

ORIGINAL ARTICLE

Regional variation in the incidence, general characteristics, and outcomes of prehospital cardiac arrest in Spain: the Out-of-Hospital Spanish Cardiac Arrest Registry

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Background and objective. The incidence and outcomes of care for out-of-hospital cardiac arrest (OHCA) vary greatly from country to country. We aimed to study variation in the incidence, characteristics, and outcomes of care for OHCA given by Spanish prehospital emergency services.

Methods. Descriptive retrospective analysis of data from the Out-of-Hospital Spanish Cardiac Arrest Registry (OHSCAR) from October 2013 to October 2014. Attempts by 19 Spanish emergency services to resuscitate patients were studied. All OHCA cases were reviewed to obtain the following data: incidence, patient and event characteristics, prior emergencies, resuscitation attempts, and the main treatments provided in the hospital. If a patient was admitted, we compared the neurologic status on hospital discharge.

Results. Statistically significant differences were detected between emergency services ($P < .0001$) in the incidence of attempted resuscitation and all general characteristics except sex. Hospital treatments and outcomes also differed significantly: pulse had been restored on arrival of 30.5% of patients (range 21.3% to 56.1%, $P < .001$), and 31.8% of admitted patients were discharged in cerebral performance categories 1 or 2 (range 17.2% to 58.3%, $P < .001$).

Conclusion. Differences in the incidence of resuscitation attempts, key variables, and survival at discharge from the hospital are present in OHCA cases attended by prehospital emergency services in different regions of Spain.

Keywords: Out-of-hospital cardiac arrest. Survival. Geographic variation. Prehospital emergency health services.

Variabilidad regional en incidencia, características generales y resultados finales de la parada cardiaca extrahospitalaria en España: Registro ohscar

Objetivos. Existe gran variabilidad internacional en la incidencia y los resultados en la atención a la parada cardiaca extrahospitalaria (PCRE). El objetivo es conocer si existe variabilidad en la incidencia, características y resultados en supervivencia en la atención a la PCRE por los servicios extrahospitalarios de emergencias (SEM) de España.

Método. Análisis descriptivo, retrospectivo de los datos del registro OHSCAR correspondientes al periodo octubre 2013-octubre 2014, que incluye pacientes atendidos por 19 SEM de España con intento de reanimación. Se recogieron los casos atendidos y variables clave sobre la asistencia a una PCRE: incidencia, características del paciente, del evento, de la actuación previa a los equipos de emergencias (EE), de la reanimación realizada, y de los principales tratamientos hospitalarios. Se comparó la situación neurológica al alta hospitalaria de los casos con ingreso hospitalario.

Resultados. La incidencia de casos con intento de reanimación y todas las características generales, salvo la distribución por sexo, presentaron diferencias estadísticamente significativas entre los SEM participantes ($p < 0,001$). Hubo diferencias significativas en los tratamientos hospitalarios recibidos y en los resultados finales, tanto en la proporción de pacientes que llegaron con pulso espontáneo al hospital, 30,5%, rango entre 21,3% y 56,1% ($p < 0,001$), como en el porcentaje de altas hospitalarias con categoría 1 o 2 de la clasificación Cerebral Performance Categories (CPC), sobre el total de ingresados, 31,8%, rango entre 17,2% y 58,3% ($p < 0,001$).

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Conclusiones. Existe una importante variabilidad entre los SEM españoles en la incidencia de casos con intento de reanimación, en todas las variables clave y en la supervivencia al alta hospitalaria de la atención a la PCRE.

Palabras clave: Parada cardíaca extrahospitalaria. Supervivencia. Variabilidad. Servicios de emergencias extrahospitalarias.

Introduction

Out-of-hospital cardiac arrest (OHCA) is a major public health problem worldwide, with an estimated incidence of approximately 432,000 OHCA in Europe in 2014¹ and 356,000 in the USA² in the same year. Internationally published survival barely reaches 10%, with significant variability in the figures reported by each country^{1,3,4}. These differences between countries could be expected due to the important social, legal and healthcare model differences, but more surprising is the great variability that exists even within the same country, with a homogeneous healthcare structure and theoretically similar EMS⁵⁻⁹. Most of these published results refer to EMS attended by paramedics. The Spanish model of out-of-hospital emergency care is different from most of these countries. These are public services, with universal access, dependent on the corresponding health administrations, which include a physician on board the emergency teams (ET) and also have the presence of physicians in the coordination centers that receive and manage emergency calls¹⁰. Some of these EMS have their own results^{11,12} yet it has not been explored whether this possible variability also exists between services with this same model. Therefore, the aim of this study is to analyze the variability in the incidence, characteristics, and survival outcomes of OHCA in Spain.

Method

The methodology of the OHSCAR registry has been described in previous publications¹³. OHSCAR is a prospective and continuous registry of ECA attended by public out-of-hospital emergency services in Spain. With a common methodology, following the Utstein recommendations for the definition of variables¹⁴, the EMS of the 17 autonomous communities of Spain participated, in addition to two local EMS in two large cities, Madrid and Zaragoza. The total population coverage offered by all the participating EMSs was 46,343,655 inhabitants¹³.

The registry period was 13 months, from October 2013 to October 2014. Cases of OHCA were included in which EMS attempted resuscitation of the patient or continued resuscitation when it had been initiated by a first responder.

Patient epidemiological variables were collected on the event and the conditions in which they occurred, the action taken prior to the arrival of the EMS, the resuscitation performed by the EMS, the main hospital treatments received, and the neurological status at hospital discharge, expressed according to the Cerebral Performance Categories (CPC) classification¹⁵. The dependent variables were arrival with spontaneous pulse

at the hospital and neurological status at discharge with CPC 1-2. Cases without attempted resuscitation and CRP considered futile were excluded.

The results available at the time of the aforementioned publication of OHSCAR¹³ were subsequently completed by one of the participating EMS which, after obtaining permission to access the hospital data, was able to incorporate the discharge follow-up data of the patients provided during that period. Finally, only one of the EMS was unable to obtain data on the hospital situation during admission, the treatments administered during this phase, or the patient's condition at discharge.

The OHSCAR project received authorization from several ethics and reference research committees in the participating autonomous communities. OHSCAR uses the STROBE system for data collection, quality control and communication of the results¹⁶.

For the statistical analysis, a descriptive analysis was performed for quantitative variables, using measures of central tendency and measures of dispersion, and for qualitative variables, using absolute and relative frequency distribution. Normality was checked with the Kolmogorov-Smirnov test and Kruskal-Wallis tests were used to compare quantitative variables (age), since normal distribution could not be assumed, and for categorical variables, Pearson's chi-square test was used. A significance level of 5% was established. All statistical analyses were performed with the IBM SPSS statistical program.

Incidence was expressed as number of cases per 100,000 (105) inhabitants of population coverage and year. The results are expressed in numbers and percentages.

The distribution of the main outcome variables was analyzed: among them, patients with spontaneous pulse on arrival at the hospital, survival at discharge with good neurological status, overall and by specified subgroups that allow the association of some of these key variables, following the Utstein style recommendations¹⁴:

1) Group Utstein comparator (witnessed arrest, excluding those witnessed by the ET, with initial shockable rhythm); 2) ET-witnessed arrest; 3) witnessed arrest, excluding those witnessed by the ET, with initial non-shockable rhythm.

To minimize the effect of a possible bias in the inclusion of cases, this same comparative analysis was performed excluding EMS whose incidence of cases per 105 inhabitants was below the 25th percentile of the incidence of the total sample. This method was used to verify whether a possible greater completeness in the inclusion of cases modified the statistical result. The authors make the results obtained on patients arriving at the hospital with a spontaneous pulse, the general group and the different subgroups, as well as the hospital treatment received, available to researchers on request.

Results

A total of 8,789 patients were included in the final analysis. The description of the incidence in each EMS, as well as the general characteristics, the variables related to the process of care and their comparison between the different EMS are shown in Table 1. Except for the distribution by sex, there were significant differences between all the EMS in all the variables collected, including age.

The overall incidence was 18.6 cases per 105 inhabitants per year, with a range between 13.5 and 29.2, after excluding EMS with an incidence below the 25th percentile of the total sample.

The variability found in the main key variables prior to ET performance among all the EMS in relation to the total cohort was highly significant: event location (home) 57.5% (range 6.8-70.7), witnessed OHCA 74.0% (range 38.3-91.8), initial shockable rhythm 22.1% (range 12.6-40.9), resuscitation by witness prior to EMS arrival 56.7% (range 36.8-74.4), and interval from collapse to EMS arrival less than 8 minutes 25.4% (range 11.4-51.0) ($p < 0.001$).

A total of 2,669 (30.5%) arrived at the hospital with a spontaneous pulse, ranging from 16.7 to 56.1. Of these, 979 (33.9%) were discharged from hospital, 850 (86.8%) of these patients with good neurological status (CPC 12). There were significant differences among all EMS both in the proportion of patients who arrived with a spontaneous pulse at the hospital, with a value of 30.5%, range between 21.3% and 56.1% ($p < 0.001$), and in the percentage of hospital discharges with CPC 12, with a value of 31.8%, range between 17.2% and 58.3% ($p < 0.001$). The distribution and comparison of results among all the EMS are shown in Table 2.

The proportion of in-hospital treatments performed during the admission of resuscitated patients, mainly centered on percutaneous coronary intervention (PCI), 21.2% (range 8.3-51.1) and hypothermia, 14% (range 2.5-47.4), showed significant differences between the EMS analyzed ($p < 0.001$) (Table 3).

The final results in terms of survival at discharge with good neurological status of the total number of cases included, as well as the results by subgroups of cases with predefined characteristics according to the conditions of the event, subgroups 1, 2 and 3 of the methodology, are shown in Table 4.

Excluding EMS whose incidence was below the 25th percentile of the sample incidence, the same differences were maintained with equal statistical significance in the exploratory analysis.

Discussion

There are significant differences in Spain between the EMS of the different public health administrations in terms of incidence, general characteristics, and final results in survival to hospital discharge of care for

OHCA. The only data that did not show variability was the ratio between men and women treated for OHCA. A ratio that usually retains a 3:1 ratio.

Variability in incidence is one of the main factors that can influence the general characteristics and final results of each EMS. This has been shown very well in European studies, in which the data provided by the OHSCAR registry have always been at the lower limits of incidence in Europe^{1,3}.

Despite the overall homogeneity of the general characteristics of the Spanish EMS, they also have some specific peculiarities in terms of operation, area and population coverage, especially those at the municipal level¹⁰ and those covering larger areas. It cannot be ruled out that these characteristics, together with the protocols for responding to calls in the coordination centers or the distribution of resources in the field, play a relevant role in this variability. This is a factor that has been found especially in urban areas with a high population density and concentration of resources¹⁷. In fact, one of the key aspects in OHCA is the time of action, i.e., the interval between the moment of collapse and the arrival of the EMS. This interval is also related to both the actual availability of resources and the geographic dispersion of the population. In our registry, the differences observed in this interval, both in what we have considered to be a short interval (< 8 minutes), more urban, and in the first 15 minutes, more rural areas, are very important. These differences may influence the incidence of cases, conditioning the final decision to resuscitate. The proportion of witnessed arrests and the times of care are key variables that can influence the percentage of patients found with an initial shockable rhythm, as shown by studies on public access to automatic defibrillation^{18,19}.

Important differences also exist in the degree of social commitment to the arrest, expressed as life support prior to the arrival of the EMS. This significant variability in key variables may also have influenced the differences found in the final results. It is well known that all the links in the chain of survival are responsible for the final prognosis of patients^{20,21}, but it is also recognized that not all have the same influence and, in particular, these first links have a greater weight in the final prognosis. The role of the witness and the first responder is fundamental for patient survival²². Undoubtedly, all these factors influence the probability of patients arriving at the hospital with a spontaneous pulse, the first objective of out-of-hospital resuscitation.

There are also differences in the treatments received in hospital. Both PCI and hypothermia, treatments that have been shown to have an impact on survival^{23,24}, were applied in disparate percentages.

It is more surprising that in the analysis of specific subgroups of patients who share basic characteristics, type of initial rhythm, witnessed or unwitnessed arrest, this interdepartmental variability is also reproduced. It is quite possible that in these more homogeneous subgroups, the hospital structure itself may have had a significant influence on the variability found in final survival.

Table 1. General characteristics of the population analyzed (n = 8,789). Description according to the EMS involved

	Total	Andalucía	Aragón	Zaragoza	Asturias	Balearic Islands	Canary Islands	Cantabria	Castilla y León	Castilla-La Mancha	Catalonia	Valencian Community	Extremadura	Galicia	Madrid (Community)	Madrid (City)	Murcia	Navarra	Basque Country	La Rioja	p value
No. of cases [n (%)*]	8,789 (100)	1,172 (13.3)	109 (1.2)	25 (0.3)	335 (3.8)	318 (3.6)	402 (4.6)	154 (1.8)	687 (7.8)	359 (4.1)	1,588 (18.1)	660 (7.5)	59 (0.7)	443 (5.0)	1,014 (11.5)	337 (3.8)	304 (3.5)	93 (1.1)	657 (7.5)	73 (0.8)	
Incidence [§]	18.6	19.3	7.6	3.5	29.2	26.3	17.5	24.2	25.4	16.0	19.8	12.3	5.0	14.9	14.7	9.8	19.2	13.5	28.0	21.4	
Women [n (%)]	2,450 (27.9)	354 (30.2)	30 (27.5)	8 (32)	90 (26.9)	85 (26.7)	122 (30.4)	41 (26.6)	186 (27.1)	104 (29.1)	450 (28.5)	181 (27.4)	11 (18.6)	113 (25.5)	308 (30.4)	67 (19.9)	81 (27)	24 (25.8)	175 (26.6)	20 (27.4)	NS
Missing values = 48 (0.5%)																					
Age [mean (SD)]	63.5 (17)	61.2 (17)	62 (16.3)	69 (15.9)	65 (15.1)	60 (17.2)	60.9 (17.2)	65.2 (16.6)	65.5 (17.7)	63.5 (18)	64.9 (17)	64.3 (15.9)	64.3 (14.3)	63 (14.9)	63.6 (17.7)	62.2 (18.5)	62.6 (18.4)	61.6 (18.6)	64.7 (16.4)	64.6 (15.3)	p < 0.001
Missing values = 38 (0.4%)																					
Reason for call [n (%)]																					p < 0.001
Missing values = 48 (0.5%)																					
Unconscious/suspected CRA	5,923 (67.8)	779 (66.7)	84 (78.5)	14 (56)	248 (74.5)	192 (60.4)	284 (70.7)	97 (63.4)	527 (76.7)	278 (78.1)	955 (60.1)	458 (71.5)	43 (74.1)	292 (65.9)	713 (70.3)	272 (80.9)	187 (64.5)	74 (79.6)	380 (58)	46 (63)	
Dyspnea	821 (9.4)	153 (13.1)	8 (7.5)	0 (0)	30 (9.1)	39 (12.3)	34 (8.5)	15 (9.8)	53 (7.7)	23 (6.5)	134 (8.4)	49 (7.6)	6 (10.3)	42 (9.5)	106 (10.5)	8 (2.4)	20 (6.9)	7 (7.5)	85 (13)	9 (12.3)	
Chest pain	547 (6.3)	82 (7.0)	6 (5.6)	2 (8)	15 (4.5)	33 (10.4)	32 (3.2)	3 (1.9)	48 (7)	12 (3.4)	74 (4.7)	14 (2.2)	5 (8.6)	37 (8.4)	86 (8.5)	9 (2.7)	20 (6.9)	5 (5.4)	79 (12)	4 (5.5)	
Trauma	618 (7)	45 (3.9)	3 (2.8)	2 (8)	11 (3.3)	19 (6)	23 (5.7)	11 (7.2)	29 (4.2)	20 (5.6)	228 (14.4)	45 (7)	1 (1.7)	35 (7.9)	46 (4.5)	35 (10.4)	23 (7.9)	5 (5.4)	33 (5)	4 (5.5)	
Drowning	188 (2.1)	0 (0)	0 (0)	0 (0)	8 (2.4)	26 (8.2)	26 (6.5)	4 (2.6)	4 (0.6)	8 (2.3)	19 (1.2)	33 (5.2)	1 (1.7)	8 (1.8)	24 (2.4)	2 (0.6)	13 (4.5)	1 (1.1)	8 (1.2)	3 (4.1)	
Others (unspecified)	644 (7.4)	110 (9.4)	6 (5.6)	7 (28)	21 (6.3)	9 (2.8)	22 (5.5)	23 (15)	26 (3.8)	15 (4.2)	178 (11.2)	42 (6.6)	2 (3.5)	29 (6.6)	39 (3.9)	10 (3)	27 (9.3)	1 (1.1)	70 (10.7)	7 (9.6)	p < 0.001
Location of CRP [n (%)]																					
Missing values = 2 (0.0%)																					
Address	5,052 (57.5)	674 (57.5)	64 (58.7)	8 (32)	208 (62.1)	132 (41.5)	212 (52.7)	84 (54.6)	405 (59)	213 (59.7)	1,014 (63.9)	370 (56.1)	37 (62.7)	232 (52.4)	717 (70.7)	23 (6.8)	174 (57.2)	55 (59.1)	389 (59.2)	41 (56.2)	
Street	1,854 (21.1)	182 (15.5)	15 (13.8)	8 (32)	50 (14.9)	86 (27.1)	84 (20.9)	33 (21.4)	133 (19.4)	42 (11.8)	481 (30.3)	117 (17.7)	4 (6.8)	53 (12)	107 (10.6)	220 (65.3)	56 (18.4)	18 (19.34)	158 (24.1)	7 (9.6)	
Public place	731 (8.3)	102 (8.7)	12 (11)	6 (24)	27 (8.1)	73 (23)	49 (12.2)	14 (9.1)	58 (8.4)	22 (6.2)	28 (1.8)	66 (10)	2 (3.4)	69 (15.6)	49 (4.8)	79 (23.4)	15 (4.9)	7 (7.5)	43 (6.5)	10 (13.7)	
OPHC	467 (5.3)	91 (7.8)	6 (5.5)	3 (12)	24 (7.2)	19 (6)	36 (9)	13 (8.4)	48 (7)	39 (10.9)	15 (0.9)	43 (6.5)	10 (17)	0 (0)	59 (5.8)	5 (1.5)	21 (6.9)	4 (4.3)	25 (3.8)	6 (8.2)	
Ambulance ET	33 (0.4)	32 (2.7)	1 (0.9)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	
Others	541 (6.1)	48 (4.1)	8 (7.3)	0 (0)	26 (7.8)	7 (2.2)	17 (4.2)	10 (6.5)	43 (6.3)	31 (8.7)	15 (0.9)	54 (8.2)	6 (10.2)	89 (20.1)	82 (8.1)	10 (2.3)	35 (11.5)	9 (9.7)	42 (6.4)	9 (12.3)	
Unknown	109 (1.2)	43 (3.7)	3 (2.8)	0 (0)	0 (0)	1 (0.3)	4 (1)	0 (0)	0 (0)	10 (2.8)	35 (2.2)	10 (1.5)	0 (0)	0 (0)	0 (0)	0 (0)	3 (1)	0 (0)	0 (0)	0 (0)	
Witnessed arrest [n (%)]	6,506 (74)	899 (76.7)	92 (84.4)	18 (72)	289 (86.3)	280 (88.1)	352 (87.6)	106 (68.8)	485 (70.6)	209 (58.2)	1,120 (70.5)	389 (58.9)	55 (93.2)	408 (92.1)	807 (79.6)	129 (38.3)	189 (62.2)	72 (77.4)	540 (82.2)	67 (91.8)	p < 0.001

(Continues)

Table 1. General characteristics of the population analyzed (n = 8,789). Description according to the EMS involved (Continuation)

	Andalucía	Aragón	Zaragoza	Asturias	Balearic Islands	Canary Islands	Cantabria	Castilla y León	Castilla-La Mancha	Catalonia	Valencian Community	Extremadura	Galicia	Madrid (Community)	Madrid (City)	Murcia	Navarra	Basque Country	La Rioja	p value
Arrest witnessed by:																				p < 0.001
Non-health care witness	4,343 (66.8)	567 (63.1)	48 (52.2)	8 (44.4)	203 (70.2)	200 (71.4)	266 (75.6)	77 (72.6)	318 (65.6)	116 (55.5)	788 (70.4)	245 (63.0)	33 (60.0)	295 (72.3)	511 (63.3)	113 (59.8)	51 (70.8)	390 (72.2)	45 (67.2)	
ET	972 (14.9)	167 (18.6)	18 (19.6)	4 (22.2)	33 (11.4)	34 (12.1)	17 (4.8)	16 (15.1)	65 (13.4)	47 (22.5)	111 (9.9)	40 (10.3)	7 (12.7)	104 (25.5)	159 (19.7)	42 (16.4)	5 (6.9)	63 (11.7)	9 (13.4)	
Other healthcare personnel	1,067 (16.4)	144 (16.0)	25 (27.2)	5 (27.8)	53 (18.3)	35 (12.5)	66 (18.8)	12 (11.3)	93 (19.2)	37 (17.7)	221 (19.7)	84 (21.6)	14 (25.5)	9 (2.2)	122 (15.1)	34 (17.9)	13 (18.1)	74 (13.7)	12 (17.9)	
Other PSs	124 (1.9)	21 (2.3)	1 (1.1)	1 (5.6)	0 (0)	11 (3.9)	3 (0.9)	1 (0.9)	9 (4.3)	9 (4.3)	0 (0)	20 (5.1)	1 (1.8)	0 (0)	15 (1.9)	4 (5.8)	11 (4.2)	3 (2.4)	1 (1.5)	
Previous life support [n (%)]	4,980 (56.7)	722 (61.7)	67 (61.5)	15 (60.0)	192 (57.3)	229 (72.0)	344 (85.6)	78 (50.7)	206 (57.4)	680 (42.8)	389 (58.9)	37 (62.7)	274 (61.9)	274 (61.9)	544 (53.7)	156 (46.3)	112 (36.8)	56 (74.4)	42 (57.5)	p < 0.001
Life support performed by:																				p < 0.001
Witness	1,602 (32.2)	104 (14.4)	38 (56.7)	6 (40.0)	77 (40.1)	115 (50.2)	70 (20.4)	15 (19.2)	113 (32.5)	57 (27.7)	225 (33.1)	78 (20.1)	13 (35.1)	162 (59.1)	219 (40.3)	86 (55.1)	26 (21.4)	12 (33.7)	21 (50.0)	
Non-ET health personnel	2,668 (53.6)	367 (50.8)	28 (41.8)	6 (40.0)	105 (54.7)	72 (31.4)	265 (77.0)	48 (61.5)	214 (61.5)	129 (62.6)	374 (55.0)	220 (56.6)	24 (64.9)	111 (40.5)	242 (44.5)	38 (24.4)	73 (62.5)	35 (61.2)	18 (42.9)	
Other PSs personnel	710 (14.3)	251 (34.8)	1 (1.5)	3 (20.0)	10 (5.2)	42 (18.3)	9 (2.6)	15 (19.2)	21 (6.0)	20 (9.7)	81 (11.9)	91 (23.4)	0 (0)	1 (0.4)	83 (15.3)	32 (20.5)	13 (16.1)	9 (5.1)	3 (7.1)	
Defibrillation with FR shock n (%) N = 8,789 (100%)	1,857 (21.1)	36 (3.1)	8 (7.3)	1 (4.0)	89 (26.6)	116 (36.5)	281 (69.9)	27 (17.5)	79 (11.5)	37 (10.3)	408 (25.7)	143 (21.7)	8 (13.6)	95 (21.4)	94 (9.3)	0 (0)	10 (3.3)	27 (57.7)	19 (26.0)	p < 0.001
Initial shockable rhythm [n (%)]	1,930 (22.1)	267 (22.9)	20 (19.2)	1 (52.0)	94 (28.1)	84 (26.4)	47 (12.6)	63 (40.9)	137 (19.9)	64 (18.3)	307 (19.3)	126 (19.1)	18 (30.5)	144 (32.6)	197 (19.4)	108 (32.0)	55 (18.1)	27 (20.8)	22 (30.1)	p < 0.001
Type of non-shockable rhythm [n (%)]																				p < 0.001
Asystole	5,236 (76.9)	738 (82.3)	52 (62.0)	5 (41.7)	177 (73.4)	188 (80.3)	277 (85.2)	71 (78.1)	398 (72.4)	237 (82.9)	985 (76.9)	406 (76.0)	34 (82.9)	216 (72.5)	617 (75.5)	179 (78.2)	207 (83.1)	48 (72.7)	35 (68.6)	
Extreme bradycardia	259 (3.8)	49 (5.5)	0 (0)	3 (25.0)	5 (2.1)	13 (5.6)	9 (2.8)	2 (2.2)	38 (6.9)	22 (7.7)	0 (0)	24 (4.5)	2 (4.9)	0 (0)	46 (5.6)	9 (3.9)	23 (9.2)	2 (3.0)	6 (11.8)	
AEP	884 (13)	100 (11.2)	17 (20.2)	4 (33.3)	48 (19.9)	29 (12.4)	25 (7.7)	18 (19.8)	58 (10.5)	21 (7.3)	191 (14.9)	38 (7.1)	3 (7.3)	81 (27.2)	97 (16.6)	38 (24.2)	12 (4.8)	16 (16.0)	5 (9.8)	
Others	42 (0.6)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	
Unknown	385 (5.7)	10 (1.1)	15 (17.9)	0 (0)	11 (4.6)	4 (1.7)	14 (4.3)	0 (0)	56 (10.2)	6 (2.1)	105 (8.2)	66 (12.4)	2 (4.9)	1 (0.3)	57 (7.0)	3 (2.8)	7 (0)	23 (4.4)	5 (9.8)	
Call-arrival time ≤ 8 minutes [n (%)]	2,031 (25.4)	265 (23.4)	3 (13.6)	19 (76.0)	108 (32.5)	46 (17.5)	13 (3.5)	63 (42.0)	221 (32.4)	140 (39.6)	583 (36.8)	78 (13.7)	13 (31.7)	50 (11.4)	129 (13.2)	146 (51.1)	0 (0)	33 (16.8)	21 (28.8)	
Missing data= 807 (9.2%)																				
Call-arrival time ≤ 15 minutes [n (%)]	5,141 (64.4)	716 (63.2)	3 (13.6)	23 (92.0)	247 (74.4)	143 (54.4)	122 (32.4)	100 (66.7)	439 (64.3)	226 (63.8)	1,332 (84.1)	303 (53.1)	24 (58.5)	235 (53.7)	575 (59.0)	253 (88.5)	0 (0)	58 (72.5)	44 (60.3)	p < 0.001
Missing data= 807 (9.2%)																				
Medical etiology [n (%)]	7,785 (88.7)	1,061 (90.8)	92 (88.5)	23 (92.0)	295 (88.1)	262 (82.4)	346 (86.5)	130 (84.4)	604 (87.9)	310 (87.1)	1,505 (94.8)	533 (80.8)	57 (96.6)	422 (95.3)	892 (88.0)	278 (82.5)	249 (81.9)	78 (83.9)	62 (84.9)	p < 0.001
Missing data= 14 (0.2%)																				

*% of total cases; ^aNo. of cases x 10³ inhabitants/year; SD: standard deviation; OPHC: outpatient health centers; ET: Emergency team; PS: Public Services; FR: First Responder.

Table 2. Situation of the patients on arrival at the hospital and at discharge. Distribution by EMS

	Situation on arrival at the hospital		Condition at discharge	
	Cases included n (%)	They arrive with a normal pulse n (%) [*]	Alive on discharge n (%) [§]	Alive with CPC 1-2 on discharge n (%) [§]
Total	8,742 (99.5)	2,669 (30.5)	979 (37.9)	850 (31.8)
Andalucía	1,172 (100)	366 (31.2)	145 (39.6)	130 (35.5)
Aragón	109 (100)	29 (26.6)	5 (17.2)	5 (17.2)
Zaragoza	25 (100)	11 (44.0)	5 (45.5)	4 (36.4)
Asturias	331 (98.8)	139 (42.0)	50 (36.0)	45 (32.4)
Balearic Islands	316 (99.4)	133 (42.1)	60 (43.8)	53 (39.8)
Canary Islands	401 (99.7)	116 (28.9)	39 (45.1)	34 (29.3)
Cantabria	154 (100)	58 (37.7)	21 (36.2)	16 (27.6)
Castilla y León	687 (100)	245 (35.7)	97 (39.6)	74 (30.2)
Castilla-La Mancha	350 (97.5)	85 (24.3)	–	–
Catalonia	1,588 (100)	339 (21.3)	93 (27.4)	86 (25.4)
Comunidad Valenciana	659 (99.8)	110 (16.7)	44 (40.0)	32 (29.1)
Extremadura	56 (94.9)	24 (42.9)	18 (75.0)	14 (58.3)
Galicia	431 (97.3)	154 (35.7)	51 (33.1)	42 (27.3)
Madrid (Community)	1,013 (99.9)	314 (31.0)	117 (37.3)	110 (35.0)
Madrid (City)	337 (100)	189 (56.1)	94 (49.7)	77 (40.7)
Murcia	290 (95.4)	63 (21.7)	21 (33.3)	14 (22.2)
Navarra	93 (100)	45 (48.4)	19 (42.2)	16 (35.5)
Basque Country	657 (100)	225 (34.2)	87 (38.7)	85 (37.8)
La Rioja	73 (100)	24 (32.9)	13 (54.2)	13 (54.2)
p value		p < 0.001	p < 0.001	p < 0.001

*% of the total number of cases.

§% of those who arrive with pulse at the hospital and are followed up (excluding Castilla-La Mancha).

CPC: Cerebral Performance Categories.

Table 3. Hospital treatments applied to admitted patients. Distribution by EMS. The service that did not provide hospital follow-up is excluded

	Arrive with pulse at the hospital n (%)	PCI n (%) [*]	Thrombolysis n (%) [*]	Hypothermia n (%) [*]	ICD n (%) [*]
Total	2,584 (29.6)	567 (21.2)	52 (1.9)	373 (14.0)	93 (3.5)
Andalucía	366 (31.2)	63 (17.2)	–	9 (2.5)	–
Aragón	29 (26.6)	6 (20.7)	–	1 (3.5)	–
Zaragoza (City)	11 (44.0)	4 (36.4)	–	1 (9.1)	1 (9.1)
Asturias	139 (42.0)	57 (41.0)	3 (2.2)	21 (15.1)	7 (5.0)
Balearic Islands	133 (42.1)	50 (37.6)	5 (3.8)	37 (27.8)	10 (7.5)
Canary Islands	116 (28.9)	26 (22.4)	5 (4.3)	7 (6.0)	2 (1.7)
Cantabria	58 (37.7)	16 (27.6)	3 (5.2)	–	4 (7.0)
Castilla y León	245 (35.7)	60 (24.5)	19 (7.8)	53 (21.6)	17 (6.9)
Catalonia	339 (21.3)	36 (10.6)	4 (1.2)	28 (8.3)	–
Valencian Community	110 (16.7)	21 (19.1)	–	8 (7.3)	6 (5.4)
Extremadura	24 (42.9)	2 (8.3)	–	2 (8.3)	1 (4.2)
Galicia	154 (35.7)	19 (12.3)	–	73 (47.4)	–
Madrid (Community)	314 (31.0)	95 (30.2)	3 (1.0)	34 (10.8)	20 (6.2)
Madrid (City)	189 (56.1)	74 (39.1)	3 (1.6)	78 (41.3)	3 (1.6)
Murcia	63 (21.7)	8 (12.7)	1 (1.6)	4 (6.3)	5 (7.9)
Navarra	45 (48.4)	23 (51.1)	2 (4.4)	12 (26.7)	3 (6.7)
Basque Country	225 (34.2)	–	1 (0.4)	–	12 (5.3)
La Rioja	24 (32.9)	7 (29.2)	3 (12.5)	5 (20.8)	2 (8.3)
p value		p < 0.001	p < 0.001	p < 0.001	p < 0.001

*% of total cases.

PCI: percutaneous coronary intervention; ICD: implantable cardioverter defibrillator.

al. Not all emergency teams transfer to centers with these therapeutic possibilities. The profile of the destination hospital has a decisive influence²⁵ and, although the patient may finally receive a certain treatment, such as PCI, delays or secondary transfers may condition final survival²⁶.

This demonstrates the multifactorial dependence of the patient's final prognosis. The reality is that there are many conditioning factors that contribute to explaining

this variability, including aspects that undoubtedly escape our current analyses and which leave questions still pending to be resolved²⁷.

The limitations of the OHSCAR registry have been previously described¹³. In addition, in the case of this analysis, it cannot be ruled out that possible inclusion biases may have an important influence on the comparison of the final results. The different participating EMSs provide data with different recording systems and data

Table 4. Survival at discharge with good neurological status (CPC 1-2) according to the characteristics of the patients and the EMS analyzed (excluding the service that did not provide hospital follow-ups)

	Total		Subgroup 1		Subgroup 2		Subgroup 3	
	No. of cases n (%)	CPC 1-2 n (%)	No. of cases n (%)	CPC 1-2 n (%)	No. of cases n (%)	CPC 1-2 n (%)	No. of cases n (%)	CPC 1-2 n (%)
Total	8,789	850 (9.7)	1,698 (19.3)	395 (23.3)	972 (11.1)	177 (18.2)	6,806 (77.4)	330 (4.8)
Andalucía	1,172	130 (11.1)	230 (19.6)	72 (31.3)	167 (14.2)	24 (14.4)	897 (76.5)	42 (4.7)
Aragón	109	5 (4.6)	20 (18.3)	2 (10.0)	18 (16.5)	2 (11.1)	84 (77.1)	3 (3.6)
Zaragoza (City)	25	4 (2.0)	12 (48.0)	2 (16.7)	4 (16.0)	1 (25.0)	12 (48.0)	1 (8.3)
Asturias	335	45 (13.4)	79 (23.6)	17 (21.5)	33 (9.9)	16 (48.5)	241 (71.9)	16 (6.6)
Balearic Islands	318	53 (16.7)	77 (24.2)	30 (39.0)	34 (10.7)	10 (29.4)	234 (73.6)	18 (7.7)
Canary Islands	402	34 (8.6)	46 (11.4)	10 (21.7)	17 (4.2)	2 (11.8)	325 (80.8)	12 (3.7)
Cantabria	154	16 (10.9)	60 (39.0)	12 (20.0)	16 (10.4)	2 (12.5)	91 (59.1)	2 (2.2)
Castilla y León	687	74 (10.8)	126 (18.3)	34 (27.0)	65 (9.5)	7 (10.8)	550 (80.1)	36 (6.5)
Catalonia	1,588	86 (5.4)	282 (17.8)	49 (17.4)	111 (7.0)	5 (4.5)	1,281 (80.7)	35 (2.7)
Valencian Community	660	32 (4.8)	118 (17.9)	15 (12.7)	40 (6.1)	5 (12.5)	534 (80.9)	13 (2.4)
Extremadura	59	14 (23.7)	16 (27.1)	7 (43.8)	7 (11.9)	2 (28.6)	41 (69.5)	5 (12.2)
Galicia	443	42 (9.5)	114 (25.7)	18 (15.8)	104 (23.5)	20 (19.2)	298 (67.3)	8 (2.7)
Madrid (Community)	1,014	110 (10.8)	150 (14.8)	38 (25.3)	159 (15.7)	37 (23.3)	817 (80.6)	47 (5.7)
Madrid (City)	337	77 (22.8)	95 (28.2)	41 (43.2)	42 (12.5)	19 (45.2)	229 (68.0)	28 (12.2)
Murcia	304	14 (4.6)	51 (16.8)	10 (19.6)	31 (10.2)	–	249 (81.9)	4 (1.6)
Navarra	93	16 (17.2)	25 (26.9)	12 (48.0)	5 (5.4)	2 (40.0)	66 (71.0)	2 (3.0)
Basque Country	657	85 (12.9)	116 (17.7)	19 (16.4)	63 (9.6)	20 (31.8)	520 (79.1)	53 (10.2)
La Rioja	73	13 (17.8)	21 (28.8)	7 (33.3)	9 (12.3)	3 (33.3)	51 (69.9)	5 (9.8)
p value		p < 0.001	p < 0.001	p < 0.001	p < 0.001	p < 0.001	p < 0.001	p < 0.001

Total cases and total by subgroups according to the Utstein model.

Subgroup 1- Utstein comparison group: witnessed arrests, not by the Emergency Team (ET) and with defibrillable initial rhythm.

Subgroup 2- arrests witnessed by the ET, any initial rhythm.

Subgroup 3- witnessed arrests (not by ET) and with initial rhythm not defibrillable.

CPC: Cerebral Performance Categories.

access capacity, paper and computerized medical records. On the other hand, in the case of the OHSCAR registry, it was not possible to perform a quality control on possible cases not included, which have been shown to present variations²⁸. However, despite adjusting for the 25th percentile, excluding EMS whose incidence was below that percentile to avoid a possible bias in the inclusion of cases, the statistical differences were maintained in all the variables analyzed. It was not possible to control for some aspects of the quality of care of each EMS that could influence its practice and final results, such as the availability of certain material resources and the training and retraining of its professionals. Finally, specific aspects such as the timing of certain hospital treatments or interhospital referrals could have influenced the final results.

As a conclusion of our study, the incidence, general characteristics and survival with good neurological status at hospital discharge of the care of OHCA show significant variability among the different public emergency services in Spain.

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Addendum

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