

Mortality in OHCA during resuscitation by rescue teams without a doctor.



Paweł Szymczuk¹  ORCID <https://orcid.org/0000-0002-4773-6491>

¹ Voivodship Ambulance Station and Sanitary Transport "Meditrans", Warsaw, Poland

ADDRESS FOR
CORRESPONDENCE:

Paweł Szymczuk,

Voivodship Ambulance Station and
Sanitary Transport "Meditrans"
Warsaw, Poland

Str. Poznańska 22,
00-685 Warsaw, Poland

e-mail: szynek1987@go.pl

ABSTRACT

INTRODUCTION: Out-of-hospital cardiac arrest (OHCA) is a condition that requires immediate intervention by a medical emergency team. CPR is usually based on current scientific guidelines. In Poland, medical response teams are divided into specialist emergency medical services with a doctor (S-EMS) and basic emergency medical services with a paramedic or emergency nurse (B-EMS). The aim of the study is to assess the differences in resuscitation management between two types of teams and to determine the mortality rate for each of them.

MATERIAL AND METHODS: The study covered 75 emergency ambulance interventions performed in 2017 in central Poland, out of which calls directly to OHCA were selected. The patient's profile, resuscitation and mortality rate were analyzed, taking into account the division into types of emergency response teams. Mann-Whitney U test, chi-squared and Spearman-rho correlation were applied. All results at $p < 0.05$ were deemed significant.

RESULTS: The emergency teams were sent 54 times directly to OHCA ($n=28$; B-EMS vs. $n=26$; S-EMS). There were no significant differences between the teams in terms of arrival (Mann-Whitney U test: $Z=0.43$; $p=0.668$), nor between the profile of the patient. B-EMS more frequently applied fluid therapy (Spearman-rho = 0.312 ; $p=0.022$). More often resuscitation was discontinued in medical teams than in B-EMS (46.2% vs. 22.2%). There was a statistically significant correlation between the type of the emergency response team and the outcome of resuscitation ($\chi^2=10.6834$, $p=0.001$). Comparable often (52.6% vs. 47.4%), the doctor helping the B-EMS pronounced death and undertook transport to hospital.

CONCLUSIONS: There are few differences in resuscitation performed by S-EMS and B-EMS. Teams accompanied by a doctor called upon to assist B-EMS with resuscitation do not increase the chance of ROSC (return of spontaneous circulation). New systemic and legal solutions should be considered, taking into account the qualifications of paramedics.

KEY WORDS: EMS, paramedic, OHCA, ROSC, resuscitation, mortality.

INTRODUCTION

The consensus on handling OHCA (out-of-hospital cardiac arrest) constitute a guideline of the European Resuscitation Council [1]. The actions of EMS are based on advanced life support (ALS) procedures. In cases of OHCA, there are also situations in which the resuscitation procedure needs to be modified. This requires adequate knowledge and skills on the part of the ambulance staff. In addition to the diagnosis of OHCA and the implementation of cardiopulmonary resuscitation (CPR), the reversible causes of cardiac arrest should be carefully analyzed. The responsibility for the treatment lies with the head of the emergency medical team, who is both a doctor, a paramedic and a nurse [2].

Types of ground medical response teams (EMS) in Poland are regulated by the Act of 8th September 2006 on State Medical Rescue (Journal of Laws 2006 No. 191, item 1410). Specialistic emergency medical service (S-EMS) is commanded by a doctor who has two more persons authorized to provide medical rescue services (paramedics and/or nurses). Basic emergency medical service (B-EMS) consists of at least two persons authorized to provide medical rescue services: a system nurse and/or a paramedic. A B-EMS manager may be a person with at least five years of experience in providing health services in rescue services [3]. Both types of teams perform activities at the ALS level, having analogous equipment and a similar set of drugs at their disposal. There has been a visible transformation in the Polish medical rescue system in recent years. With the increase in the total number of EMS, the number of physicians who fight in the front line for the life and health of citizens decreases. Instead, ambulances are boarded by paramedics and emergency nurses.

According to data from the Central Statistical Office, in 2012 out of a total of 1,493 EMS, 879 (59%) were basic teams (B-EMS) and 614 (41%) were specialist teams (S-EMS). They made 2.8 million trips. The teams consisted of 11,141 paramedics, 1,998 system nurses and 1,884 physicians. After five years, in 2017, there were 1,519 teams in total. B-EMS operated in the number of 1,029 (68%) and S-EMS in the number of 490 (32%). In 2017, medical response teams carried out 3.2 million trips. About 10,000 paramedics, 1,600 system nurses and 1,500 system physicians worked at that time. The data presented in Figure 1 shows an increase in the number of EMS, combined with a decrease in the number of people employed in the rescue system. This applies to each of the professional groups. A decrease in the number of specialist teams and the number of doctors working in ambulances is particularly visible.

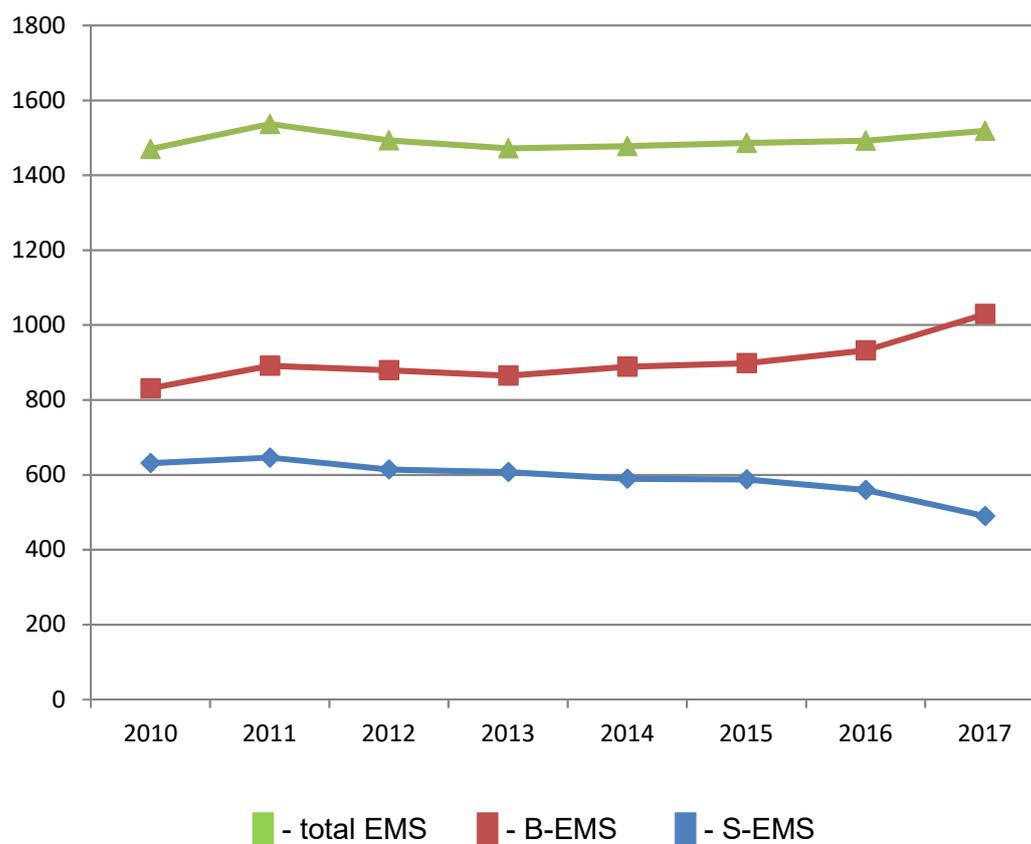


Figure 1. The amount of EMS (B-EMS, S-EMS) in Poland in individual years.

The authors of the study attempt to compare the effectiveness of resuscitation performed by B-EMS and S-EMS. The subject of the study is the management of OHCA by both teams based on the medical procedures performed, the pharmacotherapy applied and the final condition of the patient and the patient's transfer to the healthcare entity.

MATERIAL AND METHODS

The study was conducted on the basis of an analysis of 75 interventions from 2017, carried out by an ambulance unit in central Poland. The criterion for inclusion was the initiation of cardiopulmonary resuscitation by the team. In the case of S-EMS, we also took into account dispatches during which B-EMS resuscitation was undertaken and during which the team and the doctor were summoned for aid. The research tool was the content of documents in the form of medical emergency cards and dispatch order

cards. Special attention was paid to the time of arrival at the place of event, the sex of the patient, the age of the patient, the drugs administered, the place of transfer of the patient, the return of spontaneous circulation (ROSC). The study was positively evaluated by the Bioethics Committee (Resolution No. 1/2019).

The analysis of the results concerning the preparation of the patient's profile and the comparison of the medical response teams' procedures was based on descriptive statistics, Mann-Whitney's U-test, chi-squared test and Spearman-rho correlation. The distribution of variables was also analyzed. All results at $p < 0.05$ were deemed significant.

RESULTS

Intervention characteristics

A total of 75 calls were recorded during the period considered, out of which 54 were ordered directly. As a directly commissioned dispatch, the authors recognized a call for cardiac arrest, not situations in which carried arrest occurred during assistance by an emergency response team. Cardiopulmonary resuscitation was undertaken by specialist teams 26 times (48.1% of dispatches ordered directly), and 28 times by the basic teams (51.9% of dispatches ordered directly). At the request of the basic team, after recognition of OHCA, S-EMS were dispatched 21 times as a secondary team for aid.

The average arrival time for S-EMS was $Me = 4.8$ minutes, and B-EMS arrived at $Me = 4.5$ minutes on average. The time of arrival of the emergency medical team to the place of the event did not differ significantly between specialist and basic teams (Mann-Whitney U test: $Z = 0.43$; $p = 0.668$).

Patient profile

The patients consisted mostly of men in cases of both teams. Men accounted for 80.8% and women for 19.2% of the patients in the specialist team. The basic teams provided assistance in 67.9% of cases to men and 32.1% to women. The gender analysis did not show any statistically significant relationships between the examined types of emergency response team (chi-squared test: $\chi^2=6.752$; $p=1$).

The average age of a specialist team's patient is 67 years ($SD\pm 25.0$). The average age of a patient of the basic team is 67.5 years ($SD \pm 19.3$). The value for unrelated variables in Mann-Whitney's test was $Z=0.15$; $p=0.878$ (S-EMS vs. B-EMS), which proves that there are no significant intergroup differences.

Pharmacotherapy

The differences in the management by teams can be illustrated by the pharmacology used during resuscitation. The amount of drugs administered and their type depend on the mechanism and reversible causes of cardiac arrest, the duration of cardiopulmonary resuscitation and the situation at the site of the event.

OXYGEN - used in 88.5% of cases by S-EMS and in 92.9% by B-EMS. The chi-squared test value: $\chi^2=7.852$; $p=1$. There were no differences between the emergency teams in terms of oxygen therapy.

EPHINEPHRINUM - on average, patients of specialist teams received 4.1 mg while patients of basic teams - 3.7 mg. The variables did not show a normal distribution, therefore the non-parametric Spearman-rho correlation test was used, which was -0.001 for $p=0.993$. No statistically significant correlation between the emergency teams was found in the use of adrenaline.

FLUID THERAPY - specialist teams administered an average of 259.6 ml of 0.09% NaCl solution, while basic teams - 476.8 ml. The value of the Spearman-rho test was 0.312; $p=0.022$. A statistically significant correlation between the volume of administered crystalloids and the type of emergency team was found. Basic teams more often filled the vascular bed of patients and attempted to treat possible hypovolaemia as a reversible cause of cardiac arrest.

CORDARONE - specialist teams administered an average of $Me=109.6$ mg of Cordarone to patients while basic teams - an average of $Me=26.8$ mg. The value of Spearman-rho test was 0.266; $p=0.052$. Specialist teams more often implemented antiarrhythmic pharmacotherapy, and the correlation of Cordarone doses administered by S-EMS vs. B-EMS is on the verge of statistical significance.

SODIUM BICARBONATE - administered in the amount of $Me=0.26$ mg per patient for S-EMS and $Me=0.06$ mg per patient for B-EMS. In total, $NaHCO_3$ was used in all independent interventions in only four cases (3 in S-EMS vs. 1 in B-EMS). Analyzing the dependence of the use of sodium bicarbonate on the type of the emergency team, the chi-squared test value was: $\chi^2=1.248$; $p=0.264$. Thus, there was no statistically significant dependence of $NaHCO_3$ administration on the type of the team

MAGNESIUM - administered in S-EMS in the amount of Me=0.15 g per patient, and in B-EMS in the amount of Me=0.07 g per patient. The drug was administered in only two cases (1 in S-EMS vs. 1 in B-EMS). Analyzing the dependence of the use of MgSO₄ on the type of the emergency team, the chi-squared test value was: $\chi^2=0.003$; $p=0.957$. There was no statistically significant dependence of MgSO₄ administration on the type of the team.

ATROPINE - administered in the amount of Me=0.5 mg per patient by the specialist team, and Me=0.29 mg per patient by the basic team. The total number of Atropine use was 8 (5 in S-EMS vs. 3 in B-EMS). Analyzing the dependence of Atropine use on the type of the emergency response team, the chi-squared test value was: $\chi^2=0.775$; $p=0.379$. There was no statistically significant dependence of Atropine administration on the type of the team.

DOPAMINE - the drug was administered in six cases in total and the average dose was Me=93.33 mg per patient. No comparative analysis was made since this drug is available only to specialist medical response teams.

CPR survivability

The criterion was the place of transfer of the patient, where the deceased patients were deemed left behind on the scene and the survivors were transported to hospital. For the purpose of statistical analysis, only those cases in which the basic and specialist team provided assistance on their own were identified (n=35). The situation of calling for help from specialist teams by the basic teams (n=19) was not taken into account.

Specialist teams transferred the patient to the hospital in 53.8% (n=14) of cases and left the patient at the scene in 46.2% (n=12) of cases. Basic teams transferred the patient to the hospital in 77.8% (n=7) of cases and left the patient at the scene in 22.2% (n=2) of cases. The value of chi-squared test: $\chi^2= 10.6834$, $p=0.001$. The above result means that there is a statistically significant relationship between the type of the emergency response team and the CPR result.

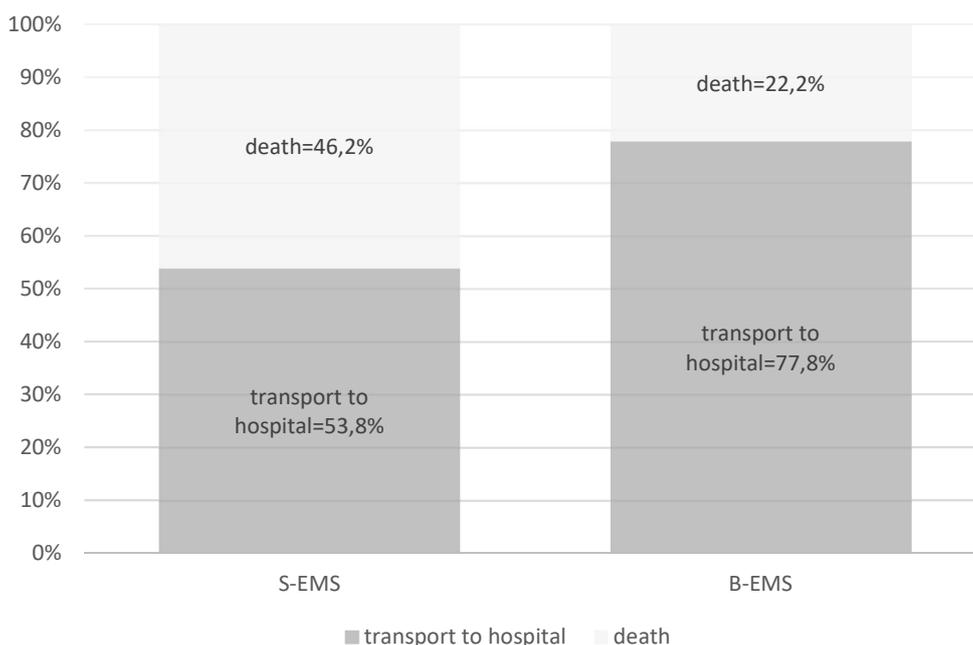


Figure 1. The occurrence of a patient's death during rescue operations conducted independently by emergency response teams.

In 52.6% (n=10) of cases the specialist team, after taking over the patient from the basic team, declared the patient dead and in 47.4% (n=9) of cases the patient was transferred to the hospital emergency department. Comparing the effectiveness of resuscitation performed by B-EMS alone (22.2% of deaths) and when the action was taken over by S-EMS (52.6% of deaths), chi-squared value was: $\chi^2= 13.903$, $p=0.000$. The authors also evaluated the relationship between the effectiveness of resuscitation in cases when S-EMS assisted alone and when it took over the action from B-EMS. No statistically significant relationships were found in this case (chi-squared: $\chi^2= 0.727$, $p=0.394$).

Attention was drawn to the actions taken by S-EMS, which came to the aid of B-EMS. Additional pharmacological action was implemented by doctors only in 28.6% (n=6) of cases of interception of patients from the basic team. Half of these activities (n=3) did not exceed the capabilities of the basic team, i.e. were de facto a continuation of the activities. The other half (n=3) consisted of dopamine administration.

DISCUSSION

The average Polish citizen, upon calling for an ambulance, expects to see a doctor. More and more often a team of medical rescuers arrives instead of a doctor. It happens to be a cause for concern. But is it right? The authors have made an attempt to assess the effectiveness of resuscitation performed by teams with and without a doctor. The Polish rescue system is undergoing a transformation which results in a visible decrease in the share of specialist teams in the total number of emergency response teams. Therefore, it seems important to define the level of medical activities performed independently by medical rescuers.

The results of cardiopulmonary resuscitation in the conducted study showed a difference between the types of emergency response teams. More often resuscitation was discontinued by medical teams accompanied by a doctor than B=EMS (46.2% vs. 22.2%). The authors draw attention to the legal issues, which at present do not give medical rescuers the right to declare death. This may cause the patient to be taken to hospital during resuscitation by the B-EMS despite the lack of effectiveness of resuscitation.

An important issue resulting from the analysis is the number of S-EMS calls to help the basic team and the actions taken by the doctor on the spot. Pharmacology used by the specialist team in the course of medical rescue operations was beyond the capabilities of the basic team only in three cases. In the remaining cases, the activities within the competence of the basic team were continued. Comparably often (52.6% vs. 47.4%), the physician assisting the B-EMS declared death and undertook transport to the hospital.

It is worth noting that in comparison to specialist teams, basic teams were more frequently disposed (28 vs. 26) for sudden cardiac arrest as a direct call. Studies show that the increase in the autonomy of medical rescuers has positive consequences in terms of better use of resources, by eliminating the need to send a second team with a doctor to the scene of the event for the sole purpose of declaring death. In addition, it has been demonstrated that paramedics make decisions on withdrawal from resuscitation and declaring death [4-6]. The research conducted in the Kraków Emergency Ambulance Service in 2014 showed a high percentage of specialist emergency response team calls to the site for procedural reasons. Despite the end of activities by the basic emergency response team, a physician was additionally available at the scene of the event to prepare a death report [6].

The study of sociodemographic data, i.e. age and gender of the patient, showed that there were no significant differences between the patients of specialist and basic teams. At the same time, there were no statistical differences in the time of arrival to the patient. This allowed to exclude the above mentioned interfering factors. The analysis of pharmacotherapy implemented during resuscitation showed significant differences in the crystalloid group (P-EMS > S-EMS) and borderline differences in the antiarrhythmic group (P-EMS < S-EMS). No statistical significance was demonstrated in the group of catecholamines (Ephinephrinum), which significantly affects the possibility of ROSC [7]. Calling a physician for resuscitation was associated with declaration of death in most cases (52.4%). The results suggest that B-EMS call for S-EMS for aid does not increase the chance of return of spontaneous circulation. According to authors, the research should be continued in order to prove the actual effectiveness of medical rescuers working alone. The experience of other countries confirms the high quality of services provided by rescue teams undertaking resuscitation without a physician [8].

Study limitations - due to lack of data from hospital emergency departments, it was not possible in all cases to differentiate between ROSC on-site and patient transport during resuscitation. Therefore, the authors had to limit themselves to differentiating the effectiveness of resuscitation to "death" and "transport". It should be added that in the examined operational area rescue teams are equipped with mechanical chest compression devices, which enable transportation to the hospital during resuscitation.

CONCLUSIONS

B-EMS teams are equally often available for cardiac arrest as S-EMS teams with a doctor. There are no statistical differences in age, gender, or arrival time between B-EMS and S-EMS. There are some differences in terms of pharmacotherapy used in patients with OHCA. Specialist teams called upon to assist B-EMS usually do not take other pharmacological action and usually declare death at the scene. In cases of OHCA, emergency medical services are significantly more likely to transport their patients to hospital than doctors.

Disclosure statement

The authors did not report any potential conflict of interest.

REFERENCES

- [1] Monsieurs KG, Nolan JP, Bossaert LL, Greif R, Maconochie IK, Nikolaou NI, et al.. ERC Guidelines 2015 Writing Group. European Resuscitation Council Guidelines for Resuscitation 2015: Section 1. Executive summary. *Resuscitation* 2015; 95: 1-80.
doi: <https://dx.doi.org/10.1016/j.resuscitation.2015.07.038>
- [2] Rej-Kietla A, Kulpok-Bagiński T, Bauer K, Borysiewicz A, Szymańska A, Poniatowski B, et al.. The problem of withdrawing and withholding medical emergency treatment in the context of paramedic's work from the State Emergency Medical Service. *Post Nauk Med.* 2017; 30(7): 397-400.
- [3] Sowizdraniuk J, Popławska M, Ładny JR, Wojewódzka-Żeleznikowicz M, Sosada K. Podstawowe zespoły ratownictwa medycznego w obliczu pacjenta z nieodwracalnym zatrzymaniem krążenia. *Post Nauk Med.* 2014; 27(1): 48-54.
- [4] Jaffe E, Sonkin R, Goldberg J, Strugo R. Paramedics declare death—A lifesaving decision. *Heal Pol Tech.* 2017; 6(3): 316-321.
doi: <https://dx.doi.org/10.1016/j.hlpt.2017.07.005>
- [5] Pabisiak K, Krejczy A, Bohatyrewicz R, Ciechanowski K. Underestimated Role in the Organ Donation Pathway-Paramedics' Attitudes and Knowledge About Donation After Circulatory Death. *Transplant Proc.* 2018; 50(7): 1953-1956.
doi: <https://dx.doi.org/10.1016/j.transproceed.2018.02.111>
- [6] Sowizdraniuk J, Popławska M, Ładny J, Sosada K. Realizowanie medycznych czynności ratunkowych przez podstawowe zespoły ratownictwa medycznego na przykładzie Krakowskiego Pogotowia Ratunkowego. *Post Nauk Med.* 2014; 7: 525-530.
- [7] Vargas M, Pasquale B, Carmine I, Giuseppe S. Epinephrine for out of hospital cardiac arrest: A systematic review and meta-analysis of randomized controlled trials. *Resuscitation*, 2019; 136: 54–60.
doi: <https://dx.doi.org/10.1016/j.resuscitation.2019.01.016>
- [8] Baker PW, Conway J, Cotton C, Ashby DT, Smyth J, Woodman RJ, Grantham H. Defibrillation or cardiopulmonary resuscitation first for patients with out-of-hospital cardiac arrests found by paramedics to be in ventricular fibrillation? A randomised control trial. *Resuscitation.* 2008; 79(3): 424-431.
doi: <https://dx.doi.org/10.1016/j.resuscitation.2008.07.017>