

Evaluation of an emergency coordination center training intervention for staff providing telephone assistance for lay persons applying cardiopulmonary resuscitation in out-of-hospital emergencies

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BACKGROUND AND OBJECTIVE. Telephone assistance for out-of-hospital cardiopulmonary resuscitation (CPR) provided by lay witnesses of emergencies has been included in the International Liaison Committee on Resuscitation (ILCOR) directives from 2015 through 2021. This study assessed a training intervention to improve the impact of such assistance by the staff of an emergency coordination center (ECC).

MATERIAL AND METHODS. Pre-post study of interventions involving ECC guidance of lay persons applying CPR during heart- or respiratory-arrest emergencies in Castile-Leon. We designed a checklist with 11 points to include in giving guidance. After gathering performance information for a control period (4 months), we provided training for ECC staff on how to give telephone assistance for lay witnesses applying CRP. We then studied performance in the post-training period of 4 months.

RESULTS. A total of 174 cases were included in the control and post-training periods. Eighteen variables were assessed. We observed no significant differences between the adherence of either nurses or physician managers to the steps on the checklist, the number of hours worked, or professional profiles between periods. Significant differences between the pre-post periods were identified in the performance of 5 of the 11 points on the checklist ($P < .01$) and the total number of checklist items adhered to; adherence to more than 80% of the items rose from 4% to 22% between periods. Adherence to instructions for patient transport did not differ between the 2 study periods.

CONCLUSION. The training for physician and nurse ECC staff and the introduction of a checklist improved adherence to protocols for telephone assistance for lay persons applying out-of-hospital CPR but no improvement in survival.

Keywords: Cardiopulmonary resuscitation. Emergency medical services. Clinical practice guidelines. Counseling. Cell phone use. Hotlines. Telemedicine, emergency care. Heart arrest, out-of-hospital.

Evaluación de una intervención para mejorar la asistencia telefónica a la reanimación por testigos legos desde un centro coordinador de emergencias sanitarias

INTRODUCCIÓN. La asistencia telefónica durante la reanimación cardiopulmonar (RCP) extrahospitalaria por testigos legos está avalada en recomendaciones ILCOR 2015-2021 por sus buenos resultados. Se evalúa una intervención formativa para mejorar su impacto en un centro coordinador de urgencias y emergencias (CCUE).

MATERIAL Y MÉTODOS. Estudio pre-post sobre las intervenciones desde CCUE de Castilla y León en los incidentes sanitarios RCP o parada respiratoria (PR) donde el CCUE realizó una asistencia telefónica de RCP ante reanimación por testigos legos. Se diseñó un *checklist* con 11 puntos de seguimiento. Tras un análisis pre-intervención de 4 meses –Grupo control (GC)–, se realizó una intervención formativa a Reguladores Sanitarios (RS) médicos y enfermeros, sobre Asistencia Telefónica en RCP por testigos no profesionales. Posteriormente se hizo un análisis post-intervención (Grupo Intervención –GI–) durante 4 meses. Fueron evaluadas 18 variables en ambos grupos.

RESULTADOS. Se incluyeron 174 casos en cada grupo. No se obtuvieron diferencias significativas en el cumplimiento de las guías de ayuda entre Médicos y Enfermeros Reguladores, tampoco en las horas acumuladas en el turno de trabajo, ni el perfil del reanimador mostraron diferencias. El GI mostró mejoras con diferencias significativas ($p < 0,01$) en 5 de los 11 pasos de la guía, número total de ítems cumplimentados y cumplimiento $> 80\%$ pasando del 4% a 22%. El cumplimiento de las instrucciones no mostró diferencias en los resultados de traslado de las víctimas.

CONCLUSIONES. La intervención formativa sobre Médicos y Enfermeras Reguladores Sanitarios y el uso de *checklist* mejora el cumplimiento de protocolos de asistencia telefónica ante RCP extrahospitalaria por reanimadores legos, aunque sin mejoras en la supervivencia.

Palabras clave: Reanimación cardiopulmonar. Servicios Médicos de Urgencia. Consejo telefónico. Paro cardíaco extrahospitalario.

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Introduction

In the OHSCAR study on out-of-hospital cardiac arrest (OHCA) in Spain, which included 14 Spanish emergency medical services (EMS), in the region of Castile and León (Spain)—covering a population of 2,425,801 inhabitants—1,357 cases were recorded (11.8% of the total Spanish sample), with an incidence rate of 29.1 cases per 100,000 inhabitants per year and an average rate of return of spontaneous circulation (ROSC) prior to hospital transport of 30.5%.¹ Other investigators have reported a range of hospital transport with ROSC after OHCA between 23% and 28%, although with significant differences in the initial cardiac rhythm, response times, access to automated external defibrillators (AEDs), and bystander resuscitation rates, among other important factors.^{2,3}

To increase bystander-initiated resuscitation, following the ILCOR 2010 recommendations, programs were launched to implement telephone-assisted cardiopulmonary resuscitation (T-CPR) protocols through out-of-hospital emergency coordination centers (OHECCs). This telephone assistance has shown positive results by improving response times, early recognition of OHCA, immediate initiation of CPR maneuvers, and instruction of bystanders on how to perform them.⁴

In line with the ILCOR 2015 recommendations on dispatcher-assisted CPR from OHECCs to bystanders witnessing OHCA,⁵ the Spanish Council of Cardiopulmonary Resuscitation (CERCP) emphasized the need to develop clear, simple, and standardized T-CPR protocols for all OHECCs nationwide. These protocols should be implemented together with specific operator training aimed at facilitating the early identification of cardiac arrest and the prompt initiation of resuscitation maneuvers.⁶

The implementation of improvement programs for dispatcher-assisted CPR in layperson bystanders has also been associated with significant improvements in final outcomes, including survival to hospital discharge and neurologically favorable survival.^{7,8} More recent studies further demonstrate the positive impact of dispatcher-assisted CPR on increasing survival without neurological sequelae among OHCA victims.⁹ Additionally, telephone-guided CPR could help reduce regional disparities in healthcare resource availability for OHCA management.¹⁰

Indeed, the early recognition of OHCA and initiation of resuscitation by OHECC professionals remain central to the ILCOR 2021 recommendations.¹¹⁻¹³

Our objective was to evaluate the impact of a training intervention designed to improve telephone assistance during OHCA performed by lay bystander rescuers, under the hypothesis that this intervention would enhance both protocol compliance and final resuscitation outcomes.

Material and methods

We conducted a quasi-experimental study with pre- and post-intervention analysis of OHCA cases performed by lay bystanders under telephone guidance from a regional OHECC. A training intervention was implemented for medical dispatchers (MDs), accompanied by the devel-

opment of a protocol guide for telephone assistance in CPR.

The study period extended from October 1st, 2017 through July 31st, 2018. The pre-intervention phase (control group, CG) lasted four months (October 2017 through January 2018); the intervention period covered February and March 2018; and the post-intervention phase (intervention group, IG) lasted four months (April through July 2018).

The intervention consisted of a 2-hour training course on telephone-assisted CPR for MDs, physicians, and nurses. The content adhered to the 2015 CPR guidelines and CERCP recommendations.^{5,6} The researchers developed a user-friendly quick-reference guide and designed an infographic (Figure 1) with 10 key points for dispatchers to use as a reference. These materials were distributed to all attendees and were used as a checklist during the evaluation of recorded calls.

Several real-life emergency calls were reenacted and analyzed collectively by participants to identify strengths and weaknesses, aiming to improve and standardize the delivery of telephone guidance.

The study was conducted in the geographic and administrative area of the Regional EMS, serving a reference population of 2,425,801 inhabitants according to 2017 census data (INE).

All calls managed by 28 dispatchers, 18 physicians, and 10 nurses were analyzed anonymously. Calls were initially classified at the OHECC as cardiac arrest (CA) or respiratory arrest (RA) during the selected dates. Included were cases where lay bystanders initiated CPR under dispatcher guidance. Excluded were incidents in which CA or RA was detected during subsequent calls, or in the post-intervention phase, those handled by dispatchers who did not participate in the training session.

A database was designed, and all recorded calls received at the OHECC for CA or RA during the study periods were analyzed anonymously by the research team, using secure access while maintaining strict confidentiality of both users and professionals.

The following variables were analyzed: date and time of the incident; professional category of the dispatcher; number of hours worked in the current shift; type of caller; patient age and sex; outcome of the incident: death on scene, transport with CPR in progress, transport with ROSC, or no transport (on-site discharge or transport by other services); degree of compliance with the 10-item T-CPR assistance protocol; and logical sequence of the intervention steps

Anonymous recordings of all calls related to the selected incidents were reviewed. In each case, it was verified whether there was someone at the scene who knew how to perform CPR and whether the caller was cooperative. Only calls in which the rescuer required telephone assistance from the OHECC were included in the study.

Instructions given to lay rescuers were evaluated for both pre- and post-intervention groups using the 10-item checklist developed by the research team, which also included 1 additional item (11) assessing adherence to the

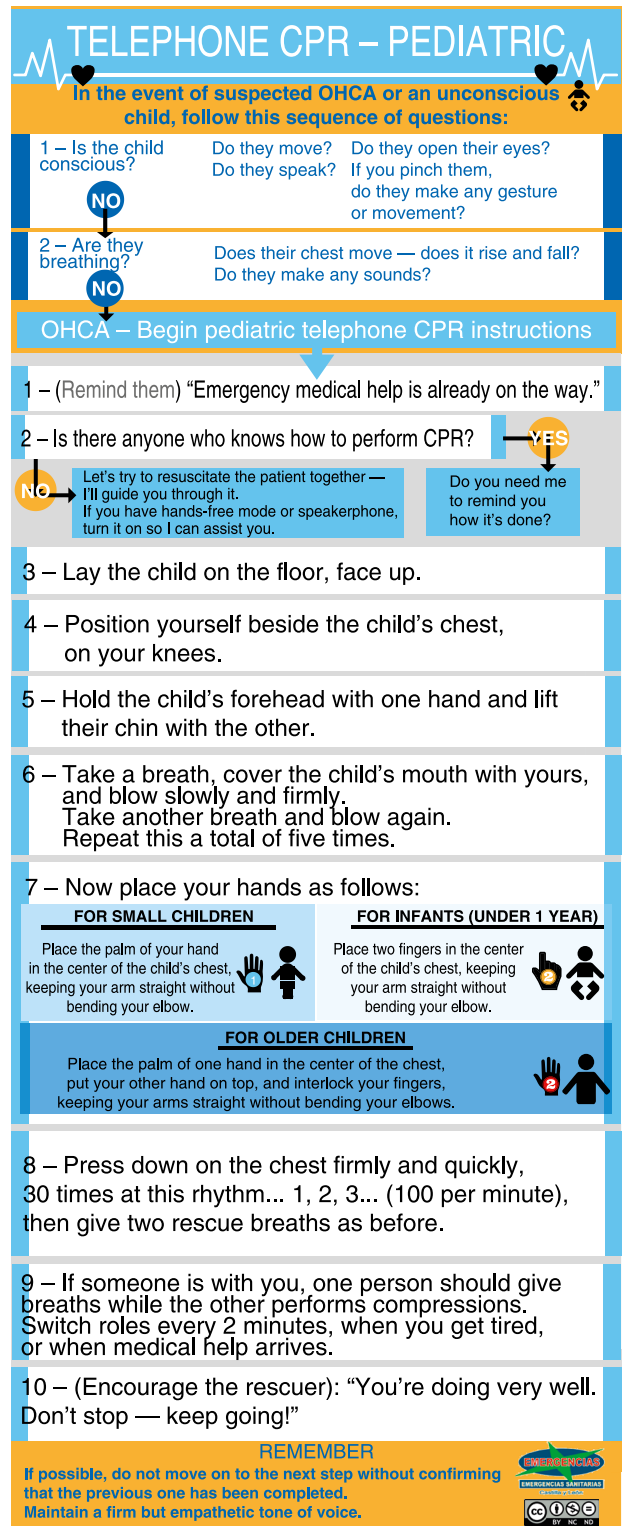
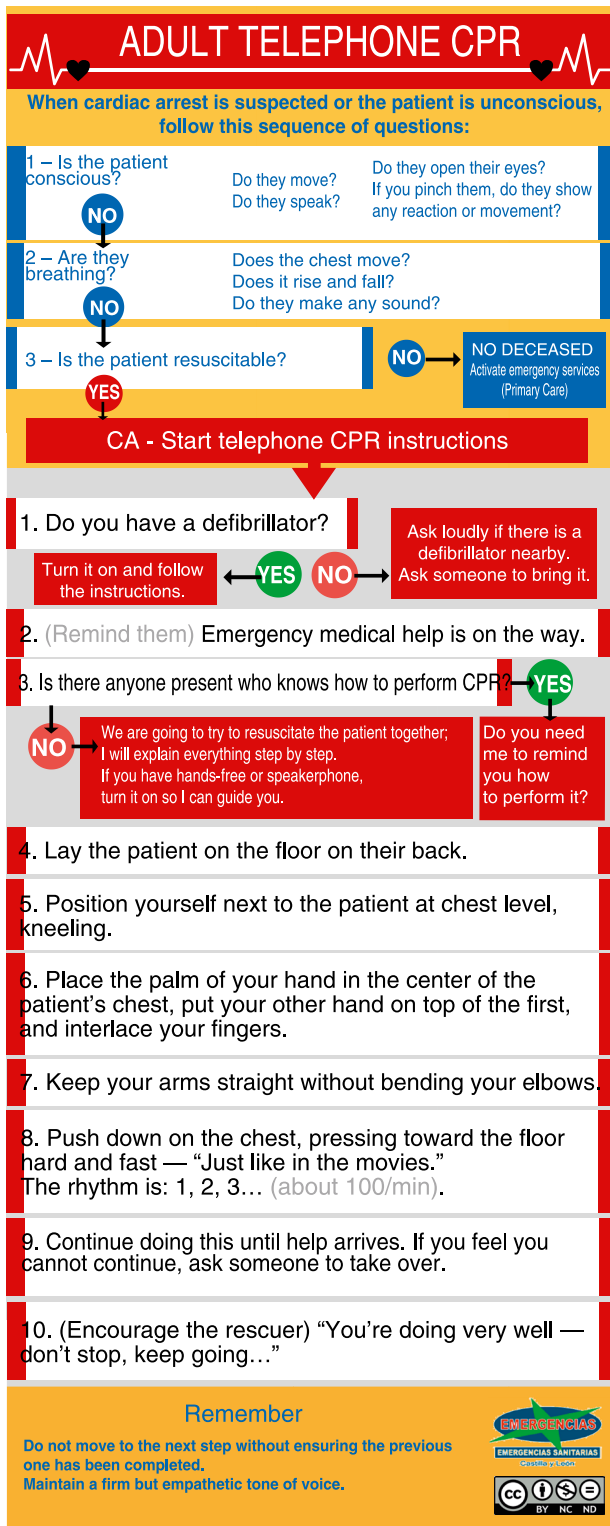


Figure 1. Infographic showing the telephone assistance guide for cardiopulmonary resuscitation performed by lay rescuers.

logical sequence of instructions (Figure 2). Each item was scored as completed (yes/no), and compliance $\geq 80\%$ of items was also recorded.

A total of 18 variables were evaluated in each group: 11 dependent on compliance with the items of the telephone assistance protocol for OHCA, 3 related to overall

protocol compliance, 1 concerning the final outcome of the incident, and 3 sociodemographic variables.

Using analysis of variance (ANOVA), the independent variables and overall compliance results with the guide in the intervention group (IG) were analyzed to determine whether there was any influence related to the profile of

1. Is there an AED nearby?
2. Turn on the hands-free (speaker) mode on your phone.
3. Place the patient on the floor.
4. Lay the patient face up.
5. Kneel down beside the patient.
6. Interlock your hands.
7. Press firmly and quickly in the center of the chest.
8. The rhythm for compressions should be 1, 2... (maintain the pace).
9. If you get tired, ask someone to take over.
10. You're doing very well—keep going until emergency services arrive.
11. Follow the logical order of the steps.

Developed by the authors.
AED: automated external defibrillator.

Figure 2. List of 11 items evaluated in the pre- and post-intervention study during out-of-hospital cardiopulmonary resuscitation performed by lay rescuers under telephone assistance from the emergency medical coordination center.

the medical dispatcher (MD), the number of hours worked at the time of the incident, and the professional profile of the MD who provided assistance.

The mean number of the 11 items followed by the OHECC during telephone assistance to lay rescuers performing CPR was analyzed. The researchers considered all items to have equal importance and established 80% compliance with the 11 items as the minimum acceptable standard.

A univariate analysis was performed, and in the comparisons, a *P*-value < .05 was considered statistically significant. The percentages of item compliance ($\geq 80\%$), hours worked by the MD (0–12 hours), type of caller, and final outcome of the incident were evaluated, comparing pre- and post-intervention results using the chi-square test, except in cases where the expected frequency was < 5, in which case Fisher's exact test was used. Statistical analysis was conducted using the open-source software R, version 4.2.1.

The study was approved by the Ethics Committee of the GES EMS. Confidentiality and respect for the rights of both patients and participating professionals were maintained throughout the study.

Results

A total of 570 incidents were analyzed: 276 in the control group (CG), 70% men, and 294 in the IG (65% men). A total of 174 incidents were included in the final analysis for both the CG and IG. All patients were older than 18 years.

The percentage of incidents managed by nurse dispatchers (NDs) was 7.47% in the CG and 10.92% in the IG, with the remaining incidents handled by MDs; no significant differences were observed (Table 1).

The caller was most frequently a bystander in both groups (97.13% in CG and 97.70% in IG), while incidents reported by law enforcement (LE) or health professionals were minimal, with similar distributions between groups (Table 1).

The distribution of OHCA throughout the 12-hour shifts showed a slight decrease from the start to the end of the shift, but no differences were found between groups (Table 1).

Table 1. Comparison between control group and intervention group by dispatcher profile, accumulated work hours, type of caller, and final resuscitation outcome

Variable	Control Group n = 174 n (%)	Intervention Group n = 174 n (%)	<i>P</i> -value
Professional profile			.266
Medical dispatcher	161 (92.53)	155 (89.08)	
Nurse dispatcher	13 (7.47)	19 (10.92)	
Work hours			.427
0–4 hours	67 (38.51)	79 (45.40)	
4–8 hours	56 (32.18)	50 (28.74)	
8–12 hours	51 (29.31)	45 (25.86)	
Type of caller			.845
Bystander	169 (97.13)	170 (97.70)	
Law enforcement	2 (1.15)	1 (0.57)	
Healthcare professional	3 (1.72)	3 (1.72)	
Outcome			.111
Deceased	132 (75.86)	122 (70.11)	
No transport	4 (2.30)	12 (6.90)	
Transport by EMS	38 (21.84)	40 (22.99)	

EMS: emergency medical services.

Regarding survival-related outcomes, mortality decreased slightly in the IG (75.86% in CG vs 70.11% in IG), though without statistical significance *P* = .111, Table 1).

In the IG, a higher number of cases with > 80% compliance with the checklist items was recorded among NDs vs MDs. Neither the number of hours worked at the time of the incident nor the caller profile influenced the number of completed items (Table 2).

Analysis of compliance with the 11 items of the telephone-assistance protocol showed significant improvement in the IG. Five items displayed statistically significant increases (*P* < .01): activating speaker mode (0% in CG vs 24.14% in IG), placing the victim on the floor (48.28% vs 86.21%), kneeling beside the victim (37.93% vs 64.94%), interlacing hands (60.34% vs 74.14%), and marking the rhythm of compressions (22.99% vs 61.49%) (Table 3).

In the CG, the mean number of items completed was 5.14, with only 7 incidents including > 8 recommendations. After the intervention, the proportion of incidents in which > 8 of the 11 recommendations were given rose significantly—from 4% in the CG to 22% in the IG (*P* < .001) (Table 3).

None of the instructions provided by the OHECC to lay rescuers showed a statistically significant association with survival. However, an increase in transports by EMS was observed in cases managed by nurse dispatchers, in incidents occurring toward the end of shifts, and when instructions included speaker mode, placing the victim supine, kneeling, interlacing hands, compressing, rotating rescuers, encouraging, and following the logical order of instructions, although none reached statistical significance (Table 4).

Discussion

Compliance with telephone-assisted CPR protocols by OHECC dispatchers improved following the training intervention and the implementation of the structured checklist.

Table 2. Results of compliance with the total items of the telephone assistance guide for out-of-hospital cardiopulmonary resuscitation by lay rescuers, according to independent variables in the intervention group

Variable (POST)	% of total 11 items correctly completed	P-value	Yes > 80%	P-value
Professional profile		0.4633		.046
Nurse	63%		36%	
Physician	59%		20%	
Hours worked		0.2076		.068
0-4	61%		20%	
4-8	55%		14%	
8-12	63%		33%	
Type of caller		0.1276		.111
Law enforcement	90%		100%	
Bystander	60%		21%	
Healthcare professional	39%		0%	

Our study analyzed several variables not typically included in previous research on telephone-assisted CPR, such as caller profile and dispatcher workload, estimated by the number of cases handled and total shift hours.^{9,15,18} None of these variables influenced outcomes, although the proportion of alerts originating from LE or health care personnel was small.

Although NDs achieved a higher percentage of > 80% compliance with checklist items vs MDs, the proportion of incidents managed by nurses remained < 11%.

When attempting to correlate the sequence of telephone instructions given by MDs to lay rescuers with resuscitation outcomes, no statistically significant relationship was found between any individual instruction and hospital transport outcomes, either individually or collectively (> 80% checklist completion). In our series, we could not demonstrate a direct association between survival and compliance with MD instructions.

According to the OHSCAR registry, the Spanish national average for transport after ROSC is 30.5%, a figure

Table 3. Compliance results for each item of the telephone assistance guide in out-of-hospital cardiopulmonary resuscitation for lay rescuers

Variable	CG n = 174 n (%)	IG n = 174 n (%)	P-value
1. AED nearby	1 (0.57)	1 (0.57)	1
2. Activate hands-free mode	0 (0.0)	42 (24.14)	< .001
3. Place patient on the floor	84 (48.28)	150 (86.21)	< .001
4. Place patient on their back	129 (74.14)	127 (72.99)	.808
5. Kneel beside the patient	66 (37.93)	113 (64.94)	< .001
6. Interlock hands	105 (60.34)	129 (74.14)	< .01
7. Push hard	155 (89.08)	157 (90.23)	.725
8. Set compression rhythm	40 (22.99)	107 (61.49)	< .001
9. Ask for rotation	27 (15.52)	35 (20.11)	.262
10. Encourage the rescuer	149 (85.63)	143 (82.18)	.381
11. Follow logical order	139 (79.89)	143 (82.18)	.584
Variable	Valor GC	Valor GI	Valor p
Number of checklist items completed [mean (95% CI)]	5.14 (4.80 5.48)	6.59 (6.21 6.97)	< 0.001
Guide compliance ≥ 80%	7 (4%)	38 (22%)	< 0.001

AED: automated external defibrillator; CG: control group; IG: intervention group.

Table 4. Relationship between study variables and the outcome of medical assistance

Variable (CG + IG)	Result of health care provided n (%)				P-value
	n = 348	Death n (%)	No Transfer n (%)	Transfer by EMS n (%)	
Regulating profile					.141
Nurse	32	19 (59.4)	2 (6.2)	11 (34.4)	
Physician	316	235 (74.4)	14 (4.4)	67 (21.2)	
Hours worked					.722
0-4	146	109 (74.7)	8 (5.5)	29 (19.9)	
4-8	106	79 (74.5)	4 (3.8)	23 (21.7)	
8-12	96	66 (68.8)	4 (4.2)	26 (27.1)	
Type of caller					.29
Law enforcement	3	2 (66.7)	1 (33.3)	0 (0.0)	
Bystander	339	247 (72.89)	15 (4.4)	77 (22.7)	
Healthcare professional	6	5 (83.3)	0 (0.0)	1 (16.7)	
AED nearby					.023
Yes	2	0 (0.0)	1 (50.0)	1 (50.0)	
No	346	254 (73.4)	15 (4.3)	77 (22.3)	
Hands-free phone					.063
Yes	42	27 (64.3)	5 (11.9)	10 (23.8)	
No	306	227 (74.2)	11 (3.6)	68 (22.2)	
Place patient on the floor					.830
Yes	234	169 (72.2)	12 (5.1)	53 (22.6)	
No	114	85 (74.6)	4 (3.5)	25 (21.9)	
Supine position (on back)					.232
Yes	256	187 (73.0)	9 (3.5)	60 (23.4)	
No	92	67 (72.8)	7 (7.6)	18 (19.6)	
Kneeling position					.208
Yes	179	124 (69.3)	8 (4.5)	47 (26.3)	
No	169	130 (76.9)	8 (4.7)	31 (18.3)	
Hands interlocked					.116
Yes	234	164 (70.1)	10 (4.3)	60 (25.6)	
No	114	90 (78.9)	6 (5.3)	18 (15.8)	
Push hard					.091
Yes	312	227 (72.8)	12 (3.8)	73 (23.4)	
No	36	27 (75.0)	4 (11.1)	5 (13.9)	
Set compression rhythm					.966
Yes	147	108 (73.5)	7 (4.8)	32 (21.8)	
No	201	146 (72.6)	9 (4.5)	46 (22.9)	
Ask for rotation					.329
Yes	62	41 (66.1)	4 (6.5)	17 (27.4)	
No	286	213 (74.5)	12 (4.2)	61 (21.3)	
Encourage rescuer					.09
Yes	292	211 (72.3)	11 (3.8)	70 (24.0)	
No	56	43 (76.8)	5 (8.9)	8 (14.3)	
Follow logical order					.301
Yes	282	205 (72.7)	11 (3.9)	66 (23.4)	
No	66	49 (74.2)	5 (7.6)	12 (18.2)	
CG + IG variable					
Total items "Yes" [Mean (SD) %]		5.76 (2.53)	5.62 (3.83)	6.26 (2.17)	.276
Compliance ≥ 80%		11%	31%	14%	.068

EMS: emergency medical services; AED: Automated external defibrillator; GC: control group; IG: intervention group; SD: standard deviation.

exceeded in our study region (35.7%). Of note, these data include patients initially treated by bystanders as well as those attended exclusively by EMS, including witnessed OHCA by EMS teams. Other studies report bystander CPR with telephone assistance resulting in transport with ROSC in approximately 19% of cases.^{1,14} This lower rate of transport may reflect the poorer survival outcomes observed in OHCA occurring under such circumstances.¹⁴⁻¹⁶

The 22% transport rate with ROSC in both study groups may be interpreted as a favorable outcome, though with room for improvement. The lack of significant differences between groups could be attributed to the small sample size and to other factors described in the literature, such as delays in CPR initiation and early recognition of OHCA.¹⁵⁻¹⁷

The training intervention demonstrated a tangible impact on protocol adherence. Significant improvements were observed in 5 of the 11 evaluated items, the mean number of items completed, and the percentage of cases with > 80% adherence, which increased 5-fold—underscoring the success of the intervention. The training design, including pocket infographics, simulation sessions, and experienced in-house instructors, likely contributed to these outcomes. However, as seen in other training interventions reporting only partial impact, the fact that only 22% of post-intervention cases achieved > 80% compliance indicates both a relevant margin for improvement and the need for ongoing initiatives to reinforce guideline adherence and assess results as quality indicators.¹⁸

One major factor negatively affecting telephone-assisted CPR outcomes is delay in the initiation of maneuvers. In this study, time from arrest recognition to CPR initiation was not recorded. Additionally, not all EMS participating in similar studies have NDs or MDs—some rely on trained call operators.¹⁹⁻²¹ These methodological differences hinder direct comparison between studies. Standardized registries,

following Utstein-style consensus models, would enhance comparability and data interpretation across investigators.^{1,22} Other aspects, such as CPR quality assessment and barriers or facilitators experienced by MDs in guiding lay rescuers, are especially relevant, though beyond this study's scope. Future efforts to improve telephone-assisted CPR should incorporate these considerations into program design.^{14,23}

Among the study's additional limitations we find the lack of significant associations between analyzed variables and survival outcomes may be due to sample size limitations. A larger dataset with higher protocol compliance might yield stronger results, encouraging future research over longer periods.

Secondly, the low frequency of certain variables (e.g., caller profile or availability of nearby AEDs) limited inter-pretability and statistical power.

Thirdly, the "outcome" variable included several non-transport cases where patients, though initially included, did not actually present cardiac arrest or were false alarms not requiring transport.

Conclusions

The training intervention for MDs and NDs, combined with the use of a telephone-assistance checklist, led to significant improvement in compliance with telephone-guided CPR protocols performed by lay rescuers. However, this improvement did not translate into survival outcomes.

ARTICLE INFORMATION

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REFERENCES

1. Ignacio Ruiz-Azpiazu J, Daponte-Codina A, Fernández del Valle P, López-Cabeza N, Xavier Jiménez-Fábrega F, Antonio Iglesias-Vázquez J, et al. Regional variation in the incidence, general characteristics, and outcomes of prehospital cardiac arrest in Spain: the Out-of-Hospital Spanish Cardiac Arrest Registry. *Emergencias*. 2021;33:15-22.

2. Azeli Y, Barbería E, Jiménez-Herrera M, Bonet G, Valero-Mora E, Lopez-Gomariz A, et al. The ReCaPTa study - a prospective out of hospital cardiac arrest registry including multiple sources of surveillance for the study of sudden cardiac death in the Mediterranean area. *Scand J Trauma Resusc Emerg Med*. 2016;24:127.
3. Rosell Ortiz F, Mellado Vergel F, López Messa JB, Fernández Valle P, Ruiz Montero MM, Martínez Lara M, et al. Survival and Neurologic Outcome After Out-of-hospital Cardiac Arrest. Results of the Andalusian Out-of-hospital Cardiopulmonary Arrest Registry. *Revista Española de Cardiología (English Edition)*. 2016;69:494-500.
4. Besnier E, Damm C, Jardel B, Veber B, Compere V, Dureuil B. Dispatcher-assisted cardiopulmonary resuscitation protocol improves diagnosis and resuscitation recommendations for out-of-hospital cardiac arrest. *Emerg Med Australas*. 2015;27:590-6.
5. 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.
6. García del Águila J, López-Messa J, Rosell-Ortiz F, de Elías Hernández R, Martínez del Valle M, Sánchez-Santos L, et al. Recomendaciones para el soporte telefónico a la reanimación por testigos desde los centros de coordinación de urgencias y emergencias. *Med Intensiva*. 2015;39:298-302.
7. Bobrow BJ, Spaite DW, Vadeboncoeur TF, Hu C, Mullins T, Tormala W, et al. Implementation of a Regional Telephone Cardiopulmo-

- nary Resuscitation Program and Outcomes After Out-of-Hospital Cardiac Arrest. *JAMA Cardiol*. 2016;1:294-302.
8. Wu Z, Panczyk M, Spaite DW, Hu C, Fukushima H, Langlais B, et al. Telephone cardiopulmonary resuscitation is independently associated with improved survival and improved functional outcome after out-of-hospital cardiac arrest. *Resuscitation*. 2018;122:135-40.
9. Eberhard KE, Linderoth G, Gregers MCT, Lippert F, Folke F. Impact of dispatcher-assisted cardiopulmonary resuscitation on neurologically intact survival in out-of-hospital cardiac arrest: a systematic review. *Scand J Trauma Resusc Emerg Med*. 2021;29:70.
10. Lapostolle F, Freund Y. Out-of-hospital cardiac arrest: The long road to equitable emergency care access to resuscitation. *Emergencias*. 2021;33:5-6.
11. Perkins GD, Graesner JT, Semeraro F, Olasveengen T, Soar J, Lott C, et al. European Resuscitation Council Guidelines 2021: Executive summary. *Resuscitation*. 2021;161:1-60.
12. Wyckoff MH, Singletary EM, Soar J, Olasveengen TM, Greif R, Liley HG, et al. 2021 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations: Summary From the Basic Life Support; Advanced Life Support; Neonatal Life Support; Education, Implementation, and Teams; First Aid Task Forces; and the COVID-19 Working Group. *Resuscitation*. 2021;169:229-311.
13. Semeraro F, Greif R, Böttiger BW, Burkart R, Cimpoesu D, Georgiou M, et al. European Resuscitation Council Guidelines 2021: Systems saving lives. *Resuscitation*. 2021;161:80-97.

14. Aldridge ES, Perera N, Ball S, Finn J, Bray J. A scoping review to determine the barriers and facilitators to initiation and performance of bystander cardiopulmonary resuscitation during emergency calls. *Resusc Plus.* 2022;11:100290.
15. Drennan IR, Geri G, Brooks S, Couper K, Hatanaka T, Kudenchuk P, et al. Diagnosis of out-of-hospital cardiac arrest by emergency medical dispatch: A diagnostic systematic review. *Resuscitation.* 2021;159:85-96.
16. Hardeland C, Claesson A, Blom MT, Blomberg SNF, Folke F, Hollenberg J, et al. Description of call handling in emergency medical dispatch centres in Scandinavia: recognition of out-of-hospital cardiac arrests and dispatcher-assisted CPR. *Scand J Trauma Resusc Emerg Med.* 2021;29:88.
17. Hardeland C, Skåre C, Kramer-Johansen J, Birkenes TS, Myklebust H, Hansen AE, et al. Targeted simulation and education to improve cardiac arrest recognition and telephone assisted CPR in an emergency medical communication centre. *Resuscitation.* 2017;114:21-6.
18. Gram KH, Præst M, Laulund O, Mikkelsen S. Assessment of a quality improvement programme to improve telephone dispatchers' accuracy in identifying out-of-hospital cardiac arrest. *Resusc Plus.* 2021;6.
19. Oman G, Bury G. Use of telephone CPR advice in Ireland: Uptake by callers and delays in the assessment process. *Resuscitation.* 2016;102:6-10.
20. Ahmed F, Khan UR, Soomar SM, Raheem A, Naeem R, Naveed A, et al. Acceptability of telephone-cardiopulmonary resuscitation (T-CPR) practice in a resource-limited country—a cross-sectional study. *BMC Emerg Med.* 2022;22(1).
21. Stangenes SR, Painter IS, Rea TD, Meischke H. Delays in recognition of the need for telephone-assisted CPR due to caller descriptions of chief complaint. *Resuscitation.* 2020;149:82-6.
22. Perkins GD, Jacobs IG, Nadkarni VM, Berg RA, Bhanji F, Biarent D, et al. Cardiac arrest and cardiopulmonary resuscitation outcome reports: update of the Utstein Resuscitation Registry Templates for Out-of-Hospital Cardiac Arrest: a statement for healthcare professionals from a task force of the International Liaison Committee on Resuscitation (American Heart Association, European Resuscitation Council, Australian and New Zealand Council on Resuscitation, Heart and Stroke Foundation of Canada, InterAmerican Heart Foundation, Resuscitation Council of Southern Africa, R. *Circulation.* 2015;132:1286-300.
23. Ecker H, Wingen S, Hamacher S, Lindacher F, Böttiger BW, Wetsch WA. Evaluation Of CPR Quality Via Smartphone With A Video Livestream—A Study In A Metropolitan Area. *Prehospital Emergency Care.* 2021;25:76-81.