

Evaluation of firefighters' knowledge about medical procedures



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ABSTRACT

INTRODUCTION: National Firefighting Rescue System (NFRS) plays an crucial role in ensuring internal security of Poland. NFRS is based on Professional Fire Services (PFS) and Voluntary Fire Services (VFS). In accordance with Polish law, firefighters are able to perform a lot of medical procedures. The purpose of this work is to to evaluate the knowledge levels among professional and voluntary firefighters.

MATERIAL AND METHODS: Observational comparative study. Participants were recruited from professionally active firefighters from PFS and VFS. In order to assess the knowledge levels, test containing questions about 22 medical procedures has been prepared. Shapiro-Wilk and Mann-Whitney U tests were used to analyze inter-group differences. All results were considered significant at $p < 0.05$.

RESULTS: The group of 100 professionally active firefighters from PFS ($n = 50$) and VFS ($n = 50$) were tested. The average age was 33.32 years ($SD \pm 6.06$), and 31.96 years ($SD \pm 8.86$) respectively. The average work experience was 10.66 years ($SD \pm 5.72$) in the group of professional firefighters and 11.38 years ($SD \pm 8.38$) among voluntary firefighters. There were no sociodemographic differences between the groups. No inter-group differences were found in an average test results (PSF: 76% vs VFS: 75%; $p = 0.795$). Work experience and the type of education were independent factors which correlated with test results ($r_s = 0.216$, $p = 0.031$ and $r_s = 0.354$, $p = 0.000$, respectively).

CONCLUSIONS: There were no significant differences in test results between PFS and VFS formations. The knowledge levels of medical procedures in professionally active firefighters is insufficient to pass the state exam. Supervision of professional development and education in NFRS structures should be considered.

KEYWORDS: medical procedure, fire service, firefighter, paramedic, knowledge level.

INTRODUCTION

The National Firefighting Rescue System (NFRS) is part of the internal security network in Poland. The system has been created to save lives, health, property and environment in cases of natural disasters and other local threats. The main elements of the NFRS are Professional Fire Services (PFS) and Voluntary Fire Services (VFS). Qualifications, equipment and logistics facilities allows firefighters to perform tasks in technical-, chemical-, ecological- and medical rescue field [1].

Medical procedres in NFRS includes rescue operations using medical equipment, but without the use of drugs for injection or invasive procedures [2]. In accordance with Polish law, firefighters are able to perform:

- cardiopulmonary resuscitation supported by the use of an automated external defibrillator (AED);
- external bleeding control and wound dressing
- extremity immobilization;
- hypothermia/hyperthermia protection;
- initial anti-shock procedure;
- oxygen therapy;
- evacuation;
- psychological support;
- initial medical segregation.

Medical procedures course lasts 66 hours and is followed by an theoretical and practical examination. The theoretical part is a test of 30 single-choice questions. Questions are selected from a database of approximately 200 officially published tasks. To pass an examination it is necessary to achive 27 points (90%).The practical exam includes cardiopulmonary resuscitation and two randomly selected tasks related to the above-mentioned procedures. Recertification is carried out every three years.

The aim of the study is to assess knowledge level of medical procedures that can be carried out by firefighters, as well as potential differences between PFS and VFS in in this field.

In 2013 within NFRS has been established 22. procedures:

Procedure 1 - accident area assessment;

Procedure 2 - medical rescue operations sequence;

Procedure 3 - cardiac arrest management (adults);

Procedure 4 - cardiac arrest management (children, infants and newborns);

Procedure 5 - head injuries management;

Procedure 6 - spinal injuries management;

Procedure 7 - chest injuries management;

Procedure 8 - abdominal injuries management;

Procedure 9 - pelvic injuries management;

Procedure 10 - musculoskeletal injuries management;

Procedure 11 - wounds;

Procedure 12 - traumatic amputation;

Procedure 13 - hypovolemic shock - preliminary procedure;

Procedure 14 - thermal burn management;

Procedure 15 - chemical burn management;

Procedure 16 - inhalation poisoning;

Procedure 17 - drowning;

Procedure 18 - hypothermia;

Procedure 19 - circulatory and respiratory disorders in non-traumatic patients;

Procedure 20 - seizures;

Procedure 21 - pregnancy-related emergencies;

Procedure 22 - psychological support.

MATERIAL AND METHODS

The study was conducted in the first half of 2019 in fire brigades in central Poland. In order to assess the knowledge levels, test containing 22 questions about 22 medical procedures has been prepared. Shapiro-Wilk and Mann-Whitney U tests were used to analyze inter-group differences. All results were considered significant at $p < 0.05$. Results with a value of $0.05 < p < 0.10$ were considered as a statistical trend.

RESULTS

Participants of the study

A group of 100 firefighters (100 men) took part in the study: 50 from PSF and 50 from VFS. All respondents were male. The average age was 33.32 years ($SD \pm 6.06$), and 31.96 years ($SD \pm 8.86$) respectively. In order to compare the PFS and VFS groups in respect to age, an analysis of the normality of variable distribution was performed, obtaining for the PFS group Shapiro-Wilk = 0.968 ($p = 0.677$) and VFS Shapiro-Wilk = 0.890 ($p = 0.000$). Due to the lack of normal distribution of age variables in the VFS group, a nonparametric test was performed. In the Mann-Whitney U test analysis, a result of 1001.5 was obtained for $p = 0.087$, which confirmed the absence of statistically significant intergroup differences.

The average work experience was 10.66 years ($SD \pm 5.72$) in the group of professional firefighters and 11.38 years ($SD \pm 8.38$) among voluntary firefighters. In order to compare the PFS and VFS groups in respect to work experience, an analysis of the normality of variable distribution was performed, obtaining for the PFS group Shapiro-Wilk = 0.962 ($p = 0.112$) and VFS Shapiro-Wilk = 0.877 ($p = 9.210$). Due to the lack of normality of the distribution of variables for seniority in the VFS group, a nonparametric test was performed.

In the Mann-Whitney U test analysis, the result was 1226 for $p = 0.871$, which confirmed the absence of statistically significant intergroup differences. Some firefighters graduated from higher medical studies (medical rescue), and for this reason an analysis of education in the examined group was carried out as a possible disturbing factor. The vast majority (94%; $n = 47$) of the PFS firefighters were rescuers after course

medical procedures course, and 6% (n = 3) were paramedics. Similar relationship was observed among VFS firefighters, where 96% (n = 48) were rescuers after course, and 4% (n = 2) were paramedics. There was no statistically significant difference between the groups in terms of medical education (Mann-Whitney U test = 1225; p = 0.655).

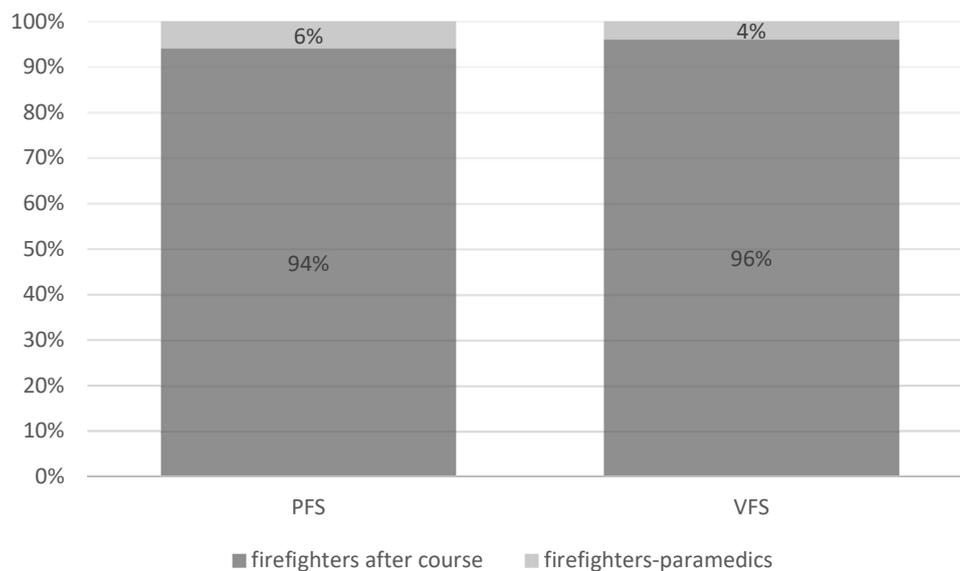


Figure 1. Percentage share of firefighters after course and paramedics-firefighters in the examined groups.

Written exam analysis

A group of PFS firefighters (n = 50) gave 76% correct answers and 24% incorrect answers. The average score was 16.82 points (SD = 3.37). A group of VFS firefighters (n = 50) gave 75% correct answers and 25% incorrect answers. The average score was 16.58 points (SD = 3.59). In order to analyse the differences between the PFS and VFS groups for independent samples the Mann Whitney U test = 1212 for p = 0.795 was obtained. Figure 2 presents a summary of the percentage of correct answers.

Among PFS firefighters, the best result (96%) was obtained in the question about procedure 16, i.e. the symptoms of inhalation poisoning. The second result (90%) was obtained in question about procedure 6, i.e. situations in which spinal injury can be expected. The third best result (88%) was obtained in question about procedure 14, i.e. recognition of the degree of thermal burns. The worst result (50%) was obtained in the question about procedure 1 (accident area assessment).

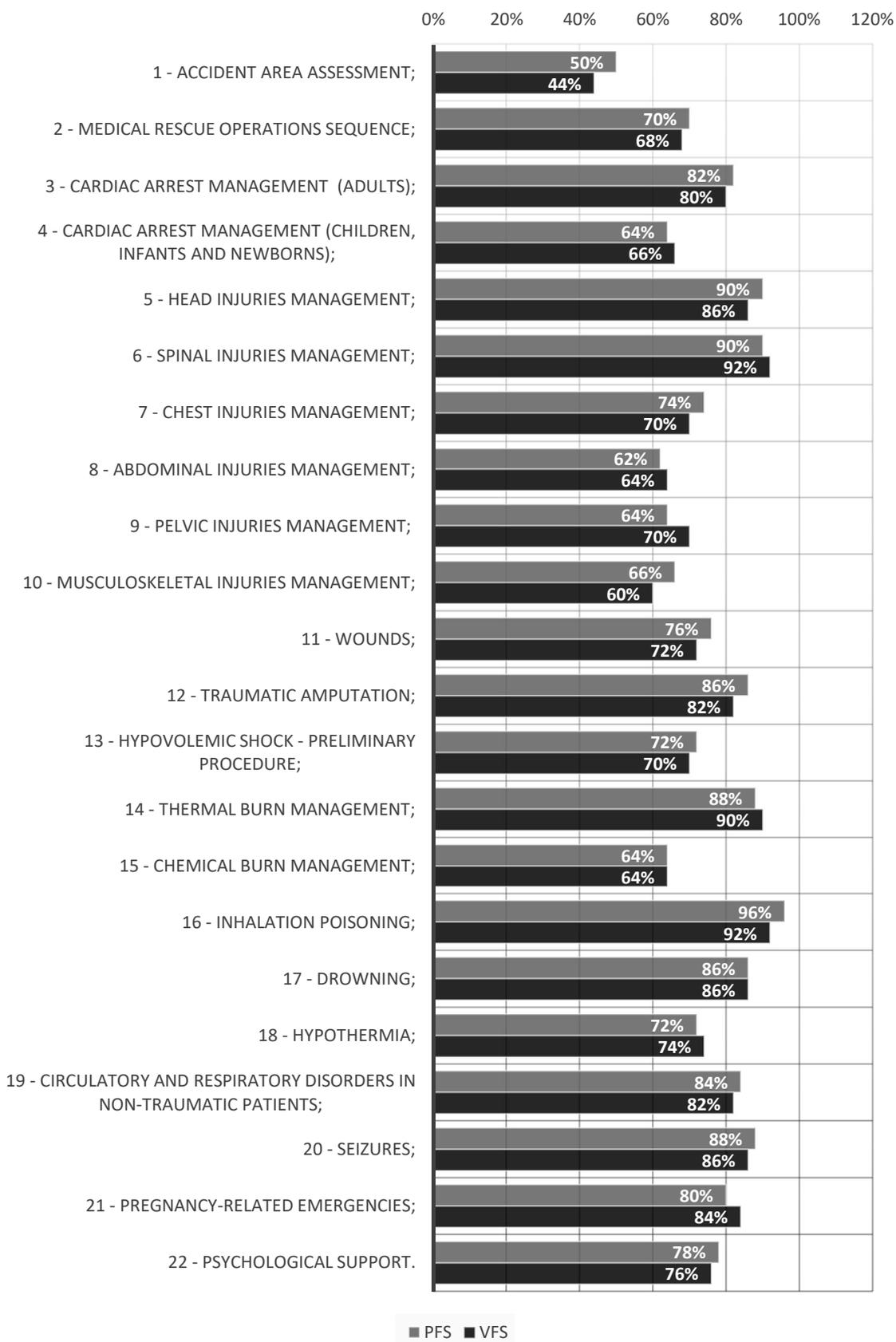


Figure 2. Percentage of correct answers divided by type of formation.

Among VFS firefighters, the highest score (92%) was obtained in the question about procedure 6, i.e. suspected spine injury, and 16, i.e. signs of carbon monoxide poisoning. The second result (90%) was obtained in the question about procedure 14, i.e. the recognition of the degree of thermal burn. The third result (86%) was obtained simultaneously in 3 questions: traumatic cerebro-spinal fluid otorrhea, drowning and epileptic seizure management. The worst result (44%) was obtained in the question about procedure 1 (accident area assessment).

Correlation of the level of knowledge with sociodemographic factors

In order to analyze the correlation of the test results with the age of the respondents, the Rho-Spearman test was performed, the result of which was: 0.157 for $p = 0.120$. The result was statistically insignificant. correlation of the test result with the work experience of the respondents, the Rho-Spearman test was performed, the result of which was: 0.216 for $p = 0.031$. The result was statistically significant. This result means that there is a relationship between the work experience of the respondents and the knowledge level of in medical procedures. The greater the work experience, the better the results were achieved by the respondents. While comparing the result of the test with medical education, the Rho-Spearman test was performed, the result of which was: 0.354 for $p = 0.000$. The result was statistically significant. This means that there is a relationship between the education of the respondents and their knowledge level of NFRS medical procedures (Figure 3).

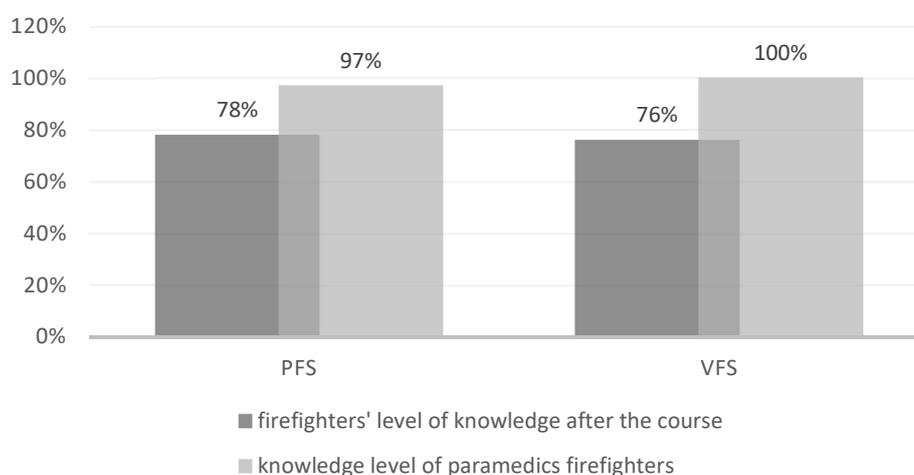


Figure 3. Comparison of the level of knowledge of PFS and VFS firefighters depending on their education.

DISCUSSION

The rules for training firefighters in the field of NFRS medical procedures have been set out in relevant normative acts. The verification of their knowledge is carried out by means of a standardized test concerning the issues contained in 22 NFRS procedures. Passing the exam requires reaching the 90% threshold of correct answers. In the study, firefighters received an average of 76% correct answers for PFS and 75% correct answers for VFS. This is not a satisfactory result, because it is below the exam pass rate [4].

The assessment of intergroup differences excluded the possibility of falsifying results due to the influence of disturbing factors. Therefore, the relationship between the level of knowledge and selected variables of the study group was compared. Analyzing the test result in the PFS and VFS groups, it was found that there were no statistically significant differences. Thus, it can be concluded that both formations have knowledge at a similar level.

The study showed that seniority in firefighters service significantly affects the level of knowledge in the field of NFRS medical procedures. The authors explain the higher test result of firefighters with more seniority depending on greater experience in passing recertification exams [5]. The last factor examined was the level of education of the study participants. The relationship between the test result and the education of the respondents was demonstrated. Paramedics, despite being a small group (5% of respondents), achieved an average result of 97% of correct answers. This means that being a paramedic predisposes you to pass a test with medical procedures at a very high level.

The detailed test results analyzed, based on a qualitative analysis of the content of the questions, are the three best results obtained in questions regarding symptoms and injury recognition of victims. Among PFS firefighters, the best results were obtained in question about procedure 16, i.e. the symptoms of inhalation poisoning, procedure 6, i.e. situations in which a spinal injury can be expected, and procedure 14, i.e. recognition of the degree of thermal burn. Among the VFS firefighters, the highest scores were obtained in questions about procedure 6, i.e. suspected spinal injury, procedure 16, i.e. signs of carbon monoxide poisoning, procedure 14, i.e. the degree of thermal burns.

Among the PFS firefighters, the worst result was obtained in the question regarding procedure 1, i.e. about the elements of recognition of the place of the incident, the next worst result was obtained in the question concerning procedure 8 (abdominal injuries management). The third worst result occurred simultaneously in three questions regarding procedures 4, i.e. the question about the initial CPR sequence in the infant, 9 i.e. the procedure for the breakdown of the long bone, and 15 - the question about the action in the event of a chemical burn.

Among the VFS firefighters, the worst result was obtained in the question about procedure 1, i.e. about the elements of the accident area assessment. The second from the end result was obtained in the question about procedure 10, i.e. the amount of possible blood loss in the case of a broken pelvis, followed by procedure 8 (abdominal injuries management), and 15, i.e. the question about action in the event of a chemical burn.

Therefore, the key stages for both professional firefighters and volunteer firefighters are the basic steps at the scene. The overall result of the test clearly indicates a lack of full understanding of NFRS medical procedures issues. Firefighters received a clearly lower score when the content of the questions was worded differently than on standard tests. The obtained results indicate the urgent need to verify the form of training and test exam in the scope of qualified first aid in NFRS [6,7].

CONCLUSIONS

Firefighters are well acquainted with the procedures related to injuries management, and significantly worse with accident area assessment. Knowledge level of medical procedures depends on type of education and work experience. There were no significant differences in test results between PFS and VFS formations. The average knowledge level of rescue procedures in the NFRS is insufficient, which undermines the reliability of state examinations. Higher medical education among firefighters significantly improves knowledge level. For that reason it is worth to consider to improve the qualifications of firefighters by graduating from medical rescue studies.

Disclosure statement

The authors did not report any potential conflict of interest.

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