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# Evaluation of the abilities of the staff to perform medical rescue procedures at the advanced level in the State Fire Service in Poland in connection with an update of the Principles of Medical Rescue Organisation in the National Emergency and Fire System

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### **ABSTRACT**

**Introduction:** Analysis of the medical education of State Fire Service (SFS) officers in terms of the possibility to perform medical emergency procedures at the advanced level in connection with an update of the Rules of Medical Rescue Organisation in National Emergency and Fire System (NEFS).

**Material and methods:** An analysis was conducted of the nationwide staff-related data on the medical education of SFS officers, both in the day-based and shift-based system. The analysis also covered additional qualifications for the pursuit of the profession of a physician, nurse and medical emergency worker among the firefighters/medical emergency workers in Poland, satisfaction of the obligation of professional training and additional employment in healthcare facilities.

**Results:** 2220 officers with medical education work in the organisational units of SFS. Nearly 40% of the officers with medical education in SFS additionally work in healthcare units and more than a half pursues the statutory professional training. To ensure one medical emergency worker per professional shift on the ready, every SFS EFU should have ca. 5.6 full-time positions for medical emergency workers — this is a coefficient including absences of leave, sickness absences and other variables. Therefore, the above calculations indicate that to ensure one medical emergency worker per professional shift in one SFS EFU (E  $\approx$  5.6), ca. 2817 officers with medical education should be employed. With the current staff level (S $_{\rm RM}$  = 2220), ca. 597 officers should be employed to fill the demand (Mrt) if the advanced level is to be achieved **Conclusions:** The medical rescue in SFS as one of the disciplines of medicine requires continual development in terms of solutions for the system, equipment and first of all the staff. A higher number of medical emergency workers in SFS may have a positive effect on the quality of the medical procedures carried out during isolated emergency medical incidents. The organisational units of SFS in most voivodeships in Poland face a shortage of medical emergency workers on duty, which has a negative effect on the possibility to perform Medical Rescue Procedures at the advanced level.

**Key words:** medical rescue operations, firefighter-paramedic, National Emergency and Fire System

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### Introduction

On 30 June 2021, the Fire Chief of the State Fire Service (SFS) Approved the updated "Rules of Medical Rescue Organisation in the National Emergency and Fire System (NEFS)". The update was necessary to live up to the challenges which the medical rescue in SFS are facing as every year firefighters are taking up more and more medical procedures during emergency and fire operations. Moreover, they have been supporting the health care system in fighting the aftermaths of the SARS-CoV-2 pandemic in Poland for nearly 2 years. Significantly, the previous version of the rules took effect in 2013. [1]

The field of emergency medicine requires regular updating for continuous development. A good example here might be the international guidelines on resuscitation by the European Resuscitation Council (ERC) and the guidelines on the management of traumas by International Trauma Life Support (ITLS), which are updated every 5 years. This guarantees the introduction of new technical solutions and management standards dedicated to the medical rescue, which in turn translates into the quality of medical procedures. A higher management standard combined with the proper equipment allows survival or psychophysical well-being of as many people in life-threatening conditions as possible [2, 3].

The authors of this publication will use the following abridged names of these rules:

- "Rules '13" Rules of Medical Rescue Organisation in NEFS of 2013,
- "Rules '21" Rules of Medical Rescue Organisation in NEFS of 2021.

The update of "Rules '21" refers to the Regulation of the Minister of Health of 20 April 2016, which was introduced as part of an amendment to the State Medical Rescue (SMR) Act, and expanded the rights of the medical emergency worker both in terms of the procedures and the places of their performance. The amendment allowed the introduction of Medical Rescue Procedures (MRPs) outside the rescue system, e.g. for the officers on duty in the State Fire Service (SFS) licensed as medical emergency workers (referred to specifically as healthcare services other than medical rescue procedures). Before the amendment, medical emergency workers could perform MRPs solely in SMR entities, Accident and Emergency Departments (A&E) and Admission Rooms (AR) in hospitals. In every other case, despite possession of proper education and licences, a medical emergency worker provided medical aid at the level of qualified first aid (QFA) [4].

The Rules '21 Introduced two levels into the Medical Rescue Organisation in NEFS:

 "basic level — implemented by all emergency and fire units of the State Fire Service (SFS EFU) and other fire protection units or other entities declaring operational readiness for the performance of tasks

- according to their organisation and equipment possibilities and training the scope of qualified first aid"
- "advanced level implemented by SFS EFUs and other fire protection units or other entities declaring operational readiness for provision of healthcare services other than medical rescue procedures according to their organisation and equipment possibilities and training — the scope of healthcare provisions other than medical rescue procedures" [1].

Please note that the advanced level is not mandatory for the organisational units of SFS. To implement it, specific entities would have to meet a range of conditions such as:

- specialised rescue equipment exceeding the QFA scope.
- medicines and infrastructure for proper storage of medicines (storage room — a medicine storehouse, refrigerators),
- keeping proper medical records,
- qualified staff healthcare professionals (e.g. a medical rescue worker).

In addition, the above examples require proper funding for the purchase and maintenance of equipment and medical measures. However, the main prerequisite for the advanced level is the procurement of the staff with proper education. The staff factor is the most important and simultaneously the most difficult to realize, requiring expenditure and time for the education of medical staff if there are shortages in this area. With proper funding, the equipment and medical measures can be purchased in a time shorter than required for the education of the staff. Education in the field of emergency medical service is currently run during 3-year first-cycle studies. In the period from 1993 to 2015 (the last enrolment: 2012/2013), Medical rescue workers trained in a 2-year (4-semester) postsecondary school [5–7].

The importance of the medical staff in SFS was shown in the situation from 2020 when during the third wave of COVID-19, officers with medical education (medical emergency workers, nurses) were delegated for instance to the temporary hospital for patients infected by the SARS-CoV-2 virus, established in the Warsaw National Stadium [8].

To implement the advanced level in the given organisational unit of SFS, in other words, to have the operational readiness to carry out medical rescue procedures (MRPs) at the level of healthcare services other than medical rescue procedures in SFS, at least one firefighter per duty shift has to be licensed medical rescue worker and have practice in healthcare units (e.g. hospital departments, SMR), undergo statutory professional training in a five-year cycle after the achievement of the diploma of the medical emergency worker or take a medical-emergency-worker qualification course of the Ministry of the Interior and Administration [9, 10].

### Introduction

Analysis of the medical education of SFS officers in terms of the possibility to perform medical emergency procedures at the advanced level in connection with an update of the "Rules of Medical Rescue Organisation in NEFS".

## **Material and methods**

An analysis was conducted of the nationwide staff-related data on the medical education of SFS officers, both in the day-based and shift-based system. The analysis also covered additional qualifications for the pursuit of the profession of a physician, nurse and medical emergency worker among the firefighters/medical emergency workers in Poland, satisfaction of the obligation of professional training and additional employment in healthcare facilities.

Data from the SFS Chief Headquarters (CH) were used: permit for access was obtained on 08 November 2021. The database was prepared in Microsoft Excel in the MS Office 2016 suite for Windows 10 and

the spatial characteristic was carried out with QGIS on the GNU GPL licence. The said officers were fully anonymous, the general number of people with medical education broken down by voivodeships was taken to calculate and present the results. Individual medical professions were differentiated: physician, nurse and medical emergency worker, and a division into officers with medical education undergoing or not undergoing statutory professional training and additionally working in healthcare units (hospital departments, SMR).

"Rules '21" concern the medical rescue organisation in the National Emergency and Fire System (NSFS), which includes volunteer fire department (VFD) units. During emergencies, those units also provide medical procedures and VFD members include people with medical education. However, that part of NEFS was not the object of the analysis.

### Statistical methods

Geographic information systems were used to identify and visualise the distribution of SFS forces involving officers with medical backgrounds (Fig. 1).

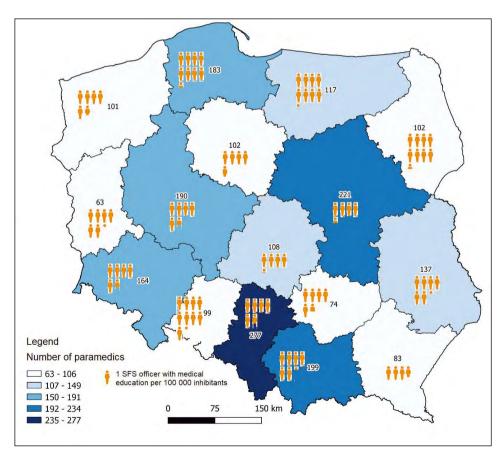


Figure 1. Spatial characteristics of the distribution of SFS officers with medical education (own elaboration)

To determine the possibility of performance of medical emergency procedures at the advanced level by SFS officers, the level of load of poviats was determined through original methods. First and foremost, the most representative statistical factors were assumed: number of medical emergency events. number of casualties, number of medical rescue procedures in the area of QFA (without psychological support for casualties), number of isolated emergency medical incidents (IEMIs) and average waiting time for a takeover of a casualty from a medical response team (MRT) during an IEMI for the period from 01 January 2015 to 21 December 2020. The data were aggregated to the level of poviats along with numerical distribution of officers with medical education, broken down by individual organisational units of SFS (Fig. 2).

# Description of the study area

The organisational structure of SFS in Poland:

- 16 voivodeship headquarters (SFS VHs),
- 335 poviat headquarters (PH) and municipal headquarters (MH) of SFS,
- 504 SFS EFUs (503 SFS EFUs were assumed in the analysis as one SFS EFU was established in the second half of 2021),

- 5 fire schools.
- Central Museum of Firefighting in Mysłowice,
- Scientific and Research Centre for Fire Protection National Research Institute (CNBOP-PIB) in Józefów.

Over 31 thousand officers worked in SFS, including 6 thousand in the day-based (8-hour) system and over 25 thousand in the shift-based system.

2220 officers had medical education (physician, medical emergency worker, nurse) as of 01 June 2021 [11].

### **Results**

As of 01 June 2021, 2220 officers with medical education worked in the organisational units of SFS. The figures in Table 1 show that nearly 40% of the medics in SFS additionally work in healthcare units (HUs) and more than a half pursues statutory professional training.

Table 2 shows the number distribution of officers with medical education in individual voivodeships. The largest number of paramedics is in the Śląskie and Mazowieckie voivodships — 277 and 221, and the least in the Lubuskie and Świętokrzyskie

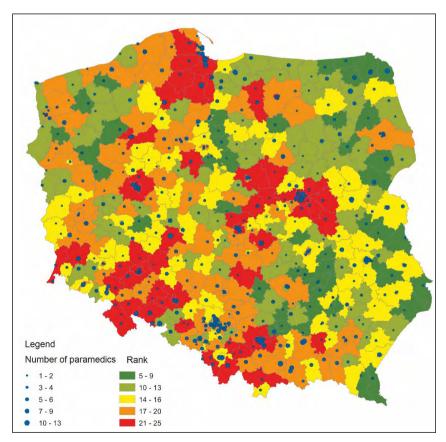


Figure 2. The burden on poviats based on the analysis of characteristic factors (own elaboration)

Table 1. General characteristics of the medical education of SFS officers

Medical qualifications	Total	All officers with medical education in SFS
Doctor	6	0.27%
Paramedic	2190	98.65%
Nurse	24	1.08%
Professional development	1238	55.76%
Works additionally in health care units	866	39.01%

<sup>\*</sup>abbreviations - health care units

Table 2. Number of officers in SFS with medical education by voivodeship

Voivodeship	Number of officers in SFS with medical education	Number of officers in SFS with medical education per 100 000 inhabitants			
Dolnośląskie	164	5.6			
Kujawsko-Pomorskie	102	4.9			
Lubelskie	137	6.2			
Lubuskie	63	6.2			
Łódzkie	108	4.1			
Małopolskie	199* (10)	6.2			
Mazowieckie	221* (2)	4.3			
Opolskie	99	9.2			
Podkarpackie	83	3.9			
Podlaskie	102	8.4			
Pomorskie	183	8.4			
Śląskie	277 * (5)	5.8			
Świętokrzyskie	74	5.7			
Warmińsko-Mazurskie	117	8.2			
Wielkopolskie	190 * (7)	5.7			
Zachodniopomorskie	101	5.9			
Whole Poland	2220	5.8			

<sup>\* —</sup> fire schools

voivodeships — 63 and 74. The distribution of the number of officers per 100.000 inhabitants is slightly different of a given voivodeship. The lowest indicator is in the Podkarpackie voivodship — 3.9/100.000 of the population, and the highest in the Opolskie voivodship — 9.2/100.000 of the population. The spatial analysis and data distribution are presented in Figure 1.

Using the methods for determination of the load of poviats, possibilities of performance of medical rescue procedures at the advanced level and places requiring staffing with medical rescue workers at the first phase of increases in the full-time worker limit were determined (including training needs). The following calculation methods needed to be assumed to calculate the full-time worker needs:

Where:

$$\begin{aligned} \mathbf{P}_{\mathrm{RM}} &= \mathbf{J} \star \mathbf{E}_{1.2} \\ \mathbf{Z}_{\mathrm{RM}} &= \mathbf{J} \star (\mathbf{E}_{1.2} - \frac{\mathbf{S}_{\mathrm{RM}}}{\mathbf{J}}) \end{aligned}$$

 $\mathbf{P}_{\mathbf{RM}}$  — professional needs for achievement of the advanced level

**Z<sub>RM</sub>** — demand for medical emergency workers

J — the number of SFS EFUs = 503

 $\mathbf{S}_{\mathbf{RM}}$  — the current number of medical emergency workers on duty = 2220

**E** — fixed full-time worker coefficient ≈ 5.6

To ensure one medical emergency worker per professional shift on the ready, every SFS EFU should have ca. 5.6 full-time positions for medical emergency workers — this is a coefficient including absences of

**Table 3.** Employment needs and needs for paramedics, broken down by voivodeships

SFS VHs	Number of PH/MH of SFS		Number of para- medics	Professional needs for achievement of the adva- nced level (1 paramedic)	emer	nd for medical gency workers paramedic)	Professional needs for achievement of the adva- nced level (2 paramedics)	Demand for medical emergency workers (2 paramedics)
Dolnośląskie	26	44	164	246		82	493	329
Kujawsko-Pomorskie	19	31	102	174		72	347	245
Lubelskie	20	29	137	162		<b>2</b> 5	325	188
Lubuskie	12	19	63	106		43	213	15 <mark>0</mark>
Łódzkie	22	34	108	190		82	381	273
Małopolskie	19	33	199	185		-14	370	171
Mazowieckie	38	61	221	342		121	683	462
Opolskie	11	17	99	95		-4	190	91
Podkarpackie	21	28	83	157		74	314	231
Podlaskie	14	19	102	106		4	213	111
Pomorskie	19	30	183	168		<b>−15</b>	336	1 <mark>53</mark>
Śląskie	31	47	277	263		-14	526	249
Świętokrzyskie	13	17	74	95		21	190	116
Warmińsko-Mazurskie	19	24	117	134		17	269	152
Wielkopolskie	31	44	190	246		56	493	303
Zachodniopomorskie	20	26	101	146		45	291	190
TOTAL	335	503	2220	2817		597	5634	3414

leave, sickness absences and other variables. Therefore, the above calculations indicate that to ensure one medical emergency worker per professional shift in one SFS EFU (E ≈ 5.6), ca. 2817 officers with medical education should be employed. With the current staff level ( $S_{RM} = 2220$ ), ca. 597 officers should be employed to fill the demand  $(Z_{RM})$  if the advanced level is to be achieved. By analogy, if the advanced level is to be achieved for 2 medical emergency workers per professional shift (E ≈ 5.6\*2), ca. 5634 officers with medical education should be employed. With the current staff level ( $S_{RM} = 2220$ ), ca. 3414 officers should be employed to fill the demand  $(Z_{RM})$  if the advanced level is to be achieved. Please note the estimated value of the E coefficient, which can be additionally rounded up or down to a full value. Table 3 shows detailed full-time worker needs and demand for medical emergency workers for the achievement of the advanced level of MRPs in NEFS broken down by voivodeships. The last column "demand for 2 medical emergency workers" illustrates the need to be satisfied to achieve MRPs at the advanced level in the ambulance staff if such a level was assumed in the given organisational unit of SFS.

# **Discussion**

A simple calculation can be made to visualize the condition of the medical staff in SFS. According to the "Rules '21", the advanced level at SFS can be achieved by EFUs, i.e. intervention-focused entities comprising the SFS MHs and PHs. The number of EFUs in Poland is n1 = 503. The number of officers with medical education working on those units is n2 = 2220. On average, there are n3 = 4 medics per EFU. It needs to be added that MHs most frequently include more than one EFU and their exact number depends on the size of the city, e.g. SFS MH in Warszawa has 17 EFUs and SFS MH Lublin — 6 EFUs. [12, 13]. Moreover, EFUs operate in the 24-hour, 3-shift system. This means that the average number of medical emergency workers (n3 = 4) is to be divided by 3 shifts. Some voivodeships (e.g. Śląskie, Mazowieckie, Małopolskie) stand out in this respect by the numbers of medical rescue workers in SFS ranks. This results from the demographics of the voivodeship, analyses of the number of isolated emergency medical incidents (IEMIs) in specific areas and the demand for officers with medical education. In recent years, a lot of SFS MHs/PHs have announced recruitment dedicated for medical emergency workers for the target position of "senior medical emergency worker on duty" [14, 15].

The introduction of the advanced level in the medical rescue organisation in NEFS aims for the ability to start MRPs mainly in three situations:

- the absence of MRTs/AMRTs (air medical response teams) at the scene of an incident,
- inability to use MRT/AMRT members when access to casualties in the danger zone is possible only for the medical emergency workers of NEFS,
- events involving numerous casualties and mass events [1].

Therefore, this concept assumes that statutory tasks from state medical rescue (SMR) not be phased out or taken over, but that medical entities be supplemented in special situations, events involving a high number of casualties within danger zones. Firefighters take part in IEMIs repeatedly during a year [16-18]. Their participation in such events has increased since the Polish healthcare system started to be burdened by the SARS-CoV-2 pandemic. The load of the SMR system during the pandemic is described by the analysis from 2021. The authors list the following impediments for MRTs to reach a patient: longer access time as teams have to put on personal protective equipment (PPE), longer time of started intervention as it is more difficult to hand the patient over to a hospital (limited number of beds, a profile of specialised departments changed into uniform Covid departments), a higher number of calls due to difficulty with starting treatment at the family doctor's office or unavailability of MRT due to the procedure of disinfection after an intervention regarding a patient infected with SARS-CoV-2 [19].

Duty with a medical emergency worker is beneficial for the other firefighters, their skills of performing QFA during medical procedures and professional training in the medical scope. Working with a medical emergency worker allows supplementation and update of the medical knowledge on every duty, particularly in the performance of more difficult QFA procedures, use of specialised medical equipment and devices (ventilator, AEDs, supraglottic methods) and medical activities in difficult conditions during emergency and fire operations [20–22].

The authors of the work of 2016 described the history and development of medical rescue in Poland. They state that the SMR system is well-developed and to keep that way, modifications and modernisations are to be implemented continually and modern technologies and the development of science must be followed. Only an efficiently operating system will result in a lower death rate among the ones in need. This holds for this study as well [23].

The need for constant development of the services responsible for medical rescue is also reported in

foreign literature. The work 2019 pertains to French firefighters (based on a literature review) who support medical entities in medical rescue activities analogously to the entities described in this study. The authors describe the organisation, obligations, communications, processes and information flow during a medical rescue operation carried out by firefighters [24].

### **Conclusions**

The medical rescue in SFS as one of the disciplines of medicine requires continual development in terms of solutions for the system, equipment and first of all the staff. A higher number of medical emergency workers in SFS may have a positive effect on the quality of the medical procedures carried out during IEMIs. The organisational units of SFS in most voivodeships in Poland face a shortage of medical emergency workers on duty, which has a negative effect on the possibility to perform MRPs at the advanced level.

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