this basis, shortcomings are made up after returning to the barracks [1, 5–7].

Equipment that firefighters have at their disposal when using trauma procedures:

1. Immobilization of suspected fractures, dislocations:

- orthopaedic board — the same pattern as in MRT an Emergency Departments (ED). In practice, it happens to switchboards between SFS and MRT, when firefighters are at the place of the call first, they transfer the victim to their board. According to the guidelines of International Trauma Life Support (ITLS) and Prehospital Trauma Life Support (PTLS), the 'one stretcher' principle is applied from the scene of the incident to the hospital, so the injured person goes through ZRM to ED on the board of firefighters who get a replacement board from MRT. The board has 4 sets of straps to secure the injured person for transport and a set of blocks for immobilizing the head and cervical spine. The transport handles are large enough to allow a handle in the SFS protective glove [8–11],
- Kramer rail set — for immobilizing limbs and joints, in various sizes. Rails with the possibility of bending for modelling to the existing position of the limb up to 180 degrees. The set consists of 14 pieces of rails in covers

'protective sleeves' of material impervious to liquids, and easily washable,

- orthopaedic collars — disposable of artificial waterproof material, in various sizes. They have the ability to adjust the size, adapt to the victim [1, 12].
- #### 2. Wound care, stopping bleeding:
- sterile gases — in sizes $\frac{1}{4} \text{ m}^2$, $\frac{1}{2} \text{ m}^2$, 1 m^2 ,
 - sterile compresses,
 - elastic bandages of different widths,
 - triangular textile scarves,
 - elastic bandage nets — an alternative to bandaging when time is short. They significantly reduce the time the dressing is placed at the bleeding site, except in the case of a haemorrhage. In intensive bleeding situations, a pressure dressing is applied to the wound using a bandage, the mesh will not provide such pressure,
 - valvular wound dressing for open wounds of the chest — is aimed at removing the air extracted from the pleural cavity, prevents the formation of pneumothorax which arises after the equalization of pressure between the atmosphere and the pleural cavity,
 - one-piece clamp (tactical) — 4 cm wide, with the possibility of smooth adjustment and a place to record the time of putting on visible on. In practice, rarely used during events and injuries with major external bleeding. As a last resort, pressure wound dressing, with subsequent layers added, is ineffective. An important necessity to use it and at the same time sense is during mass accidents, where limb haemorrhage will be revealed during pre-segregation. The segregation standard allows you to devote a minimum of time to one victim, so it would be a waste of time and mistake of the rescue rota conducting segregation to put a pressure dressing (gauze and bandage) on the site of the haemorrhage. Haemorrhage from a limb from a large blood vessel can cause hypovolemic shock and cardiac arrest within a few minutes [1, 5–7, 13].

The aim of the study is a comparative analysis of QFA procedures for injured trauma.

MATERIAL AND METHODS

The study was retrospective. Information was obtained from SFS event reports (trips) in Lublin in

2016–2018, and from the SFS Decision Support System. The SFS Lublin area (land and city parts) was the area of research.

In order to analyse the collected results, medical procedures concerning only injuries were identified, which are the most numerous group of procedures. For the purposes of analysis, the procedures were divided into two groups:

1. injuries (burns) — QFA14, QFA 15;
2. injuries — QFA 5, QFA 6, QFA 7, QFA 8, QFA 9, QFA 10, QFA 11, QFA 12, QFA 13 — Table 1.

Commander of the City Commander's permission to access reports was received. All analysed data are anonymous, both in terms of injured parties, codenames and personal warehouses of SFS

hosts, and services of cooperating services, in accordance with the Act on the protection of individuals with regard to the processing of personal data. The presented results are in such a way as to prevent possible identification of specific events and persons participating in them.

Statistical analysis

Results concerning quantitative variables were presented as average values \pm standard deviation. Qualitative variables (age, sex) were presented as quantity (n) and percentage values of the whole group (%). Statistica 13.3 software (Tibco Inc., Tulsa, USA) was used in the statistical analysis.

RESULTS

During the three analysed years, the hosts of SFS Lublin were available 15 017 times, respectively 4964 times in 2016, 4992 times in 2017 and 5061 times in 2018. In the three years described in 309 events, firefighters conducted 493 medical activities, which constituted 2.05% of all trips (Tab. 2). The analysis took into account events in which at least one QFA procedure was implemented, for at least one person injured in the event. In general, trips consist of fires, local threats and false calls, in accordance with the rules of Decision Support System SFS. The two main groups of events, apart from a false alarm, are only divided into types of events depending on the call, the activities carried out and the specialized equipment used.

In 2016, $n = 133$ trauma procedures were implemented among all medical activities.

Table 1. Qualified first aid procedures for injuries used by the National Rescue and Firefighting System (NRFS) [1]

Procedure number	Name of the procedure
5	Injury and suspected head injury
6	Injury and suspected spine injury
7	Injury and suspected chest injury
8	Injury and suspected abbell injury
9	Injury and suspect of diameter injury
10	Injury and suspected traffic organ injury
11	Wounds
12	Injury amputation
13	Hypovolemic shock — preliminary procedure
14	Thermal burn
15	Chemical burn

Table 2. General characteristics of the procedures for injuries performed in 2016–2018

2016			2017			2018		
QFA	N	%	QFA	N	%	QFA	N	%
QFA5	17	13.6	QFA5	53	22.5	QFA5	44	33
QFA6	43	34.4	QFA6	85	36.1	QFA6	44	33
QFA7	8	6.4	QFA7	15	6.3	QFA7	24	18
QFA8	2	1.6	QFA8	19	8	QFA8	14	10.5
QFA9	5	4	QFA9	23	9.8	QFA9	12	9
QFA10	20	16	QFA10	49	20.8	QFA10	22	16.5
QFA11	29	23.2	QFA11	72	30.6	QFA11	56	42
QFA12	0	0	QFA12	0	0	QFA12	0	0
QFA13	2	1.6	QFA13	4	1.7	QFA13	17	12.8
QFA14	7	5.6	QFA14	10	4.2	QFA14	12	9
QFA15	0	0	QFA15	0	0	QFA15	0	0

In 2017, $n = 330$ trauma procedures were implemented among all medical activities, while in 2018 — $n = 245$ trauma procedures were implemented. Grouping procedures for specific events is important for the study. If there were injuries to many parts of the body with a high-energy mechanism (fall from a height, traffic accident), several trauma procedures were used for one victim.

In 2016, burns affected people with an average age of 56 ± 14 years, in 2017 — 51 ± 21 years, and in 2018 — 49 ± 19 years. The average for a total of three years of people with burns was 39 ± 19 years — Figure 1. The average age of people with injuries in 2016 was 38 ± 18 years, similar to injured people without injuries 38 ± 19 years. In 2017, people with injuries were on average 36 ± 18 years old, while in 2018 — 40 ± 18 years old. The average of three years for people with injuries was 39 ± 18 years. (Fig. 1 and Fig. 2)

Detailed analysis of the event using traumatic procedures

Happening report: bus collided head-on with a passenger car — 7 people injured forces and resources available: 2 SFS (6 people), 4 MRT (12 people), 4 police patrols (8 people) description of the incident: an accident occurred on the scene of a passenger bus carrying seven people and a passenger car in which three people travelled. Based on the diagnosis, it was established that the driver of the passenger bus hit the energy-absorbing barrier for unknown reasons and then rolled over several times. Then the off-road bus hit the off-road Honda at high speed, causing the roof to tear, as well as significant injuries to passengers. At the time of arrival of the SFS, all

victims were already behind the damaged vehicles, three bus passengers the doctor declared dead as a result of injuries, and one person was resuscitated. Additional MRT commuters successively took over other conscious victims, providing them with necessary medical assistance. The actions of the rescuers consisted of securing the place of the incident, dressing and bandaging head and limb wounds, assisting MRT in transporting the injured on medical boards to ambulances, and after taking the injured on the order of the prosecutor proceeded to lighting the area of action to secure evidence.

- injured: 7, injured rescuers: 0, death: 3,
- weather conditions: clear, $+14^{\circ}\text{C}$.

DISCUSSION

In the analyzed period, most of the events with medical activities conducted by the SFS are communication events. This includes collisions of 2–3 cars with reports: 'collision of 2 cars', 'accident of 3 cars', 'bus accident with a passenger car', 'collision of 4 cars', as well as incidents with individual cars with reports such as rollover of a car, 'the vehicle hit a tree', 'the car entered a ditch', 'the car hit a fence/lamppost'. To traffic incidents one should add rare cases of collision of a car with a two-wheeler, an animal (in the examined material there was a collision with a boar, where the driver suffered injuries and required the help of QFA), and several deductions that the SFS reached faster than MRT. Traumatic procedures were used not only for the victims. During the events covered by the analysis of 10 cases, they were injuries to the rescuer during fire-fighting and rescue operations. All cases qualified as a 'lightweight lifeguard

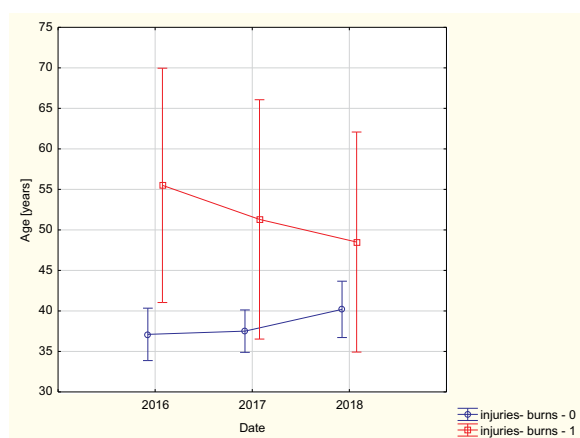


FIGURE 1. Analysis of the age of victims with burns in 2016–2018

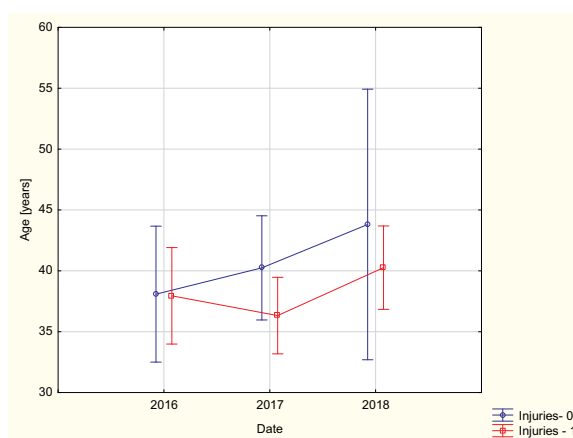


FIGURE 2. Analysis of the age of victims with injuries in 2016–2018

accident', granted to QFA at the scene of the accident, transport with the participation of MRT at the Emergency Room. In none of the cases described there was a life-threatening condition or permanent damage to health [14–16].

The most common reasons for calling SFS, in which the injured had at least one trauma procedure implemented in:

- '2 cars accident',
- 'motor fell into the ditch',
- 'hit by cyclist',
- 'car fell out of the way',
- 'accident, car in a ditch',
- '3 cars collision, unconscious person',
- 'TIR accident on the side',
- 'crushed by a truck'.

Among the reasons for disposing of events in which firefighters were injured were fires dominating $n = 6$, the rest of the reasons with equal participation $n = 1$. Among the types of events with injuries to firemen, there is no communication event, which is the most common type of event.

Available data from Road Traffic Office [17] show that over the years 2016–2018 the number of people injured in accidents has decreased. Communication events accounted for 2016 — 63%, 2017 — 73% and 2018 — 61%, respectively, in subsequent years. Most QFA procedures for injuries are used during communication events — QFA5–QFA13 procedures, much less during fires and chemical hazards — QFA14 and QFA15 procedures.

It should be remembered that in the event of a fire, the procedure regarding injuries – burns is not only the procedure used. During fires, injuries, sprains as other causes of trauma procedures are possible, as well as inhalation poisoning as the causes of non-traumatic procedures.

CONCLUSIONS

1. Traffic events (accidents, collisions, deductions) constitute the largest number of local threats.
2. QFA procedures well suited to current threats, officers of SFS Lublin in the examined period used 20 out of 22 QFA procedures, including most of the procedures regarding injuries.

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COMPARISON OF THE ANXIETY LEVELS BETWEEN THE FAMILY MEMBERS OF THE PATIENTS PRESENTING TO THE PAEDIATRIC TRAUMA UNIT AND PAEDIATRIC EMERGENCY UNITS

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ABSTRACT

INTRODUCTION: It is not the right behaviour to accept every anxiety pathologically. On the contrary, the sense of anxiety is an indicator of the response of individuals to internal or external changes. More importantly, anxiety is a beneficial affective state for individuals who contribute to the development of self and bodily adaptability to the new environment in which they live.

MATERIAL AND METHODS: This is a prospective study. The study was conducted on the parents of the patients who applied to the paediatric emergency department and paediatric trauma units of the emergency department at Atatürk University Faculty of Medicine. Beck Anxiety Scale was administered to one of the relatives who brought the patient to the hospital. Beck anxiety test was filled in by using face-to-face interview method. Pre-defined study forms for patients included in the study were completed.

RESULTS: The study was completed with 68 family members in both groups. The values of the patients who were admitted to the paediatric emergency and adult emergency departments on the Beck Anxiety Scale were equal.

CONCLUSIONS: family members of paediatric patients admitted to hospital were compared; The family members of the paediatric trauma unit and the family members of the paediatric emergency department have the same level of anxiety.

KEY WORDS: anxiety; paediatric patients; emergency; paediatric trauma unit; family members

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INTRODUCTION

The word anxiety is derived from the word angh, which means sore throat, distress. The word Angh comes from the Indo-Germanic language family. The state of anxiety was first mentioned in the Gil-

gamesh epic, written in 3000s before Christ [1, 2]. In short, anxiety is an individual's response to environmental or physical changes for attack and defence purposes. The basis of their actual behaviour is to preserve the self, integrity and values that exist

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in that individual due to the inheritance inherited from the evolutionary process [3, 4]. It is not correct behaviour to accept each anxiety pathologically. On the contrary, the sense of anxiety is an indicator of the response of individuals to internal or external changes. More importantly, anxiety is a beneficial affective state for individuals who contribute to the development of self and bodily adaptability to the new environment in which they live [5]. However, exaggerated responses to internal or external stimuli, it is inevitable that any condition that damages the self-integrity of people affects socially negatively and even disrupts body physiology is inevitable [3].

MATERIAL AND METHODS

Study design and setting

This is a prospective study. The study was conducted with face to face interviews with the family members of the patients admitted to the paediatric emergency department and paediatric trauma units of the emergency department of Atatürk University School of Medicine. The study was conducted on 01.10.2016–31.01.2017.

Patients

In the paediatric trauma emergency department in our hospital, services are provided to paediatric trauma patients. In the paediatric emergency unit, patients without trauma are served. patients with fever, nausea and vomiting. Our study was carried out after the consent of the accompanying persons (only the mother or father was asked to fill the scale) of the patients who applied to the paediatric emergency department of our hospital's paediatric health and diseases. Companions who did not give written consent and who were life-threatening in their patients were not included in the study.

Measurements

The pre-determined study forms were completed for the patients included in the study. The diagnoses of the patients, patient genders, family member ages, family member genders and scores from the Beck Anxiety Scale were recorded. Beck anxiety test was filled in by using a face-to-face interview method.

Beck Anxiety Scale

It is a self-assessment test. It is used to investigate the frequency of anxiety symptoms experienced by

individuals. Likert type is measured. In our country, reliability and validity studies have been made and accepted. The test consists of 21 items. For each item, the participant is asked to score between 0–3. According to the answers given, the severity of the anxiety experienced by the people is determined.

Statistics

The analyses were performed with IBM SPSS 20 statistical analysis program. Data were presented as mean, standard deviation, median, minimum, maximum, percentage and number. Shapiro-Wilk and Kolmogorov-Smirnov tests were used to evaluate the normal distribution of continuous variables. In the comparison between two independent groups, the Independent Samples t-test was used when the normal distribution condition was satisfied, and the Mann-Whitney U test was used when not provided. The comparison between the categorical variables was made using the Chi-square test and Fisher's Exact test. Statistical significance level was taken as $p < 0.05$.

RESULTS

The study was completed with 68 family members of patients who applied to the emergency department and 68 family members of patients with trauma to the emergency department. 37 patients admitted to the paediatric trauma units of emergency department were male and 34 of the family members of the patients admitted to the paediatric trauma units emergency department were male. The most common reason for admission to the paediatric emergency department was fever with 51 patients. This was followed by vomiting in 10 patients and diarrhoea in 7 patients. The majority of the patients admitted to the paediatric trauma units of emergency department were admitted after the fall ($n = 60$). 8 patients were admitted after a traffic accident. The mean age of the parents of the patients admitted to the paediatric emergency department was 33.09 ± 7.46 . The mean age of the parents of the patients admitted to the paediatric trauma emergency was 32.88 ± 9.06 ($p > 0.05$). According to the results of the beck anxiety test applied to the parents of the paediatric patients included in the study; The mean value of the parents of the patients who applied to the paediatric emergency department was 10.85 ± 9.17 and the value of the parents of the patients who applied to the paediatric

Table 1. Beck depression test scores and the mean age of parents

	Beck Depression Test scores	The Mean Age
Paediatric Emergency Department	10.85 ± 9.17	33.09 ± 7.46
Paediatric Trauma Emergency Department	10.90 ± 6.40	32.88 ± 9.06

trauma emergency was 10.90 ± 6.40 ($p > 0.05$). According to Beck Depression Test scores, this was not clinically significant.

DISCUSSION

Anxiety occurs in life-threatening events as a normal reaction to life events such as separation from a loved one or environment, physical illnesses. Along with anxiety, autonomic and somatic symptoms are seen at the same time. This prevents further damage as a protective mechanism. In some cases, the stimuli coming from the inner world of the individual without any external stimuli can cause an anxiety sensation to develop automatically. If the defence mechanisms in individuals are meaningfully healthy, they can cope with controlling anxiety, but if individuals are not fully mentally healthy, the anxiety may become chronic. If a person cannot control his or her anxiety, a mental disorder called anxiety disorder occurs. Anxiety disorders have a higher prevalence of life in women (30%) than men (19%). This ratio decreases in those with high socioeconomic status [6, 7]. Anxiety is distinguished from other forms of effect by unpleasant features. Anxious person may develop psychological symptoms such as anxiety, excitement, a sudden bad feeling or suspicion. The difference between anxiety and fear is that the source of anxiety is often uncertain. Mild anxiety accelerates the process of adapting to new conditions in individuals and supports their mental development. mild anxiety, therefore, is a useful feeling for people. There is an optimal range in which anxiety positively affects a person's performance. in people above these levels it can cause adversities. Anxiety above a certain level no longer acts as adaptive but acts as a barrier. The extent of the adaptive and nonadaptive effects of anxiety should be well established. Anxiety states that include physical symptoms such as muscle tension, dry mouth, palpitations and tremors that cause impaired inter-human ties, which decrease the occu-

pational functions of chronic individuals should be considered pathologically [8]. Generally, the economic situation can cause problems in the workplace, health problems, problems of children, housework and any event in the social environment. In addition, it can be seen in somatic symptoms as a cause of stress [9–11]. Generalized anxiety disorder is a disorder that is associated with feelings of significant tension, anxiety, worries about everyday events and, often chronic and sometimes intermittent, and this condition decreases quality of life [12, 13].

It has been described according to DSM-5 of the anxiety disorder related to another health condition [14, 15]. Accordingly, anxiety may also develop due to health problems. The aim of this study was to investigate whether the parents of the paediatric patients who admitted to the hospital urgently had more anxiety in cases such as falls, admission to the emergency department after traffic accidents and nausea. In our study, it was found that the parents of paediatric patients who applied to both the paediatric trauma emergency department and the paediatric emergency department had the same level of anxiety.

CONCLUSIONS

Irrespective of the complaints of the children's emergency admission to the hospital, it causes the same level of anxiety in family members. Paediatric patients are a particularly important group of patients for families. Families are protective of their children and are concerned about their hospital application. In our study, emergency department applications of children were studied. According to the results of the study, it was found that the families of the patients who applied to the paediatric emergency department and who applied to the paediatric trauma emergency department had similar levels of concern. the reason for this is that all emergency applications should be given equal priority regardless of the reason for the application of the families. All families are equally concerned about their children.

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EPIDEMIOLOGY OF LIMB INJURIES IN PAEDIATRIC PATIENTS RECEIVING CARE FROM EMERGENCY MEDICAL SERVICE TEAMS: DESCRIPTIVE ANALYSIS

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ABSTRACT

INTRODUCTION: Injury-related interventions currently place a heavy workload on emergency medical teams in both adults and paediatric patients. One of the most common types of injuries are limb injuries caused by physical activity, falls or traffic accidents. It is extremely important to provide adequate protection for the paediatric patient in case of injury, as homeostasis disorders can occur very quickly in this age group.

The aim of the study was to obtain data on the type and frequency of limb injuries in the group of paediatric patients who received medical rescue services interventions. An attempt was also made to specify the most frequent causes of limb injuries.

MATERIAL AND METHODS: The study was based on a retrospective analysis of medical records of emergency rescue teams in the period from November 2017 to October 2018. The study included an analysis of interventions to patients under 18 years of age to whom EMS teams intervened due to limb injury. The analysis included sociodemographic data such as age, gender, time and place of the injury, as well as the type of injury based on the ICD-10 classification.

RESULTS: In the studied period, 289 interventions in paediatric patients with limb injuries were recorded, which constituted 9.8% of all interventions in paediatric patients. The main site of the injury was a school. Upper limb injuries were reported in 123 cases, which constituted 42.6% of the intervention to the studied group of patients. The upper limb injuries were predominantly caused by forearm fractures ($n = 33$; Tab. 3), while the lower limb — by knee joint injuries.

CONCLUSIONS: Limb injuries account for nearly 10% of all EMS interventions in paediatric patients. The main site of the injury was a school and the most frequent were upper limb injuries including forearm fractures, while for the lower limb — knee joint injuries. Further action should be taken to reduce the number of limb injuries in children.

KEY WORDS: limb; trauma; injury; prehospital care; emergency medicine service; emergency medicine

Disaster Emerg Med J 2019; 4(4): 151–157

INTRODUCTION

Injury-related interventions currently place a heavy workload on emergency medical teams in both adults and paediatric patients. Injuries to children

are a very important reason for visiting emergency departments and hospitalization. Children's injuries have different causes and, depending on the severity and location of the injury and co-morbidities, maybe

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a significant cause of mortality and chronic health disability. Limb injuries occur in children in different age groups, and the age of children may influence the location of injuries and their characteristics [1]. The occurrence of injuries is influenced by many factors related to parental care, environmental exposure, sport and physical activity [2]. In some parts of the world, violence and ongoing military activities are an important factor in child injuries [3].

One of the most common types of injuries are limb injuries caused by physical activity, falls or traffic accidents. Injuries caused by sport practised by young people are of special importance [4] due to the different characteristics of the injuries, for example injury rates can be greater in collegiate versus high school baseball and in competition versus practice [5]. The number of injuries to children is evidenced by the fact that on average, a child is treated in a US emergency department for a nonfatal consumer product- or sports and recreational activity-related injury every 6 seconds [6]. One of the causes of limb fractures in children can be abuse — especially common among infants [7]. Also, mistakes committed by parents and guardians of children can cause a problem [8]. It is extremely important to provide adequate protection for the paediatric patient in case of injury, as homeostasis disorders can occur very quickly in this age group. There are large differences in the mechanisms of injury, injury response, clinical signs and results of image examinations in adults and children. Injuries in children, especially in extreme age groups, require in-depth clinical evaluation and specialist consultation. In many countries, the cost of treating injuries in children and, above all, the cost of further treatment and rehabilitation are being raised [8].

The aim of the study was to obtain data on the type and frequency of limb injuries in the group of paediatric patients who received medical rescue services interventions. An attempt to specify the most frequent causes of limb injuries was also made.

MATERIAL AND METHODS

The study was designed as a retrospective study of medical records of medical rescue teams from Piaseczno, Grodzisk Mazowiecki and Pruszków districts. The study protocol was approved by the Institutional Review Board of the Polish Society for Disaster Medicine (Approval number: 32.02.2018.IRB).

We analysed paediatric patients transported by a countywide EMS system between November

2017 and October 2018. The EMS catchment area includes urban, suburban, and rural areas over approximately 1234 square kilometres containing officially a population of 437 thousand people. However, the official population statistics are understated as the survey areas are a kind of accommodation for Warsaw. Thus, the real population may exceed one million people.

Special attention has been paid to the main socio-demographic features such as age, gender, location of the injury and other circumstances of the injury such as time and place of occurrence. All diseases are classified according to the International Statistical Classification of Diseases and Related Health Problems, Revision X (ICD-10).

The material was subjected to basic statistical analysis with the use of Statistica 13.3EN and MS Office Excel 2010, calculating basic descriptive statistics. For statistical comparisons, we used Fisher's exact test for qualitative variables and Student's test for quantitative variables. Values of $P \leq 0.05$ were considered significant.

RESULTS

Population characteristics

In the period under study, medical rescue teams performed 42 482 interventions, of which 2942 were performed in patients under 18 years of age. Of all the interventions performed in paediatric patients, 9.8% ($n = 289$) were interventions for limb injuries.

The majority of the patients were males, accounting for 59.9% of the studied group. The mean age of the study group was 11.4 ± 3.9 years and was slightly higher for boys than girls (11.4 ± 3.9 vs. 11.3 ± 3.8 years, respectively; $p = 0.809$; Fig.1).

The main place of injuries in the study group was a school, then a public place, a house and finally traffic. The detailed characteristics of the study group are presented in Table 1. In the case of injuries at home, they concerned the youngest patients (Fig. 2). The median age of boys and girls was 9.3 ± 4.8 vs. 9.3 ± 5.3 years. In the case of public place injuries, the most common among boys was at the age of 12.4 ± 3.7 years, and in the case of girls — 11.1 ± 3.6 years. The age of road traffic injuries was equal for girls and boys (13.1 ± 3.5 vs. 11.5 ± 3.9 years, respectively), and for school injuries, the median age of injured girls was 12.0 ± 2.7 years and for boys 12.2 ± 3.0 years.

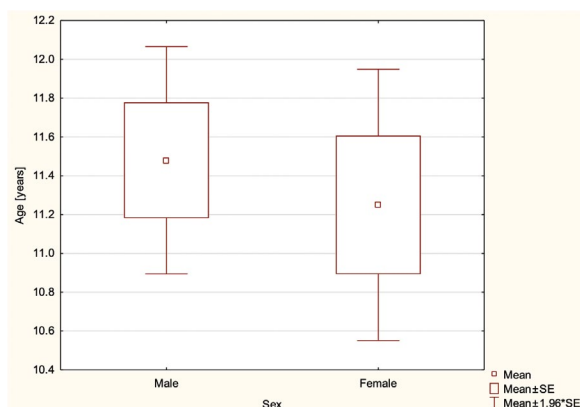


FIGURE 1. Mean age of study participants

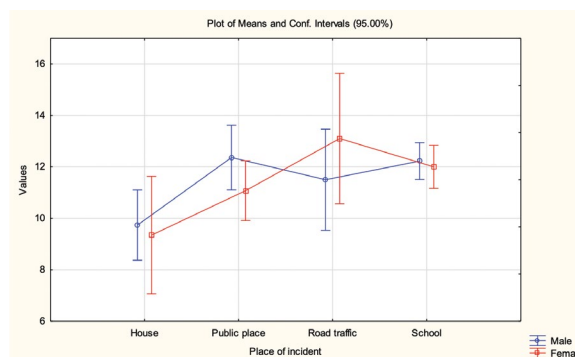


FIGURE 2. The main place of injuries in the study group compared with participants sex and age

Table 1. Characteristics of patients

Parameter	Total		Female		Male		p-value
	Count	Percent	Count	Percent	Count	Percent	
No. of Patients	289	100%	116	40.1%	173	59.9%	0.812
Age group							
<4	20	6.9%	6	5.2%	14	8.1%	0.955
4–7	25	8.6%	13	11.2%	12	6.9%	
8–12	120	41.5%	47	40.5%	73	42.2%	
13–15	56	19.4%	36	31.0%	50	28.9%	
16–18	38	23.6%	14	12.1%	24	13.9%	
Place of injury							
Home	72	24.9%	23	19.8%	49	28.3%	0.388
School	115	39.8%	43	37.1%	72	41.6%	
Public place	76	26.3%	40	34.5%	36	20.8%	
Road traffic	26	9.0%	10	8.6%	16	9.3%	

Characteristics of injuries

Upper limb injuries were reported in 123 cases, which constituted 42.6% of the intervention to the examined group of patients. Upper limb injuries were dominated by forearm fractures ($n = 33$; Tab. 2) and lower limb injuries by knee joint injuries (Tab. 3). No statistically significant influence of gender on the type of injury was observed. The relationship between the age of sex and the type of injury is shown in Figure 3.

The time frame of the injury

Most injuries occurred in the afternoon between 12:00 and 18:00. 45.3% of all injuries analysed in the study group occurred in the afternoon (Tab. 4).

A detailed weekly distribution of injuries is shown in Table 4. The most frequent injuries occurred on Thursday and Friday. There were no significant differ-

ences in the incidence of injuries between girls and boys in relation to the day of the injury ($p = 0.910$), month ($p = 0.472$) or season ($p = 0.192$).

DISCUSSION

The study analysed the documentation of medical records of emergency medical rescue teams that intervened in paediatric patients due to injuries to upper and lower extremities. In our study, 9.8% of all the interventions performed in paediatric patients were interventions for limb injuries. This implies that emergency medical teams must be prepared to provide assistance in such cases. Given the number of interventions in children, limb injuries are a heavy burden for both emergency departments and paediatric surgery departments [9].

Table 2. Characteristics of upper limb injuries

Parameter	Total		Female		Male		p-value
	Count	Percent	Count	Percent	Count	Percent	
Shoulder and upper arm injuries							
S40 Superficial injury of shoulder and upper arm	5	1.7%	3	2.6%	2	1.2%	0.425
S41 Open wound of shoulder and upper arm	2	0.7%	–	–	2	1.2%	
S42 Fracture of shoulder and upper arm	4	1.4%	1	0.9%	3	1.7%	
S43 Dislocation, sprain and strain of joints and ligaments of the shoulder girdle	4	1.4%	–	–	4	2.3%	
S49 Other and unspecified injuries of shoulder and upper arm	12	4.2%	3	2.6%	9	5.2%	
Total	27	9.3%	7	6.0%	20	31.6%	
Forearm injuries							
S50 Superficial injury of forearm	8	2.8%	3	2.6%	5	2.9%	0.117
S51 Open wound of forearm	10	3.5%	5	4.3%	5	2.9%	
S52 Fracture of forearm	33	11.4%	14	12.1%	29	17.8%	
S53 Dislocation, sprain and strain of joints and ligaments of elbow	4	1.4%	–	–	4	2.3%	
S59 Other and unspecified injuries of the forearm	14	4.8%	4	3.4%	10	5.8%	
Total	69	23.9%	26	22.4%	53	30.6%	
Wrist and hand injuries							
S60 Superficial injury of wrist and hand	11	3.8%	6	5.2%	5	2.9%	0.207
S61 Open wounds of wrist and hand	1	0.3%	–	–	1	0.6%	
S62 Fracture at wrist and hand level	5	1.7%	3	2.6%	2	1.2%	
S67 Crushing injury of wrist and hand	2	0.7%	–	–	2	1.2%	
S68 Traumatic amputation of thumb wrist and hand	2	0.7%	1	0.9%	1	0.6%	
S69 Other and unspecified injury of wrist and hand	6	2.1%	–	–	6	3.5%	
Total	27	9.3%	10	8.6%	27	15.6%	

In our study group, the majority of the patients with limb injuries were males, accounting for 59.9% of the studied group. This is related to the higher physical activity of boys and is consistent with the results of other studies including studies on adolescent lifestyle patterns [10]. Issin et al. analysed paediatric fractures in the metropolitan area of Turkey [11]. They

similarly showed that 65% of the paediatric patients with fractures were males and 35% were females.

Our study revealed that the mean age of paediatric patients with limb injuries was equal for boys and girls (11.4 ± 3.9 vs. 11.3 ± 3.8 years, respectively) however, at this age the physical activity of girls and boys may be at a similar level.

Table 3. Characteristics of lower limb injuries

Parameter	Total		Female		Male		p-value
	Count	Percent	Count	Percent	Count	Percent	
Hip and thigh injuries							
S70 Superficial injury of hip and thigh	11	3.8%	5	4.3%	6	3.5%	0.774
S71 Open wound of hip and thigh	4	1.4%	2	1.7%	2	1.2%	
S72 Fracture of femur	2	0.7%	1	0.9%	1	0.6%	
S73 Dislocation, sprain and strain of joint and ligaments of hip	1	0.3%	–	–	1	0.6%	
S76 Injury of muscle and tendon at hip and thigh level	1	0.3%	1	0.9%	–	–	
S79 Other and unspecified injuries of hip and thigh	5	1.7%	–	–	5	2.9%	
Total	24	8.3%	9	7.8%	15	8.7%	
Lower leg injuries							
S80 Superficial injury of lower leg	8	2.8%	6	5.2%	2	1.2%	0.351
S81 Open wound of lower leg	15	5.2%	2	1.7%	13	7.5%	
S82 Fracture of lower leg, including ankle	5	1.7%	–	–	5	2.9%	
S83 Dislocation, sprain and strain of joints and ligaments of the knee	30	10.4%	15	12.9%	15	8.7%	
S89 Other and unspecified injuries of the lower leg	18	6.2%	6	5.2%	12	6.9%	
Total	76	26.3%	29	25.0%	47	27.2%	
Ankle joint and foot injuries							
S90 Superficial injury of ankle and foot	11	3.8%	4	3.4%	7	4.0%	0.097
S93 Dislocation, sprain and strain of joints and ligaments at ankle and foot level	14	4.8%	7	6.0%	7	4.0%	
S96 Injury of muscle and tendon at ankle and foot level	6	2.1%	–	–	6	3.5%	
S99 Other and unspecified injuries of ankle and foot	35	12.1%	16	13.8%	19	11.0%	
Total	66	22.8%	27	23.3%	39	22.5%	

In our study the main place of injuries in the study group was a school, then a public place, a house and finally traffic. a school is a place where the child spends a considerable amount of time. School not only provides physical education but also encourages kids to spontaneously play team games and engage in physical activities [12]. The available results indicate a wide variety of trauma locations in children and their relationship to the type of injury.

Upper limb injuries were reported in 42.6% of the intervention to the examined group of patients. Upper limb injuries were dominated by forearm fractures and lower limb injuries by knee joint injuries. Available studies have shown that the location of injuries depends on the mechanism of its occurrence, particularly in road traffic accident victims [13].

In our study, most injuries occurred in the afternoon between 12:00 and 18:00 it is most sim-

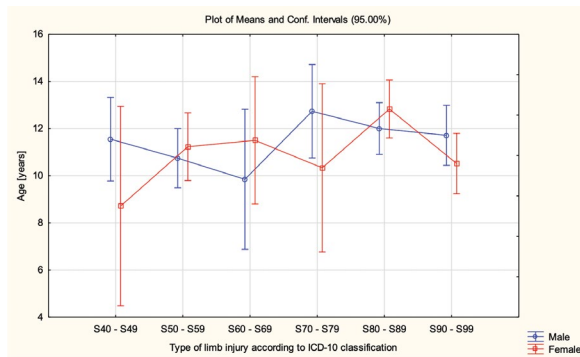


FIGURE 3. The type of injuries in the study group comparing with participants sex and age

ilarly related to children taking up physical activity immediately after school, during a long break and on their way home from school and in the afternoon before sunset. 45.3% of all injuries analysed in the study group occurred in the afternoon and the most frequent injuries occurred on Thursday and Friday, however, there were no significant differences in the incidence of injuries between girls and boys in relation to the day of the injury, month or season. The final days of the week are a period of reducing the burden on children to prepare for the next day's school day, which translates into higher levels of

Table 4. Fluctuations of limb injury

Parameter	Total		Female		Male		p-value
	Count	Percent	Count	Percent	Count	Percent	
Time of day							
00:01 – 06:00	2	0.7%	–	–	2	1.2%	0.793
06:01 – 12:00	91	31.5%	34	29.3%	57	32.9%	
12:01 – 18:00	131	45.3%	55	47.4%	76	43.9%	
18:01 – 24:00	65	22.%	27	23.3%	38	22.0%	
Day of week							
Monday	38	13.1%	21	18.1%	17	9.8%	0.910
Tuesday	43	14.9%	16	13.8%	27	15.6%	
Wednesday	48	16.6%	13	11.2%	35	20.2%	
Thursday	54	18.7%	23	19.8%	31	17.9%	
Friday	50	17.3%	16	13.8%	34	19.6%	
Saturday	27	9.3%	12	10.3%	15	8.7%	
Sunday	29	10.0%	15	12.9%	14	8.1%	
Month							
January	19	6.6%	5	4.3%	14	8.1%	0.472
February	13	4.5%	3	2.6%	10	5.8%	
March	29	10.0%	13	11.2%	16	9.2%	
April	16	5.5%	10	8.6%	6	3.5%	
May	43	14.9%	17	14.6%	26	15.0%	
June	37	12.8%	18	15.5%	19	10.9%	
July	21	7.3%	6	5.2%	15	8.7%	
August	20	6.9%	8	6.9%	12	6.9%	
September	15	5.2%	4	3.4%	11	6.4%	
October	27	9.3%	11	9.5%	16	9.2%	
November	21	7.3%	11	9.5%	10	5.8%	
December	28	9.7%	10	8.6%	18	10.4%	
Season							
Spring	88	30.4%	40	34.5%	48	27.7%	0.192
Summer	78	26.9%	32	27.6%	43	24.9%	
Autumn	63	21.8%	26	22.4%	37	21.4%	
Winter	60	20.9%	18	15.5%	42	26.0%	

physical activity. Issin et al. in their analysis paediatric fractures in a metropolitan area of Turkey [11] have shown that fractures in paediatric patients had some seasonal, daily, and circadian variations, similarly as Odetola et al. [9]. This study has its strengths and weaknesses. Among the strengths is the large analysed group. The basic weakness is the retrospective nature of the analysis.

Conclusions

Limb injuries account for nearly 10% of all EMS interventions in paediatric patients. The main site of the injury was a school and the most frequent were upper limb injuries including forearm fractures, while for the lower limb — knee joint injuries. Further action should be taken to reduce the number of limb injuries in children.

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HOW CAN PRIVATE HOSPITALS BE USED AS A SOLUTION TO PROVIDE OUTFLOW SURGE CAPACITY TO PUBLIC HOSPITALS DURING MASS CASUALTY INCIDENTS

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ABSTRACT

INTRODUCTION: Private hospitals are not utilised as a part of a solution in Ireland in the event of Mass Casualty Incidents (MCI) in Ireland. While disaster planning is evident in each hospital and there is also a national plan in place, no plan details the difficulties public hospitals are facing on a daily basis with overcrowding in both Emergency Departments (ED) and throughout the hospital. The aim of this study is to look at how private hospitals may be used as part of the greater solution in providing Outflow Surge Capacity (OSC) to the public hospitals, and: are private hospitals able to deliver outflow surge capacity in times of great need.

MATERIAL AND METHODS: This study was conducted from October 2018 – May 2019 in a selection of public and private hospitals in the greater Dublin (Ireland) region. Ethics approval was obtained and purposive sampling was employed. Semi-structured interviews following a Straussian Grounded Theory (SGT) design were conducted following the recruitment of 16 high-level key stakeholders in 4 hospitals of interest representing both public and private sectors. No demographic data was collected, ensuring anonymity. Data was analysed manually using grounded theory principles, which involved open, axial and selective coding.

RESULTS: All participants were found to be open to utilising private hospitals as OSC. Private hospitals were recognised by public hospitals as having the ability, skills and expertise to assist public hospitals with OSC. High awareness of the need for additional space in acute hospitals was evident. All participants showed concern for current overcrowding hospital wide nationally.

CONCLUSIONS: Public hospitals identified a number of approaches to utilise private hospitals as OSC. Private hospitals showed readiness and agreement to provide OSC, however, willingness was not assessed due to the number of private hospitals included in the study. Further research is required to ascertain Government willingness to participate and establish financial accountability should this finding be introduced.

KEY WORDS: surge capacity; disaster planning; disaster management; public-private partnership; mass casualty incident; disaster preparedness

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INTRODUCTION

Surge capacity is defined as “the ability of a health service to expand beyond its normal capacity to meet increased demand for clinical care” [1].

Ireland’s Health Service is overwhelmed with large numbers of patients waiting in ED for long periods — sometimes days, awaiting admission to a bed on a ward. As a result, it would be difficult to provide surge capacity beds in the event of an MCI, as has been highlighted regularly over the last number of years [2–5]. An MCI is described as an event which overwhelms the health care system locally with high numbers of casualties that exceeds the resources available within a relatively quick timeframe [6]. Although major emergencies and MCI are rare, particularly in Ireland, they create a very real burden on the health care systems preparedness and response [7]. It is further acknowledged that crowds are becoming larger due to increased attendances at sporting events and festivals and such other activities [8].

The aim of this study is to look at how private hospitals may be used as part of the greater solution in providing OSC to the public hospitals, and to identify if private hospitals are able to deliver OSC in times of great need. OSC is further described as moving patients from one hospital to another in order to create additional beds, rather than surge capacity which generally refers to creating additional bed spaces within a facility. This study focuses specifically on a selection of public and private hospitals in the Dublin region. For the purpose of this study, OSC refers to current inpatients in public hospitals who may be moved to private hospitals in order to free up acute-care beds for use in MCI.

Currently, in Ireland, there is a robust National Risk Assessment (NRA) [9] completed by the Department of Defence (2017), in which Ireland’s main hazards and vulnerabilities are documented. Although this plan is completed by the Department of Defence, it is in conjunction with Ireland’s police force (An Garda Síochána), local authorities and the Health Service Executive (HSE). The HSE is responsible for the governing of all public hospitals in the Republic of Ireland. The NRA document outlines the necessity for each hospital to have its own major emergency plan, but private hospitals are not included in this document, nor have they a structured part to play in case of an MCI.

Private hospitals account for over 20% of all hospital beds nationally [10]. Ireland is coming under increasing pressure in relation to the number of

patients in emergency departments on a daily basis awaiting admission to inpatient wards, sometimes for days [2, 3, 11]. In the event of an MCI, it is suggested it would be difficult to accommodate a surge of patients, due to the number of patients waiting to be decanted for prolonged periods in ED and acute hospital beds [11].

Although the NRA has considered many hazards and vulnerabilities, they have not identified the risk of not having the ability to provide surge capacity beds. Furthermore, data from the Irish Nurses and Midwifery Organisation (INMO) [12] shows Ireland’s public hospitals do not currently have the ability to carry out this plan due to high bed occupancy. The INMO has been compiling data on a daily basis from every hospital in Ireland in relation to the number of patients waiting on stretchers in the ED for admission (Fig. 1 and Tab. 1). This data has been collected since 2006. At all times, there are a significant number of patients waiting for beds for a prolonged period of time, and at certain periods of the year this becomes even higher due to seasonal illnesses such as influenza. This data shows that in the event of an MCI, most hospitals in Ireland would be unable to create surge capacity beds to deal with multiple patients.

According to the Health Service Capacity Review [13], bed occupancy is running at between 95–100% at all times. International average bed occupancy is 85% [14]. These figures alone highlight the difficulties Irish hospitals would face in the event of an MCI.

This paper aims to identify how willing and able are private hospitals to assist public hospitals in the greater Dublin region with OSC in the event of an MCI. It will look to understand facilitating factors and barriers, as well as to facilitate discussions with key stakeholders. The ultimate aim is to create a method of collaboration between the hospitals of interest resulting in a public-private partnership (PPP) specifically for MCI response. The long-term goal may facilitate a national collaborative public-private partnership specific to MCI in Ireland.

To date, there is some research ongoing and available on Ireland’s disaster planning and readiness, but no such research has been found involving private hospitals [7, 9, 11].

MATERIAL AND METHODS

This study was approved by the Beacon Hospital Research Ethics Committee (REC) and local approval at

INMO TROLLEY WATCH FIGURES BELOW FOR MAY 31ST 2019

Every morning at 8 am, INMO members count how many patients are waiting in the Emergency Department for a bed and how many are waiting in wards elsewhere in the hospital. The INMO Trolley Watch counts the number of patients who have been admitted to acute hospitals, but who are waiting for a free bed. These patients are often being treated on trolleys in corridors, but they may also be on chairs, in waiting rooms, or simply wherever there's space. The INMO started Trolley Watch in 2004.

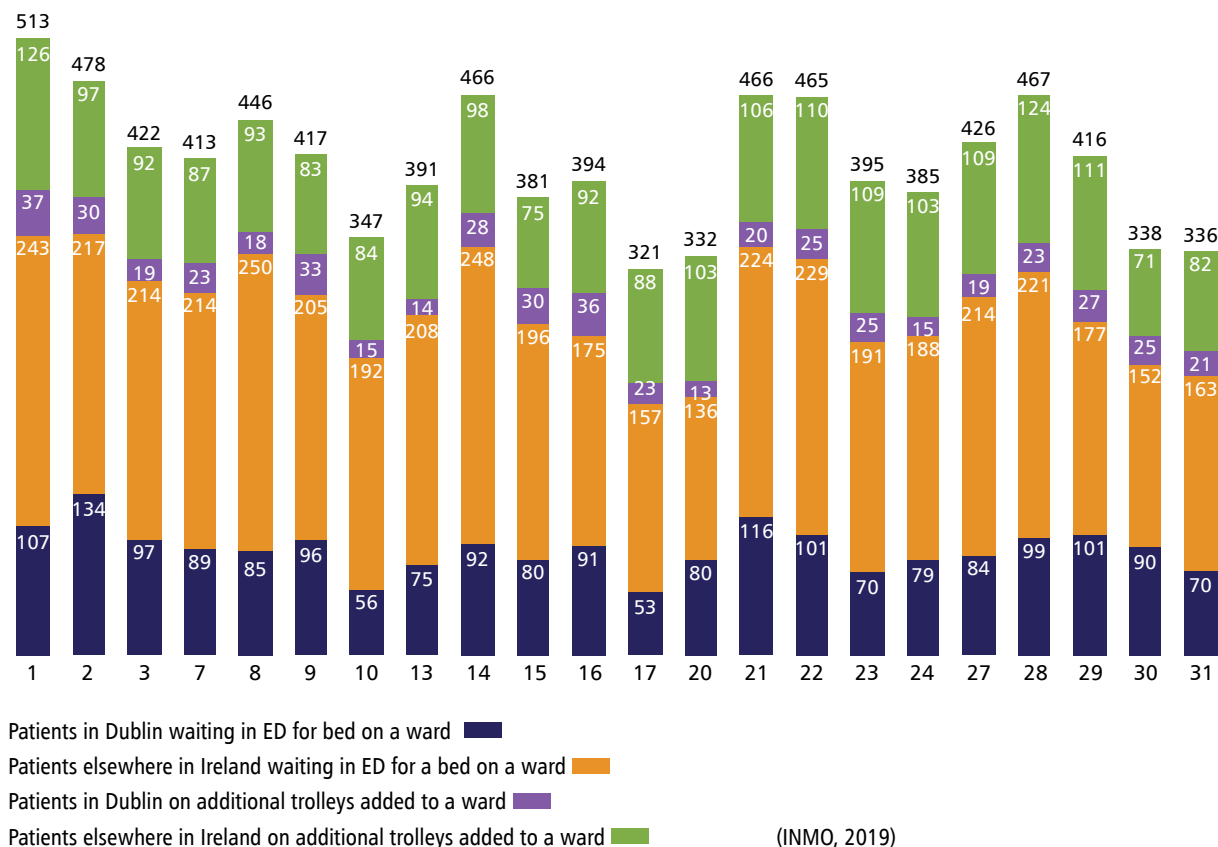


FIGURE 1. INMO Trolley Figures for May 2019

each site was also obtained. Purposive sampling was utilised to enable exploration of particular aspects of behaviours relevant to the research questions [15]. This enabled the recruitment of 16 high-level key stakeholders in 4 hospitals of interest representing both public and private sectors. Semi-structured interviews following a Straussian Grounded Theory (SGT) design were conducted between October 2018 and May 2019. No demographics were collected as an additional method of ensuring anonymity. SGT guided the collection and coding of the interview data so that emerging categories were identified and then a substantive theory generated [16]. Data was analysed manually using grounded theory principles, which involved open, axial and selective coding. Open coding was first used to generate concepts. Following this, assistance was sought to ensure the reliability of the codes. Further areas of exploration were discussed. Constant comparisons were made between the transcripts,

formulated codes and memos. The SGT method was chosen because of Strauss's willingness to accept the use of a literature review [17].

Inclusion Criteria was staff at senior management level and above, with a working knowledge of disaster planning and management and the ability to influence policy change. This list was utilised as an entry point to generate other individuals who would meet the inclusion criteria. Senior management personnel were then directly approached in person in order to gain access and permission to each site. A Participant Information Leaflet (PIL) and consent forms were sent to potential participants. Those participants who responded and returned the consent forms were then scheduled for face to face interviews. Purposive sampling allowed the use of initial participants to further initiate contact with other relevant potential participants [18]. Participant recruitment continued until the researcher was confident data saturation had been reached.

Table 1. Cumulative end of year report 2006–2018 — numbers of patients waiting in ED for bed on ward



Irish Nurses and Midwives Organisation
The Whitworth Building, North Brunswick Street, Dublin 8
Tel: (01) 664 0600, Fax: (01) 661 0466, www.inmo.ie
Trolley and Ward Count

Years: 2006 to 2018

Hospital	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Eastern													
Beaumont Hospital	4,304	6,164	8,065	8,748	8,195	7,410	6,327	7,062	6,565	8,243	6,130	3,609	2,968
Connolly Hospital, Blanchardstown	2,418	2,709	2,706	2,667	3,562	4,207	3,937	5,852	5,062	5,165	2,698	2,499	3,569
Mater Misericordiae University Hospital	4,248	5,083	5,984	4,910	5,425	3,936	4,213	2,854	3,576	4,704	4,473	5,238	4,967
Nass General Hospital	3,025	1,323	2,268	3,797	3,282	4,409	2,116	1,836	2,951	3,210	3,054	3,361	3,754
St Colmcille's Hospital	1,267	751	1,104	2,589	2,231	2,208	2,201	1,130	–	–	–	–	–
St James's Hospital	2,008	1,022	2,471	2,441	1,366	1,590	1,288	1,706	2,220	2,654	1,851	2,178	2,025
St Vincent's University Hospital	4,190	6,093	5,694	5,427	6,063	6,403	4,735	2,872	2,478	5,150	4,836	2,497	3,773
Tallaght University Hospital	4,941	3,962	5,782	6,044	7,011	4,784	1,906	3,943	3,717	4,718	4,166	4,847	5,432
Country													
National Children's Hospital, Tallaght	–	–	–	–	–	–	–	–	–	–	–	–	85
Our Lady's Children's Hospital., Crumlin	–	–	–	–	–	–	–	–	–	–	–	–	579
Temple Street Children's University Hospital	–	–	–	–	–	–	–	–	–	–	–	–	749
Country													
Bantry General Hospital	–	–	–	–	–	–	–	–	147	233	627	779	731
Cavan General Hospital	2,816	2,779	2,189	1,975	3,291	4,572	2,569	1,954	460	1,000	771	482	619
Cork University Hospital	3,867	3,615	4,516	4,539	7,021	6,649	4,230	4,102	3,574	4,670	6,032	6,815	9,135
Letterkenny University Hospital	3,059	1,253	388	378	474	592	539	1,277	2,755	2,814	2,047	4,889	5,174
Louth County Hospital	200	88	152	146	25	–	–	–	–	–	–	–	–
Mayo University Hospital	2,285	1,391	1,207	1,454	1,760	599	1,525	1,145	1,908	1,868	2,241	1,663	1,998
Mercy University Hospital, Cork	1,431	1,270	1,534	1,270	1,910	1,943	1,922	2,491	2,196	2,227	2,859	3,145	2,681

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Midland Regional Hospital, Mullingar	169	91	183	528	1,921	3,204	2,398	2,845	3,908	4,366	4,849	4,844	4,344
Midland Regional Hospital, Portlaoise	469	283	425	297	426	1,926	539	824	1,589	2,162	3,364	3,203	2,815
Midland Regional Hospital, Tullamore	64	34	95	77	766	1,857	1,303	1,156	3,746	2,758	4,748	4,774	5,831
Mid-Western Regional Hospital, Ennis	867	961	252	368	431	411	324	333	7	125	330	175	214
Monaghan General Hospital	106	287	293	119	–	–	–	–	–	–	–	–	–
Nenagh General Hospital	–	–	–	–	–	–	–	–	–	59	103	93	81
Our Lady of Lourdes Hospital, Drogheda	3,444	2,811	2,927	3,415	3,484	7,449	6,761	3,349	6,249	7,783	5,608	2,791	2,233
Our Lady's Hospital, Navan	520	847	851	1,084	453	1,469	745	1,029	1,059	1,000	595	2,435	1,265
Portluncula Hospital	403	281	306	605	840	941	821	813	912	1,100	892	1,569	1,302
Roscommon County Hospital	589	764	725	755	1,036	719	–	–	–	–	–	–	–
Sligo University Hospital	784	732	667	955	1,754	1,505	2,086	963	2,017	2,478	2,308	2,406	4,183
South Tipperary General Hospital	727	784	881	500	666	768	2,138	2,762	1,959	2,028	5,399	5,249	5,201
St Luke's General Hospital, Kilkenny	–	–	–	–	140	1,034	695	1,817	1,921	3,514	3,144	4,505	4,052
University Hospital Galway	1,654	2,414	3,470	3,444	4,103	6,544	4,193	3,907	5,312	6,514	5,807	6,563	7,452
University Hospital Kerry	1,144	507	763	337	623	672	606	694	1,005	1,389	1,664	2,215	3,396
University Hospital Limerick	1,814	1,367	1,735	2,422	3,715	3,658	3,626	5,504	6,150	7,288	8,090	8,869	11,437
University Hospital Waterford	–	–	496	589	1,349	1,165	1,590	2,269	2,249	2,445	3,835	5,525	4,319
Wexford General Hospital	2,907	736	1,306	1,833	2,536	3,857	975	1,374	1,399	1,333	1,100	1,763	1,863
Eastern Subtotal (Incl Children's Hospitals)	26,401	27,107	34,074	36,623	37,135	34,947	26,723	27,255	26,569	33,644	27,208	24,229	27,901
Country Subtotal	29,319	23,295	25,361	27,090	38,724	51,534	39,585	40,608	50,522	59,154	66,413	74,752	80,326
Overall Total	55,720	50,402	59,435	63,713	75,859	86,481	66,308	67,863	77,091	92,998	93,621	98,981	108,227

Interviews were conducted in all cases at the participant's place of work. All participants were assured of confidentiality and informed the interviews would be coded anonymously the following transcription. Interviews ranged from 10–40 minutes, depending on the level of participation from the participant. All confidential data and identifiers were removed during transcription. The interviews were recorded with permission and then transcribed verbatim in a secure location.

RESULTS

A total of 16 interviews were conducted; 8 from the private sector and 8 from the public sector. These particular participants were invited for interview due to their senior positions and ability to affect policy change; as well as their working knowledge of disaster planning and management. A considerable amount of commonality appeared between both groups of participants. In order to ensure and maintain anonymity, transcripts are numbered Participant 1–16 (P 1–16) only, and no differentiation is made between public and private participants. On completion of coding, 2 main themes emerged—Patient advocacy and transport logistics.

Patient advocacy

One of the major commonalities among both groups was the need and desire of many of the participants to do the greatest good for the greatest number of patients, thereby being efficient patient advocates.

Participants from both the private and public sectors recognised the value of efficient triage of current inpatients and assessing those most suitable to move to alternative facilities in order to free up acute beds. One participant mentioned due to the rareness of an MCI, oftentimes rash decisions are made and patients may be discharged home too soon: "Knowing patients are going to another hospital and not discharged home too early makes the decisions easier, because you know your patients are safe elsewhere without worrying they were sent home too early..." P11.

While one participant was not concerned where the patient went, once they received appropriate treatment: "The main priority is the patient gets to an appropriate referral centre in the fastest time possible to get treatment, it is not really about where the patient will go" P14.

It was evident some participants had not imagined the concept of OSC previously and were confident it would be a positive process: "More patients can be cared for in a general sense if we can move some of our already admitted patients to an alternative hospital" P7.

Utilising private hospitals also seemed to be a relatively new concept but was received positively:

"Using the private hospitals would be a great way of assisting quicker medical management, thereby saving a greater number of lives" P9.

"Using the private hospitals is ideal for really ill patients in the early post-operative phase or in need of specialist treatment like dialysis or chemotherapy" P6.

While many interviewees in public hospitals were not aware of the extent of the services available in the private hospitals, their counterparts were keen to showcase what was available and the benefits they could provide to colleagues in the public sector. In particular, the public hospitals acknowledgement of need for ICU beds is in line with much Irish news, where it is recognised ICU beds are in significant short supply [19]: "We have every facility here to be able to treat all kinds of complex patients and we are really well-positioned considering we already take patients from other ICU departments when they don't have the correct or adequate facilities" P5.

Furthermore, ICU was highlighted a number of times as an area of great need during an MCI: "...one of the main areas we would really struggle for space in would be ICU. If we could move 1 or 2 ICU patients to another ICU that would definitely be a bonus... major surgery would definitely be delayed if there was no ICU bed postoperatively" P2.

Transport coordination

Interestingly, although transport or logistics was not a direct question on the interview, every single participant mentioned their concerns regarding how a patient would be moved from one facility to another or how logistically this concept had not been previously considered: "...especially in Dublin where both private and public hospitals are so adjacent to each other, private hospitals should not be negated from being apart from a programme, because there is definitely a private hospital in geographical proximity to every public hospital..." P5.

Concern for families regarding distance from the primary hospital was negated due to the catastrophic nature of MCI: "I don't think patients would have

a say in where they would be transferred to or not, because lives are depending on the transfers" P12.

Both of these assumptions match with Joint Commission International (JCI) standards and recommendations in Access to Care and Continuity of care (ACC), whereby ACC1.1 specifies "Patients with emergent, urgent, or immediate needs are given priority for assessment and treatment" [20].

However, one participant was concerned about the extra costs incurred to families: "Do patients want to move? Because of transport issues and family circumstances, the extra costs of buses and taxis might be more than expected" P11.

Many informative statements were made by participants regarding logistics of transferring patients to other facilities, with most acknowledging the HSE and Dublin Fire Brigade (DFB) ambulances would most likely be busy with the initial disaster: "I would be straight on the phone to book a private ambulance to be with us for the rest of the day, that way we would be in control of the calls they do and could direct them where we would need" P2.

Another major factor highlighted staffs concern for their families: "if you are expecting your staff to come in and help in a disaster situation, you have to remember they might not come as they are worried about own families' safety and childcare and such and they are thinking what are you going to do for them?" P5. This concern is also emphasised within JCI standards, where it is suggested the provision of a safe area for staffs' families would assist with ensuring adequate staffing [21].

Logistically, another participant mentioned many consultants work in both public and private facilities and questioned where would this consultant be in the case of disaster? "It would be important to know what consultants work where..., most of them are in the public and the private. If there was an MCI they would likely have to leave the private hospital and report to the public, so who is responsible for these patients?" P12.

DISCUSSION

No previous research is available pertaining to the use of private hospitals during MCI in Ireland. Specifically, in Ireland, there is very little research into hospitals readiness for MCI [7, 22]. Much data is available from national newspapers [2–5, 12, 14, 19] as well as minimal research papers [7, 22] suggesting Irelands already over-packed ED's are not capa-

ble of managing a sudden influx of patients in an MCI. From a practical perspective, the researchers' observations have highlighted the importance of including private hospitals into the current national preparedness plan.

It is suggested that private hospitals in the greater Dublin region should be added to the NRA in order to reduce pressure on the already over-packed public system, as a means of decanting already admitted patients from the public hospitals, as OSC. Although there is very little research available internationally on PPP, this particular method has been utilised successfully in Central Brooklyn (United States of America), as a means of ensuring OSC beds [23]. In Ireland, it is not possible to utilise the private hospitals Emergency Departments for this purpose as none of the private hospital ED's open 24 hours per day.

Although no research or plan is without its faults, this paper has identified the merits of including private hospital management in further discussions relating to MCI. Evident from this research is the level of fear among participants that they would be unable to cope on a broader perspective. Also highlighted is the need to look more in-depth at the methods of transportation available to hospitals and the requirement to create a partnership between public and private transport services.

Of greatest significance is the fact that all staff, both public and private; were amenable to utilising/providing assistance to/from their private counterparts. What this paper does not identify, is how to create this alliance or PPP for the purpose of MCI, but it does highlight the need for governmental agencies such as the HSE to include the PHA in further plans.

CONCLUSIONS

Private Hospitals in the greater Dublin region have the ability to assist public hospitals with OSC during mass casualty incidents. Willingness was not readily assessed due to the lower number of actual private hospitals as participants.

No differentiation was made between public or private hospitals, but questions regarding financial responsibility, governance and availability of transportation methods were raised.

Further research is recommended to include national Government agencies in order to answer these questions.

Limitations

It was hoped more private hospitals would participate in this study to give a more representative view, however, access was not granted to two other facilities requested. This led to the willingness of private hospitals not being assessed.

Additionally, this study recognises the participants are representative of the greater Dublin (Ireland) region, but not representative of the country as a whole. It is suggested to carry out a further study including other areas of Ireland in order to get a more representative view, thereby having more valuable input to present to governmental agencies.

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Statement of Competing Interests

The author reports no competing interests.

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EMERGENCY HEALTHCARE PROVIDERS PERCEPTION OF WORKPLACE DANGERS IN THE POLISH EMERGENCY MEDICAL SERVICE: A MULTI-CENTRE SURVEY STUDY

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ABSTRACT

INTRODUCTION: There are many risk factors that account for hazards in paramedics' and ambulance nurses' profession. Driving a vehicle, having contact with patients, making difficult medical decisions, doing night shifts and working in a stressful environment, all of those features negatively affect their health. The aim of the study was to evaluate paramedics' and ambulance nurses attitude towards personal safety, to assess their subjective feeling of danger, as well as identify types of hazards they experience.

MATERIAL AND METHODS: The study was carried out via a diagnostic survey method, an anonymous questionnaire. Among 572 responders there were nurses and paramedics, who work in non-physician medical rescue teams in Poland.

RESULTS: Most of the surveyed medics (40.5%) have rated the level of danger of their occupation to 4 on a scale from 1 to 5, with the greatest hazard being posed by patients under the influence of designer drugs. As many as 43% of medics have had back-related problems and 41% have suffered injuries at work. Notwithstanding, a majority of respondents have admitted that if they could plan their career again, they would choose the same profession.

CONCLUSIONS: Prehospital healthcare providers have generally rated their work as dangerous. More attention should be paid to teach first responders how to deal with aggression and how to handle stress. Efforts should be made to increase paramedics' and nurses' awareness about health problems related to shift work.

KEY WORDS: workplace violence; occupational risk factors; occupational stress; Emergency Medical Services; prehospital care; workplace safety

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INTRODUCTION

Prehospital healthcare providers who render specialized help in various life-threatening situations are burdened

with great responsibility. Dynamically changing social and environmental conditions increase their stress levels. According to the International Agency for Research

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in Cancer, shift work is unavoidable because a paramedic must be available 24 hours a day, 365 days a year. Moreover, in 2007, shift work including nights has been classified as potentially carcinogenic to humans [1]. Prehospital healthcare providers are under constant professional risk, although their overriding principle is to act in safe conditions. Posttraumatic stress disorder (PTSD), as a result of multiple traumatic experiences related to suffering and death, can potentially affect everyone working in this profession [2, 3].

Prehospital healthcare providers often emphasize that cases involving children are extremely challenging, and place undue strain on their work. They are afraid of their reactions and identify their own children with the situation [4]. Number of PTSD cases varies from country to country [5]. Behavioural disorders, anxiety and depression lead to decreasing job satisfaction and professional burnout [6]. Stress can also be caused by a poor organization within a rescue team. Frequent employee rotation between different emergency service stations may cause problems with cooperation between paramedics [7]. In order to reach the scene, a paramedic or nurse, who works also as an ambulance driver, must often travel at high speeds, what increases the likelihood of an accident. The most common cause of accidents is an excessive fatigue of providers, who are unable to maintain an adequate level of safety when driving to or from an event [8]. In recent years, aggression against medical rescuers has intensified, as confirmed by numerous media reports. Other hazards include contact with potentially infectious material and are sometimes linked with a physical location where help is being provided, e.g. high altitudes, slippery surfaces, aquatic environments, and many others [7].

The aim of this study was to identify the levels of this subjective sense of danger among ambulance nurses and paramedics, as well as define dangers themselves.

MATERIAL AND METHODS

Description of the study

A diagnostic survey method was employed. The research tool was a questionnaire survey. Among responders, there were paramedics and nurses with postgraduate training in emergency medicine and anaesthesiology and intensive care, working in non-physician MRTs in Greater Poland, West Pomeranian, Masovian and Podlesian provinces. A province is the highest level of administrative division in Poland. There are

16 provinces in the country. The voluntary and anonymous questionnaire, which consisted of 16 questions, has been completed by 572 respondents. Seven questions concerned metrics (gender, age, career length, stationing, daily dispatches, number of hours worked per day, number of hours worked per month, and frequency of encountering aggression). In question number 8 the respondents were asked to assess the degree of occupational hazards on a scale from 1 to 5, with 1 representing the lowest, and 5 the highest level of danger. Questions number 9 and 10 rate the degree of threat to physical and mental health of the provider, on a scale from 0 to 5, with 0 representing no hazard and 5 representing the highest hazard level. The remaining 6 questions were closed, with qualitative variables, as well as answers to questions, described by the number (n) and frequency (%). The tool is the authors' own project, not validated at this moment. The daily number of dispatches, and risk assessment of the paramedic profession, as measurable variables, were described using basic parameters: arithmetic mean, standard deviation, median, minimum and maximum value. Statistical calculations were performed using STATISTICA 10 PL (StatSoft, Tulsa, OK, USA). A p-value < 0.05 was accepted as statistically significant. Chi² test for nonparametric variables, and multivariate ANOVA regression analysis for dependent variables assessing occupational hazards and evident exposures were performed.

Description of the analysed groups

A majority of the respondents were men — 81.8% (n = 468), whereas women represented the remainder 18.2% (n = 104). Paramedics constituted 85.2% (n = 487, 456 males and 31 females) of the group and nurses 14.8% (n = 85, 12 males and 73 females). Over half of the analysed group, 59.3% (n = 339), was between 20 and 30 years old, while 29.4% (n = 168) was 30–40. The remaining 11.3% (n = 65) was above 40 years old, and 1.2% (n = 7) was above 50. Table 1 shows the frequency of responses to questions about career length, daily dispatches, number of workplaces, and frequency of encountering aggression during work.

RESULTS

The survey questionnaire has been distributed to a group of 800 paramedics working in medical rescue teams, 71.5% (n = 572) of which have been completed.

Table 1. The frequency of responses to questions about career length, daily dispatches, number of workplaces, and frequency of encountering aggression during work

Variable	N	%
Hours worked (per month)		
< 80	10	1.7
80–120	87	15.2
160–240	181	31.6
240–320	235	41.1
> 320	59	10.4
Workplace		
Countryside	24	4.2
City < 10 thousand residents	55	9.6
City 10–20 thousand residents	92	16.1
City 20–50 thousand residents	69	12.1
City 50–100 thousand residents	71	12.4
City > 100 thousand residents	332	45.6
Career length		
< 1 year	39	6.8
1–5 years	203	35.5
5–10 years	221	38.6
> 10 years	109	19.1
Daily dispatches		
1–5	114	19.3
6–10	286	50.0
11–15	99	17.3
> 15	73	13.4
How often do you encounter aggressive patients?		
I have not met an aggressive patient	19	3.3
A few times a year	71	12.4
A few times a month	191	33.4
A few times a week	251	43.9
Every day, sometimes multiple times	40	7.0

None of the respondents has rated their profession as completely safe. The average rating of the danger level on a 1–5 scale was 3.6 ± 0.91 . Most of the respondents (40.5%) assessed the danger as 4/5 (high level of danger). In the multivariate analysis for the dependent variable evaluating the danger of the profession (1–5 scale), career length over 5 years has emerged as an independent variable. Multivariate regression has shown that providers with a career length > 5 years have assessed the danger level 1.132 times higher ($p < 0.001$, $R^2 = 0.181$).

Table 2. The average rating of threats to health and life ranked from highest to lowest

Threats	Average rate	Standard deviation
Patient under the influence of designer drugs	4.3	1.11
Patient under the influence of alcohol	3.9	1.00
Patient suffering from mental disorders	3.7	1.17
Psychological burden caused by low earnings	3.6	1.39
Patient under the influence of classic drugs	3.5	1.22
Patient suffering from diseases transmitted by body fluids (e.g. HIV, viral hepatitis)	3.4	1.43
Patients' violence	3.3	1.30
Bystanders' violence	3.1	1.34
The risk of participation in an ambulance crash	2.9	1.51
Psychological burden caused by number of work hours	2.8	1.49
Psychological burden caused by night shift	2.4	1.53
Risk of a burnout syndrome	2.4	1.55
Psychological burden caused by death	2.1	1.49
Animals attacks	2.0	1.43

As the most threatening situation respondents indicated interaction with patients under the influence of designer drugs (4.3 ± 1.11 points), followed by patients under the influence of alcohol (3.7 ± 1.0 points). The average rating of threats to health and life lowest was shown in Table 2.

The most aggressive patients were those under the influence of designer drugs (4.4 ± 0.94) and alcohol (3.8 ± 1.02), followed by people breaking the law (3.63), people under the influence of classic drugs (3.6), and people suffering from mental disorders (3.4). The lowest level of aggression among the listed group was displayed by people in shock, with an average score of 2.0 ± 1.17 .

The definition of "evident exposure" was described as contact with blood or other potentially infectious material, with an open wound or wound caused by the material. According to this definition, 39.3% of respondents have declared evident exposure, and 24.1% of respondents have declared multiple instances of evident exposure.

In multivariate analysis for a dependent variable, which most accurately assessed the occurrence and intensity of evident exposure, career length > 5 years has been found to be the most independent variable. It has been shown that medics with career lengths over five years have declared more frequent occurrence and exacerbation of evident occupational exposure 2.528 times higher ($p < 0.001$, $R^2 = 0.256$).

The results show that 41.5% of respondents employed in the EMS have been affected by health problems requiring out-patient or in-patient care. There were statistically significant differences in terms of age (> 30 years vs. < 30 years; $p < 0.001$), career length (> 10 years vs. < 10 years, $p < 0.001$), and patient aggression (several times a week vs. several times a month; $p = 0.042$).

The survey also analysed factors that could affect the responses to the question regarding an occupationally acquired spinal injury. There were statistically significant differences in the number of working hours (> 160 h vs. < 160 h; $p = 0.017$) and patient aggression (several times and week vs. several times a month; $p < 0.001$).

Beyond that, 43% of respondents have indicated that they have had an occupationally acquired spinal injury at some point during their career.

Most of the respondents (69.1%), if given the option today, would continue to choose to work as paramedics or ambulance nurses and 19.1% would not (and 2.8% of those definitely would not choose to be a paramedic again). The remaining 11.8% were not able to answer the question.

DISCUSSION

The researchers attempted to answer the question of how paramedics assess the safety of their profession, and what factors may affect their perception of danger.

Providers have assessed the danger of their profession, on average, as 3.6 on a five-point scale. None of the factors assumed by the authors contributed to the perception of work safety, namely, regardless of workload and experience, hazards are perceived in the same way. The individuals who have responded to the questionnaire considered interacting with people under the influence of various psychoactive substances as the most dangerous to their health.

Psychoactive substances which are not included in the list of controlled substances, i.e. legal high

(a.k.a. smart drugs or designer drugs) pose the biggest issue. The scale of this problem is especially pronounced in large cities with entertainment facilities in the form of clubs and discos. The most popular psychoactive substances identified by the organs of the State Sanitary Inspection are cannabinoids, cathinones (β -keto-amphetamines), and phenylethylamines. In 2014, there were 1079 reported cases of designer drugs poisonings, and 2513 in 2015, with an apparent growing trend in a number of cases reported each month. On a national scale, the rate of poisoning by alternative substances, in 2014, was 6.53 cases per 100-thousand, which is 2.45 times higher than the rate in 2013. People between the age of 16 and 24 made up the largest group of those affected [9]. A state of intoxication is also related to the increasing occurrence of violent acts. According to available publications, it is known that paramedics are confronted with aggression in various forms, both verbal and non-verbal, but it is less often mentioned that they are subject to sexual violence, as well. A paper published in 2002 showed that the greatest number of paramedics experienced aggression in their workplace once every quarter-year [10]. Another study conducted in the hospital emergency department (ED) showed that the frequency of aggression directed against staff was on average five cases a week, and that the number was particularly high during night shifts. The study by Rudnicka-Drożdżak et al. showed that over 90% of ED staff have dealt with patient aggression at some point in their careers [11]. Moreover, a study by Frydysiak et al. indicated that 50% of ED staff members declared that the aggressive patient they last dealt with was also intoxicated [12]. Petzall et al. proved that 66% of ambulance personnel in Sweden experienced threats or violence and the most common form was physical violence (pushes, punches, kicks and bites). The perpetrators were also patients under the influence of alcohol and drugs [13]. The results, however, are far more disturbing, as most of the study's respondents have been encountering this problem even several times every week. The increased incidence of aggression seems to be a consequence of high accessibility of drugs and alcohol. Aggressive behaviours can also be triggered by suffering and anxiety caused by worrying about the health of a loved one. Perhaps one of the reasons why paramedics are often a target of aggression is that they represent a crucial first layer of contact within the healthcare system. Another reason might

be that frequently patients need to wait very long in order to have a doctor appointment, usually due to a large number of patients and hospital being short-staffed.

According to the authors' research, providers assessed the danger of being involved in an accident as 2.9 points out of 5, meaning less than in the case of the previously discussed aggression. These accidents are often caused by excessive speed, bravado, inattention, or the determination of the ambulance driver to reach a victim as quickly as possible [14]. According to data published by the Central Institute for Labour Protection, paramedics usually suffered from lower and upper limbs (mainly fingers) injuries, as well as neck, back and spine damages. Moreover, paramedics pointed out that the most physically strenuous activity was cardiopulmonary resuscitation, whereas the most mentally straining factors were unsatisfactory salary and providing medical service in accidents, in which children were the victims [15]. This is consistent with this study's results, which show that low salaries are one of the leading causes of increased mental stress. At this point, it is worth to mention that due to low earnings, health-care providers take up additional work in emergency departments or in education field. Over half of respondents worked over 240 hours a month and 10% more than 320 hours. We find this data disquieting. It may lead to faster and more frequent burnout as well as health problems in the future. Employees' fatigue can also influence efficiency and accuracy of their decisions.

Our results showed that over 40% of responders had a work-related spinal injury or other medical problems, which required medical intervention. In a study published by Rahimi et al., in 2014, a group of 180 nurses working in ED indicated that over 70% of them have experienced some type of work-related back pain. Additionally, it has been proven that there is a correlation between the development of depression, increased stress levels, decreased job satisfaction and the occurrence of pain [16]. It is worrisome that in this study, long working hours and the possibility of professional burnout were placed so low on the list of potential dangers.

Disorders of biological rhythms associated with night-time work affect mood, well-being, sleep, the cardiovascular system, the digestive tract, hormonal levels, and tumour development. Melatonin-related disorders and elevated inflammatory markers have also been reported [17]. People working in such

a system also have an increased incidence of obesity, elevated triglycerides, lowered HDL cholesterol, and, in women over 60, an increased incidence of glucose intolerance. These metabolic disorders are risk factors for cardiovascular disease. However, because these discrepancies do not give any early symptoms when complications do arise, they are often severe and may significantly affect work capacity [18]. Interestingly, a shorter sleep time (≤ 6 hours per day) was associated with a lower risk of developing melanoma (HR = 0.68, 95% CI, 0.46 to 0.98) and basal cell carcinoma (HR = 0.93, 95% CI, 0.86 to 1.00) compared with the most commonly reported 7 hours [19]. In one of the studies published in 2017, the authors found a significant difference in the risk of breast cancer in the group of women with 20 years or more of shift work compared with those who never performed shift work [20]. Danish nurses working night and evening shifts had increased risk for diabetes [21]. Among registered nurses, longer duration of rotating night shift work was associated with a significant but small absolute increase in CHD (chronic heart disease) risk [22]. What might be interesting, the participants in this study rated night shift work as a threat to health at 2.8. This information seems to be alarming for us. The majority of respondents were between 20 and 30 years old, hence they may not experience health problems yet. Nevertheless, information campaigns promoting health and hygiene could prevent any potential diseases among paramedics in the future.

The results of a Polish study published in 2011 are especially interesting in this regard. The authors of that study pointed out that 100% of their respondents have experienced some sort of somatic symptoms associated with stress. Irritation, headaches, sleep disturbances, and abdominal pain were among the most commonly reported. Additionally, duodenal ulcers were present in 6% of the paramedics. The symptoms were more frequent for paramedics with a longer career length, and those older than 40, which confirmed the chronic nature of the stressors. Uncontrolled outbursts of anger, screaming, or other negative emotional behaviour was also reported by 19% of the paramedics. Although many young people participated in the study, 20% of the respondents reported suffering from professional burnout. It was also emphasized that in order to alleviate stress, respondents have turned to tobacco products, alcohol, designer drugs, and other pharmacological agents [23]. The stressor load is further exacerbated

by the fact that there is an increased risk of causing car accidents and making more mistakes in general between 1 and 3 AM when the physical response to stimuli is most delayed. This is also confirmed by the fact that the common cause for the accident was careless behaviour of a paramedic [23, 24].

Also worrying is the fact that nearly half of all respondents have been exposed to infectious material. Although the number of HBV (hepatitis B virus) and HCV (hepatitis C virus) infections has dropped by 90% since 1999 [25], there is still a risk of infection. One of the ways to enhance safety while working with potentially infectious biological material is to use double gloves. However, wearing two pairs of gloves has also been shown to decrease the precision of medical procedures [26]. In studies by Brackowska et al., paramedics made up only 3.21% of the total number of health workers who had undergone occupational exposure, while 65% were nurses and 17.5% physicians. Yilmaz found, that 41.3% of work-related injuries have occurred inside the cruising ambulance [27]. There are plenty of life-saving procedures that must be done on the way to ED. Those are for example: maintaining manual airway patency, ventilation or drug administration.

Another important aspect is the risk of exposure to carbon monoxide, which is elevated in the wintertime. There is also a risk of exposure as a result of various technological processes [28], however, knowledge of the chemical reactions or processes that result in the production of carbon monoxide is not required of MRT members. Because of this, ambulances in some cities now carry carbon monoxide detectors, although this equipment is not yet considered mandatory.

Training in communication skills improves the confidence of staff in dealing with aggression. Baby et al. found that staff training that focuses on communication skills is a possible prevention strategy for aggression [29]. Nowadays medical simulation is found to be a very efficient method of training in wide aspect, either medical or communications skills [30]. To improve providers' safety, their educational programme should encompass classes with a high fidelity simulation that imitates dealing with aggressive patients.

CONCLUSIONS

Prehospital healthcare providers are exposed to an array of factors, which may pose threats to their

health and life, even though the overriding principle of the occupation states that personal safety is a number one priority. This article represents only a preliminary to a wider subject matter of work safety in prehospital healthcare. Efforts should be made in order to enhance the level of security and to reduce the number of working hours. The authors' proposal contains postgraduate courses in self-defence and in coping with stress, both based on high fidelity simulation method. It might be beneficial for ambulance crew members to raise their awareness concerning long-term resonance of extensive working hours and shift work.

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RECOMMENDATIONS FOR THE USE OF SIMULATION METHODS IN A SELECTED AREA OF HEALTH SCIENCES BASED ON AN EXAMPLE SIMULATION SCENARIO

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ABSTRACT

Over the past two decades, there has been rapid and enthusiastic acceptance of the simulation in medical education on the international stage. Poland compared to other countries has become unique due to the possibility of developing simulation and education by training teachers who teach medical professions, and building simulation centres.

One of the most important milestones in the development of the curriculum in medical and health sciences is the introduction of a simulation-based teaching method. Active teaching methods, including medical simulation, create conditions for independent learning, so they should be permanently included in the canon of education methods in the field of health sciences.

KEY WORDS: medical simulation; education; teaching; nursing

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INTRODUCTION

Over the past two decades, there has been rapid and enthusiastic acceptance of simulation in medical education on the international stage [1]. Poland compared to other countries has become unique due to the possibility of developing simulation and education by training teachers teaching medical professions and building simulation centres on a national scale. The first medical simulation centres have been developing in Poland since 2010, mainly for medical, nursing and obstetric departments. Currently, there are over 10 mono-profile medical simulation centres in Poland, providing multidisciplinary education and 30 other

mono-profile medical simulation centres are being opened. One of the most important milestones in the development of the curriculum in medical and health sciences is the introduction of a simulation-based teaching and learning method [2]. Medicine has benefited a lot from the aviation and aerospace industry, which has been using simulation for many years as a successful tool for educating future adepts of flying. Increased demand for training hours, limited opportunities of work with patients and a focus on patient safety have led to a new model of education in healthcare that increasingly includes technology and innovative ways to provide a unified curriculum [1, 3].

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Medical simulation as a teaching method in nursing

A medical simulation is an indispensable tool used for the education of medical staff to reproduce real situations (events) in artificial conditions which are safe for trainees. Simulations consist of imitating selected situations or processes using a correspondingly analogous situation and technical devices (trainers and simulators). Active teaching methods, including medical simulation, create conditions for independent learning. Conducting classes based on scenarios, especially scenarios of high fidelity simulation, allows students to make autonomous decisions, encourages creative thinking and, most importantly, it provokes self-reflection. The learner supplements the planned scenario of classes regarding a real or potential event [4].

Simulation methods have been present in training of nurses for years, their foundations are still based on the "student-master" theory (practised, among others, by Socrates and Plato), according to the teaching model: see one, do one and teach one. From around 1905 teaching nurses was mainly based on clinical practice in medical facilities (at the patient's bedside) and vocational training process did not include practical preparation in simulation conditions, ensuring, among others, greater patient safety. The changes in the vocational training of nurses evolved and the year 1921 turned out to be the breakthrough in the introduction of simulation to the teaching method. Then The Polish Red Cross Nursing School in Poznan started to operate. Its curriculum included both theoretical and practical parts and in the available sources some information about "*demonstration rooms*" is found. The training was conducted by a teacher — a nurse (thus by a practitioner!) and one of the requirements for proceeding to the stage of clinical practice was to master the technique of individual procedures in simulated conditions [5]. The functioning of the Warsaw School of Nursing was another trace of the use of simulation methods in the education of nurses. After the year 1929 the school was moved to a new building equipped with both lecture halls and exercise rooms, which proved the use of simulation methods. At the same time (around the year 1925), the education of nurses using medical simulation took place in Krakow — University School of Nurses and Health Caregivers (later called: Hygienists). The training program included the implementation of knowledge at three stages: theoretical classes, classes in a demonstration room and practical classes in medical centres [6, 7]. Later in other medical schools

this method of knowledge implementation has been retained and it has been continued until now.

Practical education in the field of health sciences is related to health promotion and care for the sick, suffering and dying. This education is an integral part of the teaching process, which aims to shape and improve the skills necessary to obtain professional qualifications. Simulation is one of the most actively developing educational methods used in medicine. Universities emphasize the importance of the creation of medical simulation centres and try to standardize education according to a global pattern. Training in medical and health sciences is based on standards of education. These standards highlight three areas of education focused on knowledge, skills and social competencies. The knowledge refers to a good understanding of basic concepts and assumptions in a given field or discipline, the skills are the proper performance of standard activities based on widespread medical procedures, while the social competencies relate to the attitude of the students and their abilities to cooperate with the interdisciplinary team [8, 9].

Education in medicine and health sciences is now considered an industry, in which more and more emphasis is placed on responsibility, transparency, quality assurance and, to a great extent, patient safety. These factors require monitoring the type and quality of health services provided by all healthcare professionals. Therefore, it is recommended to use more recent teaching methods to fill the space between traditional teaching in the field of medicine or health sciences and a new approach. Traditional teaching is based on commonly used methods (lectures, practical classes, laboratory work, consultation at the patient's bedside), while more recent methods are based on problems and ways of creative solving of encountered clinical difficulties. The use of medical simulation techniques confirms the idea of Confucius: "Tell me and I will forget, show me and I may remember, involve me and I will understand", which reflects the essence of medical simulation. The most effective way to acquire and consolidate knowledge is to actively participate in an event or process as opposed to listening or passive participation [10]. The learner is the most important active participant in the process of teaching, while the educator is the guide responsible for creating appropriate conditions for effective learning [8]. The basic element of medical practice is above all the principle of "*primum non nocere*" — above all do no harm. Acquiring specialist knowledge in the area of medical and health sciences requires the student to engage in a practice focused on

achieving the intended learning outcomes. Student education aims to achieve the intended educational goals called learning outcomes. There are knowledge, skills and social competences among the effects. Despite the simulated conditions, simulation learning allows the student to achieve three components in one session and to be actively engaged in both work and study. This method involves the repetitive practice of intended cognitive or psychomotor skills in a given field, combined with a rigorous skill assessment that provides the learners with feedback, resulting in better skill performance under controlled conditions. Concerns about patient safety, restriction of patient access, reorganization of work in hospitals and many other factors have led to the introduction of simulation, the development of medical simulation centres in education and the transfer of some clinical classes to simulation rooms [2].

Several mono-profile medical simulation centres have been created over the last two years. Some of them are poly professional due to the presence of obstetrics in the structures of the university. Low and indirect fidelity techniques have been used in the teaching process until now and when it comes to education in high fidelity conditions, it has not been conducted in the field of nursing. These more advanced techniques and equipment were used in the process of educating doctors and paramedics, although it is difficult to implement these class schedules in the educations of nurses in a 1:1 ratio.

It is related to the style of work of these professions. The two previously mentioned are trained for teamwork with a function of a team leader. In this scheme, it is easier to design classes for a group of students (everyone has a function and an assigned task). In the case of nurses, professional work is more individual and the equivalent of a team leader does not function on shift duty. So while constructing the scenario for nursing course, some modifications should be made so that during the course each student could be activated and after the course all the assumed learning outcomes could be achieved.

While designing the scenario for simulation classes, you need to consider, among others:

- size of the group — usually 6–8 students;
- the nature and level of advancement of a group of students;
- duration of classes — real duration of the simulation (clinical situation) should be estimated; usually 10–15 minutes;
- purpose of the class — planning the learning outcomes of the class;
- description of the main task for the group;
- description of the task for the lecturer and simulation technician, if their participation is planned;
- room description and equipment guidelines — the use of models (simulator/trainer — Fig. 1.) or simulate/standardized patient (actor — Fig. 2.);



FIGURE 1. Patient examination — using a simulator
Source: own study (by Karolina Radke)



FIGURE 2. Breast examination using a model and a simulated patient (SP). Source: own study (by Karolina Radke)

- description of the scenario for the teacher (it is not always the same person);
- taking into account possible difficulties or simplifications [8, 10–12].

Additional variants introduced to the scenario mean that students do not inform each other about its course and despite the common effect to achieve, they have different arrangements of the same problem. What is more, the effect of boredom, doing the same things by everyone

can be avoided. After each scenario variant (for each pair of the students), it is recommended to conduct debriefing in order to obtain the feedback from the students and to make a specific summary of the exercise. It is recommended to modify the main task in 3 additional variants for other students (the same purpose but different arrangement, e.g. a different patient, different circumstances, a different outfit of the mannequin/ /SP outfit etc.) [14].

Table 1. An example simulation scenario for the nursing course

The title of the scenario/ duration	A breast cancer survivor	20 minutes
The main problem	The patient comes to the healthcare centre for a breast examination. The student is to carry out a breast examination in accordance with the current scheme and provide the right test conditions	
The aims to discuss during debriefing	Conducting a physical examination which enables early detection of breast lesions and shows the patient how to carry out a self-breast exam (C.U53) The student respects patients' rights (C.K5)	
The case description	You are in the exam room in the health care centre, the patient comes to the room for the scheduled appointment	
The team composition	The scenario is implemented by 2 nursing students — they work in the healthcare centre The other students observe the situation in the next room In subsequent versions of the scenario, the student pairs change but what is important, the components of the scenario also change	
Information for the participants:	N/A	N/A
Room	The exam room — standard equipment: a table, a blood pressure monitor, a thermometer, a settee, a screen, etc.	
Preparation of the mannequin or the stimulated patient and the room	A simulated patient (female) equipped with a strainer for a breast examination, possible to attach on the torso of the simulated patient. In addition, version 2: elements of a religious outfit — a nun * Trainer: – version 1: right breast lesion, lower outer quadrant – version 2: breasts without pathological changes – version 3: lesion in the left breast, upper outer quadrant – version 4: left breast lesion, tumour in the outer lower quadrant and upper inner quadrant * Medical record — the patient's record to enter the result of the breast examination	
Initial parameters	Alternative parameters: 1) virtual patient (monitoring of the patient which aims to create simulated parameters): BP 135/85 mmHg, HR 85/min. (heart tones correct) SAT 96% breath 12/min. (breathable, without breathlessness and work of additional breathing muscles, vesicular breath sounds) even pupils reacting properly to light ECG: correct 2) The Simulated Patient, factual situation Breast examination trainer: – version 1: rightbreastlesion, lower outer quadrant – version 2: breasts without pathological changes – version 3: lesion in the left breast, upper outer quadrant – version 4: left breast lesion, tumour in the outer lower quadrant and upper inner quadrant	



Table 1. cont. An example simulation scenario for the nursing course

Interview	<p>Sample information about the patient (interview based on the SAMPLE scheme)</p> <p>S1 — The patient does not carry out a breast self-examination at home. She lives with a partner who has felt for a lump in her breast during an intimate relationship. The patient comes to the health care centre for a professional examination because this fact disturbs her and causes stress and raises doubts</p> <p>S2 — The patient does not carry out a breast self-examination, there are no pathological changes in the mammary gland, she comes for a preventive breast examination referred by a primary care physician</p> <p>S3 — The patient comes for a preventive examination, she carries out a self-examination but she does not do it properly, unaware that she has a tumour in her left breast, upper external quadrant</p> <p>S4 — the patient comes to exam room crying and upset, she has felt for changes in her right breast: a tumour in the lower outer quadrant and upper inner quadrant</p> <p>A — birch pollen, aluminium deodorant rash</p> <p>M — the patient does not take any medicines, only periodically commonly available pain killers</p> <p>P — generally healthy, appendectomy surgery in childhood</p> <p>L — breakfast in the morning</p> <p>E — oral contraception for 10 years in the past, childless, smoking, her menstruation stopped 2–3 years ago</p>	
The course of the scenario, evolution in the mannequin's vital parameters	<p>The students</p> <ul style="list-style-type: none"> – greeting the patient, introducing themselves – explaining the reason for the patient's visit – preparation for the breast examination: explaining the examination, providing comfortable (intimate) conditions – conducting the examination in accordance with the scheme – documenting the examination in the patient's record – informing about further proceedings — order to contact a primary care physician and request for a Rapid Oncological Diagnosis card in case of the scenario version 1, 3, 4 – informing about further proceedings — teaching and instructing how to carry out a breast self-examination at home: a version of scenario 2 <p>The course of the examination:</p> <ol style="list-style-type: none"> 1) The interview: an examination on the 2–3 days after menstruation in case the patient has no menstrual period — always on the same day of the month 2) Viewing and assessment: the shape and symmetry of the breast and axillary pits, the appearance of the skin of the breast, the appearance of the areola and the breast nipple Sitting (or standing) position and leaning position — with hands on the hips, with hands raised up, arms down along the torso 3) Palpation: an examination by the flat surface of the three middle fingers Sitting (or standing) position, lying on the side and lying on the back <ul style="list-style-type: none"> – palpation of 4 breast quadrants and axillary region – evaluation of each breast quadrant and axillary region in 3 positions – nipple assessment 4) Assessment of axillary and supraclavicular lymph nodes 	
	<p>Expected action:</p> <p>The students follow all the rules for the proper breast examination:</p> <ul style="list-style-type: none"> – provide comfort and intimacy – provide the correct technique of a breast examination – keep examination records – inform the patient about recommended further action – provide mental support 	<p>Negative action:</p> <p>The students do not respect the patients right to intimacy (they do not use a screen):</p> <ul style="list-style-type: none"> – the students do not know the examination scheme and they do conduct it incorrectly – the students do not keep examination records – the students do not inform the patient about recommended further action – the students ignore the patient's condition and do not provide her mental support – the students have a problem with being serious during the interview and the examination



Table 1. cont. An example simulation scenario for the nursing course	
Diagnosis	N/A — The patient has not been undiagnosed additionally yet
Physical examination	N/A — The Simulated Patient
A supportive question	If the students do not set the screen in front of the door, the Simulated Patient (SP) asks if someone will not come in during the examination because undressing is embarrassing for her
Distractions and difficulties	<ul style="list-style-type: none"> – version 2: the patient feels very uncomfortable, she is a nun (without a habit) and she does not want to undress — interview and communication. Scenario for a female and a male student. – version 3: the patient ignores the disease, after diagnosing a change in the breast, she does not want to see a primary care physician, she says: "What for? Probably it's nothing serious. My neighbour has had the same and she is still alive". (communication and argumentation in difficult situations)
Alternative courses of the scenario	<ol style="list-style-type: none"> 1. The first two students implement the baseline scenario 2. The second two students implement the baseline scenario with the changes: the patient has no changes in the mammary gland, she comes to a breast preventive examination referred by a primary care physician 3. The third two students implement the baseline scenario with changes: the patient comes to a preventive examination, unaware of the fact that she has a tumour in her left breast, the upper external quadrant 4. The fourth two students implement the baseline scenario with the changes: the patient comes to the exam room crying and upset because she has felt for changes in her right breast: a tumour in the outer lower quadrant and the upper inner quadrant



FIGURE 3. Examples of breast examination models. Source: own study (by Karolina Radke)



FIGURE 4. Silicone breast model used in the simulator. Source: own study (by Karolina Radke)

It should be remembered that medical simulation consists not only of trainers and simulators (Fig. 3–5). An additional and very important advantage of medical simulation is the possibility of getting communication skills. Interpersonal communication is an extremely important skill that should be acquired by all the graduates of medical universities, including nursing departments. In safe simulation conditions, with the support of a simulated patient, it is possible to shape appropriate situations in which appropriate reactions and behaviours occur (e.g. behaviour in difficult situations, such as cultural/religious differences, death, conflict or aggression) [11–13].



FIGURE 5. Examples of pathological changes used in breast examination models. Source: own study (by Karolina Radke)

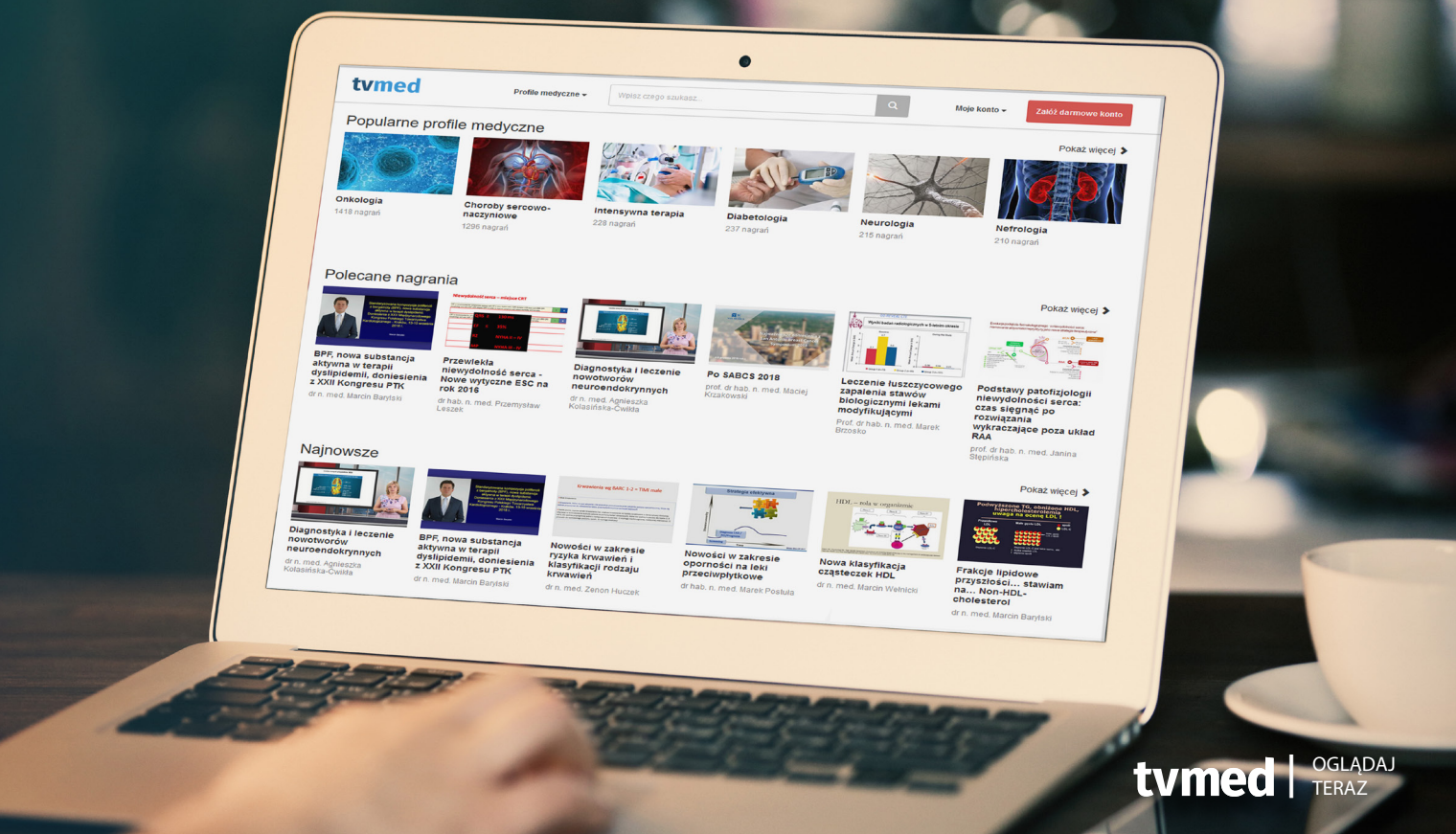
Summary

Simulation teaching methods are recommended by the actively developing medical education scene. It is known that modifying the teaching process is difficult but it can be implemented gradually in small steps. The use of information and simulation technologies is strongly recommended for several reasons:

- improving the quality of education;
- increasing the qualifications of the teaching staff — progress in the development of medical simulation should encourage the use of innovative or improved solutions and modifications;
- increasing the attractiveness of classes and thus increasing the effectiveness of teaching as a result of greater student involvement;
- increasing the attractiveness of classes previously considered uninteresting by students;
- standardization of the didactic process — everyone has the same learning/credit conditions;
- implementing the knowledge on several levels, which has a positive effect on the remembering process;
- techniques of introduction and summary with the feedback of the classes interesting for the student (pre-briefing and debriefing), which require certain skills from the teacher but bring excellent results [8, 12–14].

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