

The role of the Volunteer Fire Service during interventions in rural agglomeration.



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ABSTRACT

INTRODUCTION: At the moment, the role of the Fire Service in the vast majority of cases differs from actions related to fires or natural disasters. The type of intervention depends on the specificity of the region and the equipment of the unit. The aim of the study was to analyze the activities of the Volunteer Fire Services (VFS) in a rural agglomeration.

MATERIAL AND METHODS: 164 interventions from 2018 were analyzed. The VFS unit was located in the Zbuczyn area in Poland. Tables showing the activity of the unit in numerical terms were used to present the research results. Statistical analysis was performed by assessing the normal distribution with the Shapiro-Wilk test. Spearman's Rho test was used to calculate the significance of variable correlations. The significance level was assumed at $p < 0.05$.

RESULTS: More than 1/3 of all interventions ($n=55$; 33.60%) concerned traffic events. Calls to fire constituted 21.90% ($n=36$). A total of 586 activities were undertaken, of which 78 (13.31%) were related to securing the incident site, 50 (8.53%) to stopping hemorrhage and dressing wounds, and 46 (7.85%) to cutting various structures in order to free the casualties. Rescue equipment was used 698 times. Firefighters usually used dressing sets ($n=74$; 10.60%), as well as stretchers and immobilizing equipment ($n=62$; 8.88%). Rescue operations were usually conducted in the open air ($n=84$; 51.22%) in the afternoon (4:00 p.m -5:00 p.m). There was a significant correlation ($p=0.004$) shown between the hours per day cycle and the number of calls.

CONCLUSIONS: In case of incidents in rural areas, VFS firefighters are most often called to road accidents. The majority of on-site interventions are related to providing safety and dressing the wounds of the injured persons. The number of interventions closely correlates with the time of day and is the highest in the afternoon.

KEY WORDS: Volunteer Fire Services, Fire Department, village, firefighters, rescue operations.

INTRODUCTION

The social and political changes that took place in Poland in the 1990s led to a specific kind of change in the approach to safety-related issues. Nowadays, it can be said that the most common threats are no longer military-related, demonstrating civilization- and nature-related character instead [1]. The basic public service in Poland, which was established to protect the population against fires, is the Professional Fire Services (PFS). Half a thousand rescue and firefighting PFS units are supported by 4,439 Voluntary Fire Services (VFS) units [2].

The data of the National Headquarters of the State Fire Service indicate that in 2018, all the Fire Service units in the country had 149,434 interventions related to fires, constituting less than 29.76% of all calls. However, most of the activities were not related to fire hazards ($n=311,978$; 62.14%). As many as 40,643 (8.1%) calls proved to be a false alarm. The characteristics of events draw attention to the need for appropriate disposal of forces and resources depending on the threat [3]. At the moment, the role of the Fire Service in the vast majority of cases differs from actions related to fires or natural disasters.

The aim of the study was to attempt to assess the characteristics of interventions undertaken by the VFS with particular emphasis on the specificity of activities in rural agglomeration. The analysis of incident types, forms of rescue operations and the equipment used will allow to specify the current demand for assistance provided by rural fire service units.

MATERIAL AND METHODS

The data for 2018 were obtained from VFS reports in the Zbuczyn region in Poland. Tables showing the activity of the unit in numerical terms were used to present the research results. Statistical analysis was performed by assessing the normal distribution with the Shapiro-Wilk test. Spearman's Rho test was used to calculate the significance of variable correlations, interpreting the results according to J. Guilford's scale. The significance level was assumed at $p < 0.05$.

RESULTS

164 interventions were included in the analysis. Table 1 presents the general statistics of VFS Zbuczyn activities in 2018. It can be seen that most interventions, i.e. 78.7% of all calls, concern the categories of road accidents, local events and fires. However, it should be noted that out of the total number of events to which the Voluntary Fire Brigade intervenes, fires account for nearly 22% of all calls.

Table 1. VFS intervention characteristics

Event	Number of calls (%)
Road accident	55 (33.60%)
Local danger	38 (23.20%)
Fires	36 (21.90%)
Other	19 (11.60%)
Storms	12 (7.30%)
False alarms	2 (1.20%)
Chemical rescue	2 (1.20%)
TOTAL	164 (100.00%)

Table 2 shows detailed statistics on the activities of VFS Zbuczyn. It is clear that most interventions were related to securing the site of emergency. Firefighters, who also have appropriate qualifications, provide first aid to the injured persons, using professional rescue sets. Medical assistance consists primarily of stopping external bleeding and dressing wounds. In addition, one of the most frequent interventions is the cutting of metal structures in order to evacuate the victims.

Table 2. Detailed list of activities performed by the VFS

Type of intervention undertaken	Number (%)
Securing the site of emergency	78 (13.31%)
Stopping external bleeding and dressing wounds	50 (8.53%)
Cutting, bending of structures, equipment, machines	46 (7.85%)
Evacuation of people	34 (5.80%)
Providing access to persons at risk or casualties	31 (5.29%)
Smoke removal, providing air ventilation	31 (5.29%)
Transportation, water supply in case of fire	30 (5.12%)
Cooling burns	29 (4.95%)
Animal evacuation	27 (4.61%)
Providing extinguishing agents during active phase	21 (3.58%)
Fixing fractures and suspected fractures and dislocations	19 (3.25%)
Opening rooms	17 (2.90%)
Providing extinguishing agents during defensive phase	15 (2.57%)
Protection of mass events	15 (2.57%)
Evacuation of properties	14 (2.39%)
Restoring or maintaining airway patency	11 (1.88%)
Performing an external cardiac massage	11 (1.88%)
Cooling of objects, equipment	10 (1.71%)
Cutting, removal of trees and other natural objects	9 (1.54%)
Determining danger zones	8 (1.37%)
Pumping water and other fluids out of sites	8 (1.37%)
Providing access to animals	7 (1.19%)
Oxygen therapy using 100% O ₂ or artificial respiration	7 (1.19%)
Protection against heat loss	7 (1.19%)
Transportation of casualties in the danger zone	6 (1.02%)
Providing casualties with care after segregation	6 (1.02%)
Moving structures, equipment, machinery	4 (0.68%)
Reducing spills, leaks	4 (0.68%)
Provision of material aid to the population	4 (0.68%)
Demolition work on building structures	3 (0.51%)
Providing protective belts, logging	3 (0.51%)
Long-distance water transfer	3 (0.51%)
Preliminary anti-shock actions	3 (0.51%)
Lifting of structural elements, machines, equipment	2 (0.34%)
Collecting, removing, washing chemical substances and others	2 (0.34%)
Debris removal, excavation	2 (0.34%)
Determination, recognition of chemical and other substances	2 (0.34%)
Neutralization, sorption of chemicals and other substances	2 (0.34%)
Provision of water to the public	2 (0.34%)
Movement of aggressively behaving insects or animals	2 (0.34%)
Search for missing persons	1 (0.17%)
Sealing of tanks, cisterns, pipelines	0 (0.00%)
Pumping of oil-based, chemical and other substances	0 (0.00%)
Making trenches, underground passages, punctures	0 (0.00%)
TOTAL	586 (100.00%)

Technical and medical equipment is used during rescue operations. The study included detailed analysis of using the VFS unit equipment. The results show that in the study group, dressing sets and immobilizing equipment, including stretchers, were used most often (Table 3).

Table 3. Equipment used by VFS

Equipment name	Number of applications (%)
Dressing kit	74 (10.60%)
Stretcher, immobilization equipment	62 (8.88%)
Ventilator	56 (8.02%)
Hand-operated fire fighting equipment	47 (6.73%)
Protective clothing / High temperature protective clothing	41 (5.87%)
Typical, fire-fighting pumps	39 (5.59%)
Lighting equipment	37 (5.30%)
Hydraulic tools	37 (5.30%)
Portable ladders	33 (4.73%)
Respiratory protective devices	31 (4.44%)
Mechanical ladders and hoists	29 (4.16%)
Measuring equipment	28 (4.02%)
Hand-operated demolition equipment	27 (3.87%)
Bag valve mask	21 (3.00%)
Mechanical saws for cutting concrete and steel	21 (3.00%)
Human rescue equipment	19 (2.73%)
Equipment for restoring respiratory tract patency	19 (2.73%)
Power generators	19 (2.73%)
Mechanical woodcutting saws	16 (2.29%)
Equipment for oxygen therapy with 100% O ₂	14 (2.00%)
Sludge pumps	7 (1.00%)
Pumps for other media	6 (0.86%)
Pneumatic tools	6 (0.86%)
Oil separators	5 (0.72%)
Skimmers	4 (0.57%)
Barriers, dams	0 (0.00%)
Protective chemical clothing	0 (0.00%)
Gas-tight clothing	0 (0.00%)
High altitude rescue operation equipment	0 (0.00%)
Diving equipment	0 (0.00%)
TOTAL	698 (100.00%)

The characteristics of the intervention also require an analysis of the place of the event. In the summary of Table 4, the vast majority of actions (51.22%; n=84) are conducted outdoors, i.e. in open spaces. The smallest number of operations is carried out at a height, representing 1.83% (n=3) of the total number of interventions.

Table 4. Characteristics of the place of VFS intervention

Place of operation	Number of actions (%)
Outside	84 (51.22%)
Inside the sites on the ground floor	29 (17.68%)
Inside the sites on floors 1-2	15 (9.15%)
Inside the sites in the basements	6 (3.66%)
On the roofs, in the attics	4 (2.44%)
At heights	3 (1.83%)
Inside the sites on floors 3-4	0 (0.00%)
Inside the sites on floors 5-7	0 (0.00%)
Inside the sites on the floors >7	0 (0.00%)
Inside shafts, chimneys, lifts	0 (0.00%)
Underwater	0 (0.00%)
Underground, inside wells, tunnels, caves	0 (0.00%)
In excavations, in landslides, in collapses	0 (0.00%)
Not specified / no data	23 (14.02%)
TOTAL	164 (100.00%)

The peak activity of the analyzed unit was in the afternoon (4:00 p.m - 5:00 p.m) and in the evening (6:00 p.m - 7:00 p.m), as shown in Figure 1. The evaluation of distribution normality for a variable number of interventions depending on the hour in the daily system was performed using the Shapiro-Wilk test: 0.839 at $p=0.001$. Due to the lack of normal distribution characteristics, a non-parametric test was used to calculate the correlation of variables. The rho-Spearman test was 0.560 for $p=0.004$, confirming the high correlation coefficient according to J.Guilford, concerning the number of interventions in relation to the time of day.

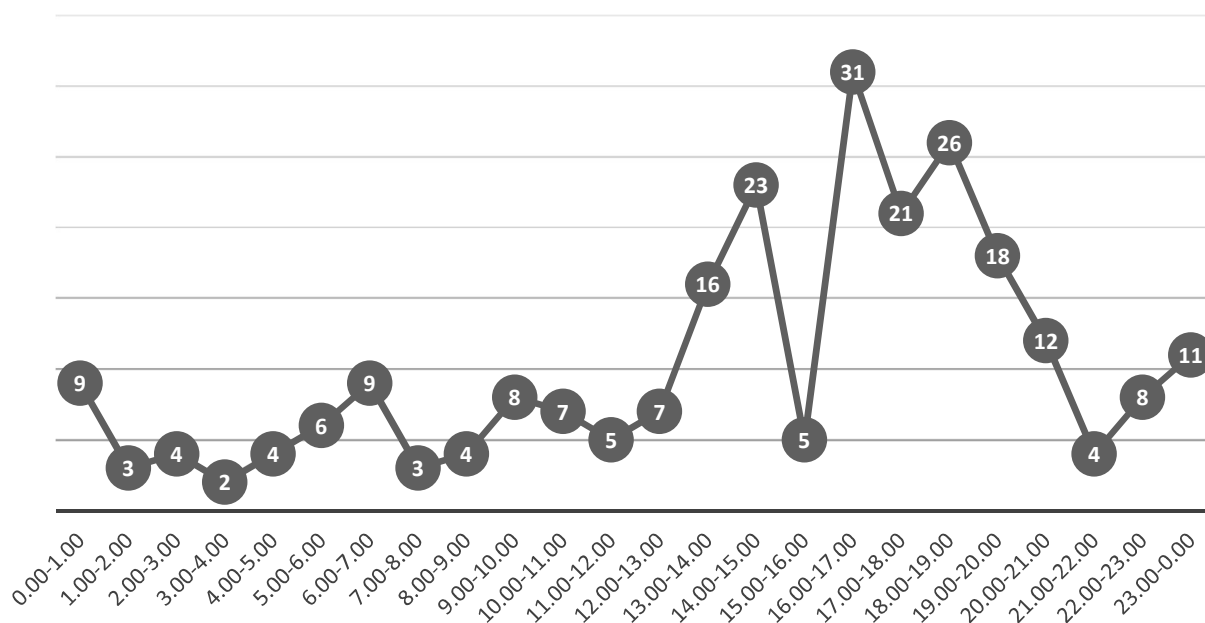


Figure 1. Hourly distribution of interventions by the VFS

DISCUSSION

The role of the Voluntary Fire Brigades in Poland is crucial for rural agglomerations [4]. The analysis of the characteristics of the intervention in VHS Zbuczyn was based on the rural area, located in the Masovian Voivodeship in Poland. The place which is the seat of the examined unit is inhabited by more than 10 thousand people. The area of the commune is 210 square kilometers, with a population density of 48 people per square kilometer. The agricultural land in this commune constitutes 79%, with the forest land being 14%. The main road passing through the commune is the national road number 2, which is a part of the international route E30 connecting East and West Europe, namely Russian Omsk with Irish Cork. It is a popular transit road, with heavy vehicle traffic, including both passenger vehicles and trucks. Given the characteristics of the VFS operational area covered by the study, it can be considered as representative compared to other rural regions.

The results confirm that VFS is an extremely important element of support for other rescue units, including the Emergency Medical Service [5]. The Fire Service, despite its unambiguous role inscribed in the name, performs multi-profile tasks today. VFS supports EMS actions, and provides first aid in road accidents

very often, while fire fighting is no longer a priority activity [6]. The performed study shows detailed wear and tear of the equipment used in the fire service units. In the rural area, dressing sets (10.60%), as well as stretchers and immobilizing equipment (8.88%) were used the most often. Securing the site of emergency (13.31%), as well as stopping external hemorrhages and dressing the wounds (8.53%) were the activities performed the most often on site. The studies carried out by Karen Smith show increasing awareness of firefighters who have been entrusted with the medical role (as first-responders) [7].

The activity of the VFS is based on 24-hour cycle, and therefore the afternoon hours are indicated as those with a significant increase in the number of calls. The lowest number of events takes place at night and in the morning. The intervention sites are mainly open spaces (51.22%). As predicted, no VFS actions have been recorded in multi-storey buildings. Despite relatively few VFS interventions in 2018 (164 interventions/365 days), emphasis should be put on numerous activities (n=586) performed by firefighters on emergency sites, and the use of specialized equipment (n=698). Further studies are needed to identify the specificity of Fire Service operations in rural areas in order to improve the quality of rescue operations.

CONCLUSIONS

In case of incidents in rural areas, VFS firefighters are most often called to road accidents. The majority of on-site interventions are related to providing safety and dressing the wounds of the injured persons. The number of interventions closely correlates with the time of day ($p=0.004$) and is the highest in the afternoon and in the evening.

Disclosure statement

The authors did not report any potential conflict of interest.

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