Acta Clin Croat 2022; 61:265-272

doi: 10.20471/acc.2022.61.02.13

Original Scientific Paper

OUT-OF-HOSPITAL CARDIAC ARREST OUTCOMES – BYSTANDER CARDIOPULMONARY RESUSCITATION RATE IMPROVEMENT

Damir Važanić[1,2,3], Ingrid Prkačin[4,5], Višnja Nesek-Adam[6,7], Biljana Kurtović[3] and Cecilija Rotim[3,8]

[1]Croatian Institute for Emergency Medicine, Zagreb, Croatia;
[2]Catholic University of Croatia, Zagreb, Croatia;
[3]University of Applied Health Sciences, Zagreb, Croatia;
[4]Department of Internal Medicine, Merkur University Hospital, Zagreb, Croatia;
[5]University of Zagreb, School of Medicine, Zagreb, Croatia;
[6]Department for Anesthesiology, Resuscitation and Intensive Care, Sveti Duh University Hospital, Zagreb, Croatia;
[7]Josip Juraj Strossmayer University of Osijek, Faculty of Medicine, Osijek, Croatia;
[8]Andrija Štampar Teaching Institute of Public Health, Zagreb, Croatia

SUMMARY – Approximately 8000 people suffer from an out-of-hospital cardiac arrest (OHCA) in the Republic of Croatia every year. OHCA survival rates generally remain low despite major advances in resuscitation. Its incidence and survival rate are well known in many European countries, but reliable data on OHCA in Croatia are lacking. The aim of the study was to determine survival rate of patients with OHCA in the Republic of Croatia and the importance of the community bystander cardiopulmonary resuscitation (CPR) rates in the survival chain. This prospective observational study performed between October 1, 2017 and December 31, 2017 included all adult patients with OHCA in Croatia who were treated by Emergency Medical Services (EMS). OHCA data were collected from the Croatian Institute of Emergency Medicine database and Utstein cardiac arrest data collection form. Descriptive data presentation was used in the analyses. Data were expressed as absolute frequencies and percentages and central tendency measures. Testing of correlations in return of spontaneous circulation (ROSC) was performed by logistic regression. During the observation period, a total of 1763 adult patients without signs of circulation were assessed by EMS in Croatia and 760 (43%) adult patients were resuscitated by EMS personnel. Outcomes measured in ROSC until emergency department admission were reported in 126 (17%) cases. Shockable rhythm *vs*. non-shockable rhythm (OR: 5.832, 95% CI: 3.621-9.392; p<0.001) and bystander witnessed cardiac arrest (OR: 8.213, 95% CI: 2.554-26.411, p<0.001) were significantly associated with a higher probability of survival. There was no significant difference in correlation with day or night shift, etiology of cardiac arrest and bystander CPR variables. Survival rate of OHCA patients who received CPR until emergency department admission in Croatia was 17%. A higher survival rate post-OHCA was more likely among patients who received bystander CPR and had shockable rhythm.

Key words: *Out-of-hospital cardiac arrest; Outcome; Emergency medical services; Survival*

Introduction

Each year, around 350,000-700,000 Europeans experience out-of-hospital cardiac arrest (OHCA), but only 9% will survive to hospital discharge[1]. Approximately 55 *per* 100,000 people suffer from cardiac arrest

Correspondence to: *Damir Važanić, BSN, MSN*, Croatian Institute for Emergency Medicine, Planinska 13, HR-10000 Zagreb, Croatia
E-mail: damir.vazanic@hzhm.hr

Received December 7, 2020, accepted February 12, 2021

each year in the United States and Canada, resulting in more than 173,000 deaths annually, with a survival rate of less than 5%[2]. Worldwide results for survival rates remain relatively low, i.e., in Europe 9%, North America 6%, Asia 3%, and Australia 13%[1]. Reported survival rates after hospital cardiac arrest vary significantly from 1.8% to 21.5% in different communities[3-5]. OHCA remains associated with a very high rate of morbidity and mortality[6], ranging from 2.6% to 9.9%[7].

Out-of-hospital cardiac arrest remains a common medical issue in any community, with extremely high costs in terms of morbidity and mortality[8]. OHCA is a significant global public health problem with poor survival outcomes[1,9]. Compared to a low percentage of cardiopulmonary resuscitation (CPR), a cardiac arrest victim outside the hospital has poor chance of survival[10].

The outcome of OHCA depends on a number of factors, but critical determinants of survival are current CPR and early defibrillation, which has been repeatedly emphasized by the European Resuscitation Council[11]. Although the incidence, survival and CPR rates of respondents are known in many countries[1], there is still no information on OHCA features in Croatia that could provide a basis for improving the management and survival of OHCA[12].

Emergency care in Croatia is organized through the Institutes of Emergency Medicine at the county level. Also, the Emergency Medicine Network prescribes the number, composition and type of emergency medicine teams operating in certain areas of the country. The goal of the Emergency Medicine Network is to cover the entire country, so that within a radius of 25 kilometers there is at least one emergency medical team. Within 21 county Institutes of Emergency Medicine, there are a total of 709 T1 teams, 205 T2 teams, and 31 standby teams in force, i.e., a form of work when the employee does not have to be present in the health institution but must be available to perform emergency medical care. Team T1 consists of a doctor specialized in emergency medicine, nurse and driver, and team T2 is composed only of a nurse or technician with specialist training and driver. The teams in the medical dispatch unit consist of a doctor or nurse. The emergency service is organized through ambulance transport and from the islands in two areas by helicopter service for secondary interventions.

Successful treatment of a patient with OHCA emphasizes access to systematic treatment of OHCA, activation of the emergency response system as described above, and an immediate basic life support provided by bystander. These early interventions can be referred to as pre-hospital care, defined as basic medical interventions started by observers prior to professional medical contact, including cardiac arrest recognition and emergency call, CPR, and automated external defibrillator (AED) use. The study by Okabayashi *et al*. highlights the importance of appropriate pre-hospital care in OHCA, and its contribution to patient survival[13].

Bystander CPR is one of the key communal factors driving the OHCA survival chain[14]. Bystander-initiated CPR is a strong predictor of survival in OHCA[14,15]. The American Heart Association guidelines were based on studies that showed that return of spontaneous circulation (ROSC), cardiac rhythm, availability of a witness at the time of arrest, and availability of defibrillation at the scene predicted the chance of survival of patients with OHCA[16].

Bystander CPR has been cited as a major factor in increasing the chances of survival after OHCA by 50%[17]. Despite efforts in advocacy, campaigns, and distributed public CPR training programs, bystander CPR remains one of the significant contributors to the poor survival of patients with OHCA[14]. The study conducted by Drager found that CPR education is provided in 12% to 64% of the general population, and actual passing rates of public CPR are only 15% to 30%. The reasons for that included inappropriate characteristics of the victim, fear of litigation, transmission of infectious diseases from the victim, or misconduct of CPR[10].

The effectiveness of bystander CPR depends on the availability of a bystander near the site of cardiac arrest, who is willing and competent to attempt CPR. Therefore, environmental factors and bystander are associated with the provision of bystander CPR[18]. Several studies found that community characteristics such as low income, high proportion of older adults, and ethnic or racial distribution were associated with a lower likelihood of receiving inappropriate CPR after OHCA[19-21].

Vaillancourt *et al*.[2] performed a systematic review of experimental and non-experimental studies published on bystander CPR, and included 252 articles. The results of this study indicate that targeted efforts were needed to attract trainees who are most likely to experience cardiac arrest, and students should be appointed that believe in the low incidence of commu-

nicable disease transmission when performing CPR. In addition, CPR courses need to be streamlined and shortened, students need more time to practice manikin, and they need to develop improved strategies for providing CPR guidance with the help of dispatchers. Dwyer[22] examined psychological and socioeconomic factors that can prevent family member confidence in initiating CPR in a sample of 1,208 adult participants. The results showed that those who learned CPR were significantly more confident in initiating CPR on a family member than those who did not. The fear of failure and the concern about performing CPR correctly were the two main reasons given by the participants why they would not perform CPR.

Although the incidence of cardiac arrest and local emergency response systems vary widely, previous research highlighted the effects of rapid onset of basic and advanced life support and quality of CPR on survival[23]. Therefore, survival after hospital cardiac arrest may directly reflect the quality of the community survival chain[10]. Furthermore, detailed analysis of the incidence and outcomes should identify weak links in this chain and provide suggestions for improving them.

The aim of the study was to determine survival rate of patients with OHCA in the Republic of Croatia and the importance of the community bystander CPR rates in the survival chain.

Material and Methods

All OHCA cases treated by the Emergency Medical Service (EMS) in Croatia between October 1, 2017 and December 31, 2017 were reported. Data were collected from the Croatian Institute of Emergency Medicine database and Utstein cardiac arrest data collection form.

In the analysis, descriptive methods of data presentation were used and data were expressed in the form of absolute frequencies and percentages, and central tendency measures (median, interquartile range and arithmetic mean, and standard deviation as a measure of deviation). Also, odds ratio and 95% confidence interval (95% CI) were used and correlation testing in the observed categories was performed using logistic regression.

Cardiac arrest was monitored according to Utstein recommendations. Utstein guidelines for assessing outcomes of hospital heart failure and examining pediatric cardiopulmonary emergencies were developed from the survival chain perspective. As originally formulated, the out-of-hospital guidelines for Utstein were intended to provide a structure for evaluating the ambulance system. Numerous identified communities have confirmed the utility of the Utstein template weaknesses in the 'connections' of their Emergency Care Community system. Communities continue to apply modifications and optimize treatment for their critical outpatients[24].

The study was approved by the Ethics Committee of the Croatian Institute for Emergency Medicine, No. 510-14/16-01/01 from August 23, 2016.

Results

This research was based on OHCA records that were prospectively collected for the period from October 1 to December 31, 2017 in Republic of Croatia for all patients over 18 years of age having experienced OHCA. During the 3-month follow-up, there were a total of 1763 (167.9/100,000 population/year) cases. CPR by emergency staff was performed in 760 (43%) patients, whereas in 1003 (57%) persons it was not performed because there was no indication. The most common reasons for not doing so were definitive signs of death.

The incidence of all those in whom resuscitation was attempted *per* 100,000 inhabitants was 17.26, as shown in the 2011 census.

Table 1 shows that the mean age at which recovery was attempted was 68.96±12.90 years, median age 70 years, interquartile range from 61.25 to 79. The youngest and oldest age was 20 and 94 years, respectively.

Table 1. Age of adult subjects in whom resuscitation was attempted

Age (years)		
N	Valid	760
	Missing	0
Mean		68.96
Standard deviation		12.90
Minimum		20
Maximum		94
Percentile	25	61.25
	50	70
	75	79

Table 2 shows data on time interval until arrival; arithmetic mean was 12.91±9.70 minutes, median 11 minutes, interquartile range 7-16 minutes; the minimum and maximum value was 0 and 113 minutes, respectively.

Table 2. Time to Emergency Medical Service arrival (min)

Time interval		
N	Valid	757
	Missing	3
Mean		12.9168
Standard deviation		9.69998
Minimum		0.00
Maximum		113
Percentile	25	7
	50	11
	75	16

Table 3 shows univariate logistic regression for the parameters analyzed, where a significant difference was found for defibrillation *versus* no defibrillation (p<0.001) parameters, where the odds ratio was 5.832, implying a much higher probability of survival in defibrillation patients with 95% CI 3.621-9.392.

A significant difference was also found between the bystander witnessed *versus* bystander not witnessed (p<0.001) parameters, where the odds ratio was 8.213, implying a much higher probability of survival in cases where the event was bystander witnessed with 95% CI 2.554-26.411.

Discussion

We found significant association between survival rate in OHCA patients and bystander witnessing the OHCA (p<0.001). Early and effective pre-hospital cardiac arrest managing is crucial and contributes significantly to patient survival. An important segment of this pre-hospital care is provided by bystanders who recognize cardiac arrest, call for help,

Table 3. Univariate logistic regression of the total number of patients undergoing cardiopulmonary resuscitation in cardiac arrest not certified by the EMS team

	Survival (yes - ROSC to hospital yes, NO-ROSC to hospital no)				
	ROSC n (%)	NO-ROSC n (%)	Odds ratio	95% CI	p-value
Age (years): ≤65 ≥65	 43 (16) 55 (15)	 217 (84) 322 (85)	1.160	0.751-1.791	0.503
Hands-on-time (min) 0-10 ≥11	 56 (18) 42 (13)	 252 (82) 285 (87)	1.508	0.977-2.329	0.064
Shockable rhythm Non-shockable rhythm	47 (45) 42 (9)	85 (55) 443 (91)	5.832	3.621-9.392	<0.001
Daily shift Night shift**	70 (19) 28 (16)	366 (81) 173 (84)	1.182	0.736-1.898	0.490
Etiology: cardiology non cardiology	 72 (17) v 26 (23)	 427 (83) 112 (77)	0.726	0.443-1.191	0.205
Bystander witnessed: yes no	 95 (22) 3 (3)	 428 (78) 111 (97)	8.213	2.554-26.411	<0.001
Bystander CPR: yes no	 41 (16) 57 (20)	 250 (84) 289 (80)	0.832	0.538-1.285	0.406

*hands-on-time = time from receiving the call to the arrival of the Emergency Medicine Service (EMS) team to the patient; **day shift 7-19, night shift 19-07; ROSC = return of spontaneous circulation; CPR = cardiopulmonary resuscitation

perform CPR, and use AED with public access, all of which are important interventions conducted prior to the EMS arrival[25]. In the study conducted by Simic *et al.*, it was found that the bystander CPR rate in Croatia (62.9%) was higher than the European rate[26]. Certainly, early use of a defibrillator by bystanders is positively associated with increased survival[17,18]. Public AEDs have proved effective if they are placed in strategic locations[27]. This care is a disproportionately important component of pre-hospital treatment for heart failure. The factors of communities in the chain of OHCA survival, such as early arrest recognition, early call to EMS and bystander CPR, carried out by people close to the event of arrest, are important in terms of starting the chain of survival. Studies show that bystander CPR could double the chance of survival after OHCA[14]. As noted by Okabayashi *et al.*, the overall rate of pre-arrival care was largest in the public location which was also noted to have optimal outcome[13]. Our results are supported by the results of the study conducted by Mauri *et al.* They found that a significant increase in survival rates and an improved neurological outcome in OHCA which is bystander witnessed provide good evidence that coordinated and rapid EMS response, together with an effective first response network and high density AEDs are essential elements for the success of OHCA care[28].

During the three-month study period, 1,763 OHCA in adults occurred in the Republic of Croatia. Despite the development of CPR and defibrillation as treatments for more than half a century, OHCA continues to represent a major public health problem[1]. In our study, CPR was performed in 760 adults by emergency staff. According to a study from Poland, emergency teams without a doctor as basic teams are as often available for cardiac arrest as specialist teams with a doctor who usually declares death at the scene. In cases of OHCA, EMS are significantly more likely to transport their patients to hospital than doctors[29].

Median age of patients in our study was 70 years. The survival and ROSC rates decline with the patient age increase over 65. As stated by Vaillancourt *et al.* in their review of the literature on CPR, targeted efforts should be made to educate those who are most likely to witness cardiac arrests, such as this specific population, i.e. elderly people[2]. Because family members are the most frequent witnesses of changes in patient condition outside the hospital, public health nurses can use their contact with the family to propose various patient care activities, consultancy services, and education that includes CPR[2,30].

The median time interval to EMS arrival was 11 minutes. Hands-on-time over 11 minutes reduces survival and ROSC rates. In our study, defibrillated patients had a higher survival rate than non-defibrillated patients. Healthcare professionals including nurses and policy makers should focus on future efforts to improve recognition of transient cardiac arrests, facilitate distribution and access to AEDs, and encourage appropriate and early CPR initiative in OHCA patients through public education and raising public awareness[25].

In our study, no statistically significant difference was found in bystander CPR data, which emphasizes an increased need to educate the public about the importance of performing CPR and how it is performed correctly. Despite efforts to increase CPR training among the public, most patients with cardiac arrest receive their initial CPR attempt by the EMS[31]. The awareness raising campaigns for CPR and public CPR education have been highlighted worldwide. In the Republic of Croatia, public programs and national initiatives are led by national, local and academic initiatives, and are focused on compulsory CPR education in obtaining driver license, voluntary training, public action CPR education in local communities and through media advocacy. Various studies have found that such or similar programs and initiatives are associated with increased bystander CPR attempts[32,33].

It is imperative that future educational efforts continue to focus on helping bystander identify cardiac arrest early and provide appropriate initial resuscitation efforts, CPR and AED application when available. The results of a study conducted by Sklebar *et al.* pointed to the need for continuous efforts in educating citizens and health professionals in recognizing the early symptoms of stroke and heart attack and understanding them as an emergency[34]. Also, nurses and physicians should support CPR education as an extension of family-centered care by providing patients and families with education about the importance of CPR training and answer questions that would help alleviate the fears and misconceptions associated with CPR. Other possibilities for resuscitation education of society are CPR implementation in the curriculum of higher grades of elementary schools, high schools, and universities. The possibility of CPR education is

in the case of new employment in companies during taking of Occupational Safety and Health and continuous education of lay people should take place within their employers. According to Curt *et al.*, the activities of people without medical education, such local promotion of CPR education importance can effectively help in the education and promotion of CPR knowledge and skills and dissemination of the first aid principles[35]. An important factor in the success of the transfer of medical knowledge in Croatia is closely and inevitably linked to continuous adjustments to the new, more modern Information and Communication Technology options, and utilization of diverse media outlets. Thus, using the internet and social media, it is easier to target the information towards particular groups, as proposed by Daraboš and Radin[36]. Consistent with adaptation to modern options, interactive educational materials on basic and advanced resuscitation have demonstrated higher long-term efficacy of teaching in comparison to traditional presentations and traditional audiovisual materials[37]. Individuals who possess appropriate computer skills and motivation show significant progress in learning when using interactive e-learning methods[38]. Young adults are eager to use modern techniques of education, appreciate the substantive quality and innovation offered educational materials, and quickly adapt to new technologies. Supporting combined traditional learning with enriched educational content with interactive elements in CPR education are trends that will adapt medical education to the new, more demanding customer knowledge[38,39].

Limitations of the study

Interpretation of the data presented is limited by several reasons. Our study results are based on register data, with a risk of misclassification of bystander CPR performance, rescue breaths and chest compressions. Also, data on the causes why bystanders did not perform CPR are missing.

Conclusion

Patients who experienced cardiac arrest outside the hospital were more likely to survive if they were bystander witnessed. OHCA survival rate to emergency department admission in Croatia was 17%. The survival rate of OHCA patients in Croatia who received CPR was 17%. A higher survival rate post-OHCA was more likely in patients who received bystander CPR and who had shockable rhythm. Continuous public engagement, including a CPR campaign and training program, training experience within a training program aimed at raising community awareness can help improve CPR and survival outcomes.

Contribution to Emergency Nursing Practice

- Bystander witnessed cardiac arrest is significantly associated with a higher survival rate.
- Enhancing access to early professional care due to bystander involvement may be the only reasonable method of increasing survival after an out-of-hospital cardiac arrest in the immediate future.
- Future educational efforts need to continue to focus on helping bystander to identify cardiac arrest as early as possible and provide appropriate initial resuscitation efforts.

References

1. Berdowski J, Berg RA, Tijssen JGP, Koster RW. Global incidences of out-of-hospital cardiac arrest and survival rates: systematic review of 67 prospective studies. Resuscitation. 2010;81:1479-87. doi: 10.1016/j.resuscitation.2010.08.006.
2. Vaillancourt C, Stiell IG, Wells GA. Understanding and improving low bystander CPR rates: a systematic review of the literature. Can J Emerg Med. 2008;10(1):51-65.
3. Nichol G, Thomas E, Callaway CW, Hedges J, Powell JL, Aufderheide TP, *et al*. Regional variation in out-of-hospital cardiac arrest incidence and outcome. JAMA. 2008;300:1423-31.
4. Atwood C, Eisenberg MS, Herlitz J, Rea TD. Incidence of EMS-treated out-of hospital cardiac arrest in Europe. Resuscitation. 2005;67:75-80.
5. Rea TD, Eisenberg MS, Sinibaldi G, White RD. Incidence of EMS-treated out-of-hospital cardiac arrest in the United States. Resuscitation. 2004;63:17-24.
6. Ewy GA, Sanders AB. Alternative approach to improving survival of patients with out-of-hospital primary cardiac arrest. J Am Coll Cardiol. 2013;61:113-8.
7. Grasner JT, Bottiger BW, Bossaert L. European Registry of Cardiac Arrest (EuRe-Ca) ONE Steering Committee; EuReCa ONE Study Management Team. EuReCa ONE-ONE month-ONE Europe-ONE goal. Resuscitation. 2014;85:1307-8.
8. Andersen LW, Bivens MJ, Giberson T, Giberson B, Mottley JL, Gautam S, *et al*. The relationship between age and outcome in out-of-hospital cardiac arrest patients. Resuscitation. 2015;94:49-54. doi: 10.1016/j.resuscitation.2015.05.015
9. Mozaffarian D, Benjamin EJ, Go AS, *et al*. Heart disease and stroke statistics – 2015 update: a report from the American Heart Association. Circulation. 2015;131:e29-322.2.

10. Drager KK. Improving patient outcomes with compression-only CPR: will bystander CPR rates improve? J Emerg Nurs. 2012;38(3):234-8. doi: 10.1016/j.jen.2011.02.008.
11. Perkins GD, Handley AJ, Koster RW, Castrén M, Smyth MA, Olasveengen T, *et al*. European Resuscitation Council Guidelines for Resuscitation 2015. Section 2. Adult basic life support and automated external defibrillation. Resuscitation. 2015;95:81-99. doi: 10.1016/j.resuscitation.2015.07.015.
12. Grba Bujevic M. Croatian national programme of publicly available early defibrillation "Start the heart – save a life". Lijec Vjesn. 2015;137:53-5.
13. Okabayashi S, Matsuyama T, Kitamura T, Kiyohara K, Kiguchi T, Nishiyama C, *et al*. Outcomes of patients 65 year or older after out-of-hospital cardiac arrest based on location of cardiac arrest in Japan. JAMA Netw Open. 2019;2(3):e191011. doi: 10.1001/jamanetworkopen.2019.1011.
14. Sasson C, Meischke H, Abella BS, Berg RA, Bobrow BJ, Chan PS, *et al*. Increasing cardiopulmonary resuscitation provision in communities with low bystander cardiopulmonary resuscitation rates: a science advisory from the American Heart Association for healthcare providers, policymakers, public health departments, and community leaders. Circulation. 2013;127:1342-50.
15. Hasselqvist-Ax I, Riva G, Herlitz J, Rosenqvist M, Hollenberg J, Nordberg P, Ringh M, Jonsson M, Axelsson C, Lindqvist J, Karlsson T, Svensson L. Early cardiopulmonary resuscitation in out-of-hospital cardiac arrest. N Engl J Med. 2015;372:2307-15. doi: 10.1056/NEJMoa1405796.
16. Morrison LJ, Kierzek G, Diekema DS, Sayre MR, Silvers SM, Idris AH, *et al*. Part 3: Ethics: 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. Circulation. 2010;122:S665-75. doi: 10.1161/CIRCULATIONAHA.110.970905.3.
17. Hallstrom A, Cobb L, Johnson E, Copass M. Cardiopulmonary resuscitation by chest compressions alone or with mouth to mouth ventilation. N Engl J Med. 2000;342(21):1546-53.
18. Sasson C, Magid DJ, Chan P, Root ED, McNally BF, Kellermann AL, *et al*. Association of neighborhood characteristics with bystander-initiated CPR. N Engl J Med. 2012;367:1607-15.
19. Fosbøl EL, Dupre ME, Strauss B, Swanson DR, Myers B, McNally BF, *et al*. Association of neighborhood characteristics with incidence of out-of-hospital cardiac arrest and rates of bystander-initiated CPR: implications for community-based education intervention. Resuscitation. 2014;85:1512-7.
20. Moon S, Bobrow BJ, Vadeboncoeur TF, Kortuem W, Kisakye M, Sasson C, *et al*. Disparities in bystander CPR provision and survival from out-of-hospital cardiac arrest according to neighborhood ethnicity. Am J Emerg Med. 2014;32:1041-5.
21. Mitchell MJ, Stubbs BA, Eisenberg MS. Socioeconomic status is associated with provision of bystander cardiopulmonary resuscitation. Prehosp Emerg Care. 2009;13:478-86.
22. Dwyer T. Psychological factors inhibit family members' confidence to initiate CPR. Prehosp Emerg Care. 2008;12(2):157-61.
23. Lund-Kordahl I, Olasveengen TM, Lorem T, Samdal M, Wik L, Sunde K. Improving outcome after out-of-hospital cardiac arrest by strengthening weak links of the local chain of survival; quality of advanced life support and post-resuscitation care. Resuscitation. 2010;81:422-6.
24. Glass GF 3rd, Brady WJ. Bystander intervention in out-of-hospital cardiac arrest. JAMA Netw Open. 2019;2(3):e191008. doi: 10.1001/jamanetworkopen.2019.1008.
25. Garza AG, Gratton MC, Salomone JA, Lindholm D, McElroy J, Archer R. Improved patient survival using a modified resuscitation protocol for out of hospital cardiac arrest. Circulation. 2009;119(19):2597-605.
26. Simić A, Jurić I, Ognjanović Z, Matoc M, Adam VN. The outcomes of resuscitation after out-of-hospital cardiac arrest in Croatia. Resuscitation. 2019;142(1):83. doi: 10.1016/j.resuscitation.2019.06.201.
27. Sanna T, La Torre G, de Waure C, Scapigliati A, Ricciardi W, Dello Russo A, *et al*. Cardiopulmonary resuscitation alone *vs*. cardiopulmonary resuscitation plus automated external defibrillator use by non-healthcare professionals: a meta-analysis on 1583 cases of out-of-hospital cardiac arrest. Resuscitation. 2008;76:226-32.
28. Mauri R, Burkart R, Benvenuti C, Caputo ML, Moccetti T, Del Bufalo A, *et al*. Better management of out-of-hospital cardiac arrest increases survival rate and improves neurological outcome in the Swiss Canton Ticino. Europace. 2016;18(3):398-404. doi: 10.1093/europace/euv218.
29. Szymczuk P. Mortality in OHCA during resuscitation by rescue teams without a doctor. Crit Care Innov. 2019;2(4):1-10. doi: 10.32114/CCI.2019.2.4.1.10.
30. Ugur HG, Erci B. The effect of home care for stroke patients and education of caregivers on the caregiver burden and quality of life. Acta Clin Croat. 2019;58(2):321-32. doi: 10.20471/acc.2019.58.02.16
31. Deakin CD. The chain of survival: not all links are equal. Resuscitation. 2018;126:80-2. doi: 10.1016/j.resuscitation.2018.02.012.
32. Wissenberg M, Lippert FK, Folke F, Weeke P, Hansen CM, Christensen EF, *et al*. Association of national initiatives to improve cardiac arrest management with rates of bystander intervention and patient survival after out-of-hospital cardiac arrest. JAMA. 2013;310:1377-84.
33. Nielsen AM, Isbye DL, Lippert FK, Rasmussen LS. Persisting effect of community approaches to resuscitation. Resuscitation. 2014;85:1450-4. doi: 10.1016/j.resuscitation.2014.08.019.
34. Sklebar D, Preksavec M, Grzincic T, Matkovic DV, Klobucic M, Jankovic RI, *et al*. Analysis of the key issues in the organization of emergency care for stroke and heart attack patients in Bjelovar-Bilogora County. Acta Clin Croat. 2013;52(2):165-71.
35. Curt N, Tintet L, Chavada P, Mazet G, Combes D, Dekesel B. "112: CAN I HELP YOU?" - an European first aid education project. Crit Care Innov. 2020;3(1):9-17. doi: 10.32114 / CCI.2020.3.1.9.17.
36. Daraboš N, Radin D. International medical knowledge transfer as a tool of public diplomacy: the case of Croatia. Politička misao: časopis za politologiju. 2019;56 (3-4):29-49. doi: 10.20901/pm.56.3-4.02.

37. Leszczyński P, Charuta A, Łaziuk B, Gałązkowski R, Wejnarski A, Roszak M, *et al*. Multimedia and interactivity in distance learning of resuscitation guidelines: a randomized controlled trial. Interact Learn Environ. 2018;26(2):151-62. doi: 10.1080/10494820.2017.1337035.

38. Leszczyński P, Gotlib J, Kopański Z, Wejnarski A, Świeżewski S, Gałązkowski R. Analysis of web-based learning methods in emergency medicine: randomized controlled trial. Arch Med Sci. 2018;14(3):687. doi: 10.5114 / aoms.2015.56422.

Sažetak

ISHODI IZVANBOLNIČKOG SRČANOG ZASTOJA – POBOLJŠANJE USPJEŠNOSTI KARDIOPULMONALNE REANIMACIJE OD STRANE LAIKA

D. Važanić, I. Prkačin, V. Nesek-Adam, B. Kurtović i *C. Rotim*

U Republici Hrvatskoj izvanbolnički srčani zastoj (ISZ) doživi oko 8000 osoba na godinu. Preživljenje od ISZ općenito ostaje nisko unatoč velikom napretku u reanimaciji. Njegova incidencija i stopa preživljenja dobro su poznati u mnogim europskim zemljama, ali pouzdani podaci o ISZ u Hrvatskoj nedostaju. Cilj istraživanja bio je utvrditi stopu preživljenja bolesnika s ISZ u Republici Hrvatskoj i važnost kardiopulmonalne reanimacije (KPR) provedenu od strane laika u cjelokupnom lancu preživljenja. Ova prospektivna opservacijska studija provedena od 1. listopada 2017. do 31. prosinca 2017. obuhvatila je sve odrasle bolesnike s ISZ u Hrvatskoj koji su bili zbrinjavani od djelatnika hitne medicinske službe (HMS). Podaci o ISZ prikupljeni su iz baze podataka Hrvatskoga zavoda za hitnu medicinu i obrasca za prikupljanje podataka o srčanom arestu Utstein. U analizama je primijenjen deskriptivni prikaz podataka. Podaci su izraženi kao apsolutne frekvencije i postoci te mjere središnje tendencije. Testiranje korelacija povratka spontane cirkulacije (*return of spontaneous circulation*, ROSC) provedeno je logističkom regresijom. Tijekom razdoblja promatranja ukupno su u izvanbolničkoj HMS na području Republike Hrvatske bile 1763 odrasle osobe bez znakova cirkulacije, a 760 (43%) odraslih bolesnika reanimirano je od strane osoblja HMS. Ishodi mjereni po povratku spontane cirkulacije (ROSC) do prijma u hitnu bolničku službu prijavljeni su u 126 (17%) slučajeva. Ritam koji je za defibrilaciju u odnosu na ritmove srčanog zastoja koji se ne defibriliraju (OR: 5,832, 95% CI: 3,621-9,392; p<0,001) i osvjedočeni srčani zastoj od strane laika (OR: 8,213, 95% CI: 2,554-26,411, p<0,001) bili su značajno povezani s većom vjerojatnošću preživljavanja. Nije bilo značajne razlike u korelaciji s dnevnom ili noćnom smjenom i etiologijom srčanog zastoja. Stopa preživljenja bolesnika s ISZ u Republici Hrvatskoj kod kojih je provedena kardiopulmonalna reanimacija do prijma u hitnu bolničku službu bila je 17%. Veća stopa preživljenja nakon ISZ bila je vjerojatnija među bolesnicima kod kojih je započeta kardiopulmonalna reanimacija od strane laika i koji su imali srčani ritam za defibrilaciju.

Ključne riječi: *Izvanbolnički srčani zastoj; Ishod; Izvanbolnička hitna medicinska služba; Preživljenje*