Submitted: 16 September, 2025 Accepted: 05 January, 2026 Published: 08 August, 2026 DOI:10.22514/sv.2026.032

Open Access

Signa Vitae

ORIGINAL RESEARCH

Effect of rescuer–dispatcher communication on chest compression quality during simulated cardiac arrest

Damjan Slabe[1], Jakob Košir[2], Nino Fijačko[2], Eva Dolenc Šparovec[1,*]

[1] Public Health Division, Sanitary Engineering Department, Faculty of Health Sciences, University of Ljubljana, 1000 Ljubljana, Slovenia
[2] Department of Nursing, Faculty of Health Sciences, University of Ljubljana, 1000 Ljubljana, Slovenia

***Correspondence**
eva.dolenc@zf.uni-lj.si
(Eva Dolenc Šparovec)

Abstract

Background: This study aimed to assess the effects of performing chest compressions (CCs) while calling emergency medical services (EMS), compared with performing CCs without simultaneously making an EMS call, and to explore participants' experiences during both scenarios. **Methods**: We conducted a mixed-methods experimental study using a within-subjects repeated-measures design in a simulated environment at the Faculty of Health Sciences, University of Ljubljana. A total of 75 healthcare students participated in the study, and each participant performed CCs in two scenarios: (1) while communicating with a dispatcher during an EMS call and (2) without makiJanng a call. CC quality was measured using the Resusci Anne Quality Cardiopulmonary Resuscitation (QCPR) manikin (Laerdal Medical, Norway) and QCPR Learner app, with overall quality summarized using the QCPR score (0–100%). Semi-structured interviews were conducted immediately after the scenarios to explore participants' experiences, which were divided into intrinsic and extrinsic factors. **Results**: In simulated cardiac arrest, CC quality was better when the rescuer was not simultaneously calling EMS. Participants' median CC depth (65 mm *vs.* 70 mm; $Z = -6.21$, $p < 0.001$) and chest recoil (29% *vs.* 80%; $Z = -5.01$, $p < 0.001$) were reduced when participants communicated with the dispatcher. CC rate and total number of compressions remained comparable, whereas pause durations were slightly longer during the call (0.6 s *vs.* 0.1 s; $Z = -3.09$, $p = 0.002$). Qualitative findings revealed that participants experienced more intrinsic (such as physical and psychological strain) than extrinsic factors, which included environmental and communication-related obstacles. **Conclusions**: Performing CCs while talking on a smartphone with EMS reduces CC quality and increases both physical and mental effort.

Keywords

Out-of-hospital cardiac arrest; Dispatcher-assisted CPR; Telephone CPR

1. Introduction

Early recognition of cardiac arrest and timely activation of emergency medical services (EMS) are essential steps in the chain of survival [1–3]. Among these actions, prompt EMS activation is regarded as the second most crucial factor influencing outcomes in out-of-hospital cardiac arrest (OHCA) [2–4]. The European Resuscitation Council (ERC) guidelines for adult basic life support (BLS) recommend that, after ensuring the area is safe, the rescuer should check the victim's responsiveness, call EMS, and activate the speaker or hands-free option on their phone, or ask someone nearby to make the call. The rescuer should then immediately begin cardiopulmonary resuscitation (CPR) with assistance from the dispatcher if the victim is not breathing or is breathing abnormally [3].

Dispatcher-assisted CPR (DA-CPR) is endorsed by the American Heart Association (AHA) and the ERC as a vital component of the chain of survival [5]. It allows dispatchers to provide real-time CPR instructions to bystanders, thereby improving early intervention during OHCA. DA-CPR is also a key element of the ERC's System Saving Lives bundled approach, which emphasizes coordinated system-level strategies to improve outcomes [3]. DA-CPR improves patient outcomes in OHCA, significantly increasing the likelihood of bystander-initiated CPR [5, 6]. Evidence from systematic reviews and meta-analyses indicates that DA-CPR improves neurologically intact survival, return of spontaneous circulation, and survival to hospital discharge or 30-day survival. These benefits are most evident when CPR is initiated promptly. While it may not always achieve the same outcomes as CPR performed by a trained bystander, DA-CPR remains an effective intervention for improving patient outcomes and facilitating early resuscitation in OHCA. Wang *et al.* [7] highlight its importance in increasing bystander CPR rates, survival, and neurological outcomes.

Despite its proven benefits, several barriers hinder the effective delivery of DA-CPR. A recent review identified psychological hesitation, physical limitations, language barriers, and communication issues, such as callers hanging up before receiving CPR instructions, as major obstacles to initiating CPR [8, 9]. Strategies to overcome these barriers include improved dispatcher training, simplified instruction protocols, video-assisted guidance, system-level improvements such as centralized call handling, and community-based initiatives to enhance CPR education [8, 9]. Some researchers have also proposed practical solutions, such as performing one-handed CCs while simultaneously calling EMS to reduce delays in initiating CPR [10]. However, many of these barriers, particularly psychological stress, physical strain, communication difficulties, and technical challenges associated with smartphone use, directly relate to the increased cognitive load and multitasking demands placed on rescuers during DA-CPR. These factors may compromise compression quality when the rescuer must perform CCs while simultaneously communicating with the dispatcher.

Despite the proven impact of DA-CPR on improving survival rates after OHCA, the challenge of simultaneously calling EMS while performing CCs remains a concern. Therefore, this study aims to assess the effects of performing CCs while calling EMS compared with performing CCs without simultaneously making an EMS call, and to explore participants' experiences during both scenarios.

2. Methods

2.1 Study design

In May 2024, we conducted a mixed-methods experimental study using a within-subjects repeated-measures design in a simulated environment at the Faculty of Health Sciences, University of Ljubljana. Seventy-five healthcare students participated in a within-subjects design and performed CCs in two scenarios: (1) while communicating with a dispatcher during an EMS call and (2) without an EMS call. Quantitative data were collected using the Resusci Anne Quality Cardiopulmonary Resuscitation (QCPR) Skill Guide manikin (Laerdal, Norway), connected to a smartphone (Samsung Galaxy A35, Seoul, South Korea), with data stored via the QCPR Learner app (version 7.0.0, Laerdal Medical, Stavanger, Norway). The QCPR manikin automatically recorded all quantitative CPR performance parameters, including chest compression depth, rate, total number of compressions, chest recoil, and pause duration. Qualitative data were obtained through semi-structured interviews exploring participants' experiences, perceptions, and challenges during the scenarios. The reporting of the study adheres to the extensions of the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement, as outlined in the Reporting Guidelines for Health Care Simulation Research [11].

2.2 Participants

Healthcare students enrolled in the practical first aid exercises during the 2023–2024 academic year at the University of Ljubljana, Faculty of Health Sciences, were invited to participate in the study. A convenience sampling method was applied due to the accessibility of participants. The recruitment process was conducted in person during scheduled classes, where students were informed verbally about the purpose, procedures, and voluntary nature of the study. To minimize coercion, the invitation was extended by course instructors who were not involved in student assessment. No incentives or compensation were provided for participation. Inclusion criteria were informed consent, being at least 18 years of age, and having the ability to perform adult BLS on a manikin (*e.g.*, without physical limitations or injury). Our study had no exclusion criteria. Out of a total of 84 eligible participants, 75 took part in the study. Nine participants declined to participate, citing reasons such as a cold, a knee or wrist injury, or lack of access to a smartphone.

2.3 Procedure

The research consisted of three parts (Fig. 1). Part 1 and Part 2 assessed CC quality with and without simultaneous EMS communication. All quantitative parameters (see outcome measures) were automatically recorded by the QCPR manikin and stored via the QCPR Learner app. Part 3 involved semi-structured interviews to explore participants' subjective experience.

2.3.1 Part 1: CC performance during an EMS call

Participants were provided with instructions and presented with the following simulation scenario:

"You are on the third floor of the Faculty of Health Sciences, University of Ljubljana. Upon entering the hallway of office K313, you notice a man, approximately 40 years old, lying on the floor. He is unresponsive and not breathing. There is no Automated External Defibrillator (AED) available".

In this scenario, the participant was alone and was therefore required to initiate the EMS call and start CCs. Participants used their own mobile phones, having confirmed beforehand their familiarity with the speakerphone function, while the dispatcher always used a smartphone, specifically a Huawei P30 Lite (Huawei Corporation, Shenzhen China). Instead of calling the EMS number, participants placed the call to the dispatcher's phone (with the number written on a note next to the manikin, as participants had been informed beforehand).

After approximately five seconds, the call was answered by a trained individual in a neighbouring room acting as the dispatcher. The individual portraying the dispatcher had participated in a brief educational visit to the Ljubljana medical dispatch center. The dispatcher asked a series of prepared questions, adjusting them as needed based on the flow of the conversation. Communication between the dispatcher and the rescuer was designed to be continuous, without silent periods. The dispatcher guided the conversation throughout the scenario, asking additional and follow-up questions, such as the location of the victim, which room or floor they were in, whether anyone else was present to assist, and confirming details of the situation. As soon as the student stopped speaking, the dispatcher immediately asked another question, ensuring a continuous, minute-long interaction. If a participant did not respond or remained silent for more than one second,

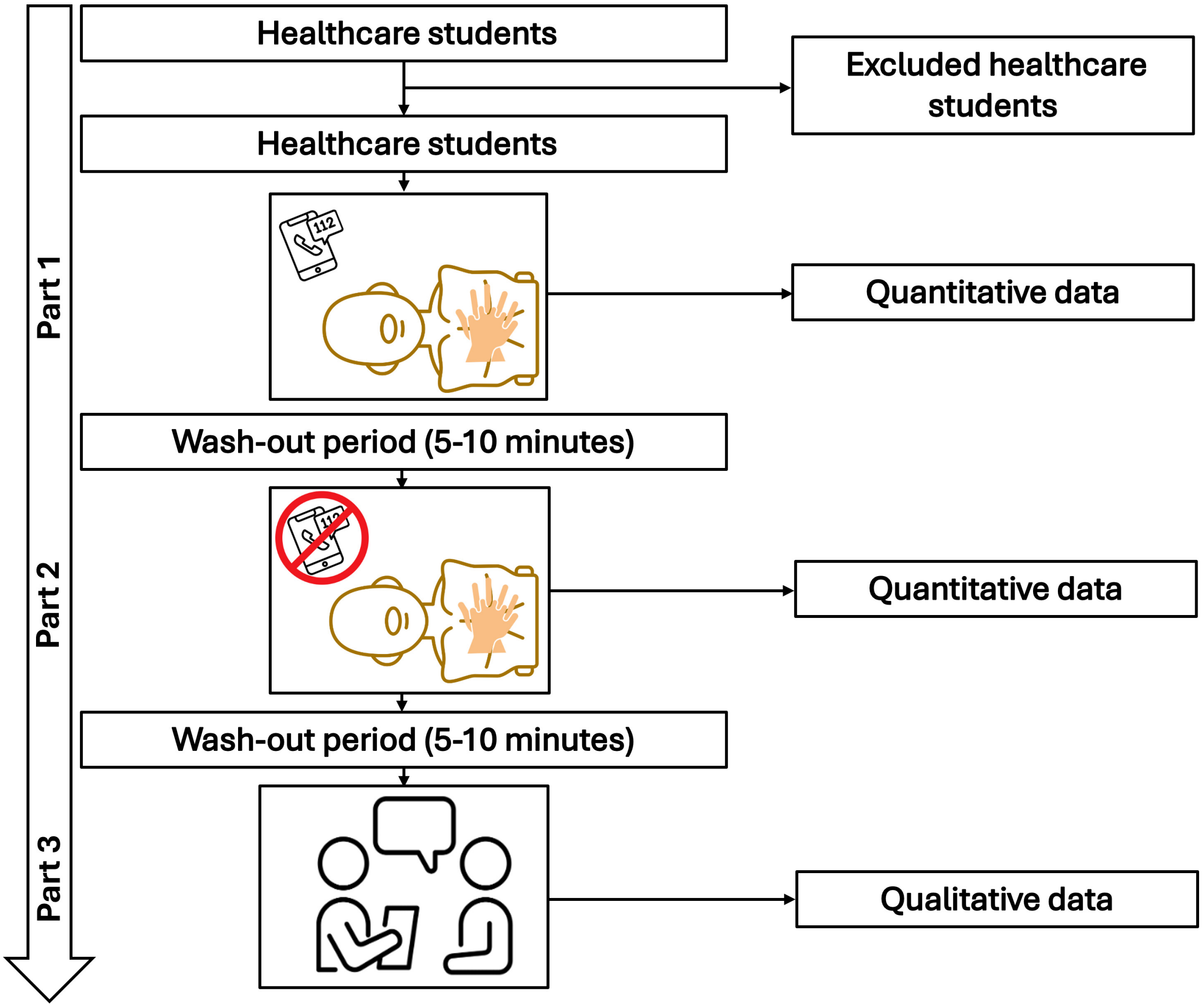

FIGURE 1. Flow diagram of study design.

for example, due to focusing on compressions, hesitation, or not hearing the question, the dispatcher immediately repeated the prompt or asked a new question to avoid variability in silence duration. The dispatcher also used active coaching and encouraging phrases, such as "keep going", "you're doing great", and "the ambulance is on its way", which can motivate bystanders and influence CC quality ("push hard", "push fast") [12].

2.3.2 Part 2: CC performance without an EMS call

In the second scenario, an assistant had already called EMS and retrieved an automated external defibrillator (AED). The participant was then left alone to perform CCs for one minute, as in the previous scenario, but without the need to call EMS.

A 5–10-minute rest period was provided between scenarios, with additional rest allowed if needed. All participants completed scenarios in a fixed order, starting with the EMS-call scenario, followed by the scenario without a call. This order was chosen because participants had previously practiced only CPR techniques without EMS communication in a classroom setting; therefore, we aimed to first assess performance under the less familiar, more complex scenario with EMS calls, followed by the more familiar scenario without a call. This approach helped standardize the procedure and ensured a meaningful comparison between the two conditions.

2.3.3 Part 3: semi-structured interviews

Immediately after completing the second scenario, each participant took part in an individual semi-structured interview to obtain qualitative data. The Consolidated Criteria for Reporting Qualitative Research (COREQ) guidelines were followed to ensure a consistent process throughout the study [13]. Interviews were based on a semi-structured questionnaire developed from a literature review and refined after pilot interviews, and were specifically designed *ad hoc* for this study. Anonymity and a quiet environment were ensured. The interviews were conducted in person by co-author JK, ensuring direct, face-to-face interaction with the participants. Each interview was recorded using a Sony IC digital voice recorder (Sony Group Corporation, Tokyo, Japan) or Olympus WS-832 digital voice recorder (Olympus Imaging Corporation, Tokyo, Japan), lasted an average of five minutes, and was subsequently transcribed verbatim in Microsoft 365 Word (Microsoft Corporation, Redmond, WA, USA) and anonymized. The interviewees' names were replaced with code numbers, such as U1 representing participant number 1. The transcripts were reviewed by listening to the audio recordings with VLC media player (version 3.0.20, VideoLAN, Paris, France), and minor corrections were made as needed. Transcripts were not returned to participants for feedback, and no repeated interviews were conducted. The interview guide explicitly explored emotional responses such as stress, anxiety, fear, uncertainty, sense of responsibility, perceived security, motivation, and mental overload experienced during both scenarios.

2.3.4 Qualitative data analysis

Three researchers, JK (registered nurse in emergency department, MSc candidate), NF (male associate professor, registered nurse in intensive care unit, and PhD in Biomedical Technology), and EDŠ (female associate professor and teaching assistant with a PhD in Biomedicine) performed qualitative content analysis on the interview transcripts. The qualitative data were analyzed inductively using a three-step coding process. Each transcript was read, qualitatively coded, reviewed, and labelled using inductive content analysis [14]. Themes and categories were not predetermined but emerged from the data through successive stages of open, axial, and selective coding.

In the first stage, open coding was conducted to identify and label key ideas within the interview transcripts. During axial coding, related codes were grouped into broader categories, and relationships among them were explored. Finally, selective coding integrated these categories into central themes that represented participants' overall experiences and the main findings of the study. Data were independently coded, and any discrepancies were discussed and resolved through consensus. An agreement was reached through iterative discussion and refinement of the coding framework. Data saturation was achieved by analyzing the complete set of interview transcripts from all participants in the quantitative phase, ensuring comprehensive coverage of relevant themes. All analyses were conducted using Microsoft Excel 365 (version 2401, Microsoft Corporation, Redmond, WA, USA). The Sankey diagrams were created using SankeyMATIC, a free online tool (https://sankeymatic.com/), and refined by Inkscape v.1.4.2 software (Inkscape Project, USA).

2.4 Outcome measures

Primary outcomes were components of CCs: CC depth (50–60 mm), CC rate (100–120 compressions per minute), total number of CCs, chest recoil (0–100%), and pause duration without compressions (seconds). The secondary outcome was a total QCPR score, ranging from 0% to 100%, automatically generated by the QCPR Learner app (version 7.0.0, Laerdal Medical, Norway) and integrating individual performance parameters including compression depth, rate, recoil, and pauses (interval without compressions), into a single overall score reflecting overall adherence to recommended CPR guidelines. More detailed information about the software's scoring algorithm is available on the Laerdal Medical website (Laerdal Medical, Norway) [15]. Tertiary outcomes were qualitative data presented in categories, subcategories, and codes.

2.5 Statistical analysis

Statistical analysis was performed using IBM® SPSS® Statistics (version 29) (International Business Machines Corporation, Armonk, NY, USA) and Microsoft Excel (2007) (Microsoft Corporation, Redmond, WA, USA). As each participant completed both scenarios, all data were treated as paired. A power analysis using G*Power (version 3.1.9.7, Heinrich Heine University Düsseldorf, Düsseldorf, NRW, Germany) for the Wilcoxon signed-rank test indicated that a minimum of 34 participants was required (assuming a medium effect size, $r = 0.3$, $\alpha = 0.05$, and 80% power). Our study exceeded this requirement, with a total of 75 participants. Primary outcomes were CC depth, rate, chest recoil, pause duration, and total QCPR score. Data normality was assessed using the Shapiro-Wilk test, and paired comparisons were performed using the Wilcoxon signed-rank test, with a Bonferroni correction for multiple outcomes (adjusted $\alpha = 0.01$). Non-parametric data are presented as median (IQR), with paired differences, effect sizes (r), and 95% confidence intervals reported where appropriate. Statistical significance was set at $p < 0.05$ unless otherwise adjusted.

3. Results

Out of a total of 84 participants, 75 took part in the study, with the majority being women (n = 59), aged between 19 and 27 years. The mean age of the participants was 20.1 years (±1.5). Physiotherapy students comprised of 36% (n = 27) of the participants, followed by midwifery students (31%; n = 23). The remaining participants were students of sanitary engineering (13%; n = 10), orthotics and prosthetics (12%; n = 9), and dental laboratory prosthetics (8%; n = 6). All participants had previously practiced adult BLS as part of training exercises at the University of Ljubljana, Faculty of Health Sciences, and the majority (92%) had completed a first aid course for motor vehicle drivers, which includes adult BLS training.

3.1 Effects of dispatcher communication on chest compression performance

Participants' CC performance differed between the two scenarios, namely communicating with the dispatcher versus performing CCs without dispatcher interaction. Participants showed lower median CC depth and reduced chest recoil percentages when communicating with the dispatcher, while the number of compressions and CC rate were largely unaffected. Pause durations were slightly longer during DA-CCs (Table 1).

The median QCPR score was 82.0% (IQR: 54.5–95.5) when participants communicated with the dispatcher while performing CCs, compared to 93.0% (IQR: 74.0–99.0) when participants performed CCs without dispatcher communication. This difference was statistically significant ($Z = -0.22$, $p = 0.001$, $r = 0.49$, paired difference = −11%, 95% confidence interval (CI) (−15.0, −7.0)).

3.2 Qualitative analysis of participants' experiences

Qualitative analysis revealed that participants reported more intrinsic factors (n = 430) than extrinsic factors (n = 253) influencing their experiences during CCs, both when commu-

TABLE 1. Primary chest compression performance outcomes.

Outcome measure	CCs with dispatcher communication (n = 75)	CCs without dispatcher communication (n = 75)	Paired difference	Z	p-value	r	95% CI
Depth–MED (IQR) (mm)	65.3 (60–70)	70.4 (65–75)	−5.1	−6.21	<0.001	0.71	−6.2, −4.0
Depth–MED (IQR) (% of CCs in target depth range)	100.0 (96.0–100.0)	100.0 (100.0–100.0)	−4.0	−4.99	<0.001	0.69	−6.0, −3.0
Rate–MED (IQR) (CCs min^{-1})	121.7 (110–133)	122.2 (112–135)	1.5	−0.38	0.706	0.04	−2.0, 5.0
Rate–MED (IQR) (% of CCs in target rate range)	25.0 (2.0–74.5)	22.0 (0.5–95.0)	1.0	−1.26	0.206	0.15	−5.0, 6.0
Recoil–MED (IQR) (%)	29.0 (7.0–87.5)	80.0 (30.0–99.0)	−51.0	−5.01	<0.001	0.65	−60.0, −42.0
Duration of pause–MED (IQR) (s)	0.6 (0–1.5)	0.1 (0–0.5)	0.5	−3.09	0.002	0.36	0.2, 0.8
Number of CCs–MED (IQR)	119.2 (110–130)	121.5 (112–135)	−2.0	−1.21	0.225	0.14	−5.0, −3.0

CCs: chest compressions; MED (IQR): median (interquartile range); Pause: average interruption duration (s); Paired difference: median difference between conditions; Z: Wilcoxon signed-rank test statistic; p: significance; r: effect size; 95% CI: 95% confidence interval of paired difference. All comparisons used the Wilcoxon signed-rank test with Bonferroni correction.

nicating with the dispatcher and when performing CCs without dispatcher communication (Figs. 2,3).

3.3 Focus and perceived quality of CCs without EMS call

Most participants who performed CCs without calling EMS reported that they could focus solely on the quality of the compressions. However, many also expressed concern about whether they were performing the CCs correctly. Participant U38 noted, "*Since I wasn't thinking about the information I needed to give the dispatcher, I was more focused on the compressions, and they felt more exhausting*". Similarly, participant U47 reflected, "*I wondered if the person would survive. Am I doing the compressions right? Is something wrong?*" Many participants also remarked that a single minute of performing CCs felt very long. For example, participant U33 stated, "*It dragged on, and pain and fatigue became noticeable much quicker*", while participant U76 added, "*One minute felt much longer to me*". Some participants felt uncomfortable being alone and missed having assistance. Participant U12 shared, "*I was alone, and the silence was uncomfortable*", and participant U32 explained, "*Since someone else was making the call and fetching the AED, I knew the survival chances were higher, but I was also afraid something might go wrong while I was alone*". Overall, participants described CPR without calling for help as stressful and exhausting, with the feeling that the responsibility for the victim's survival rested heavily on their shoulders.

3.4 Distraction and multitasking during EMS calls

Most participants reported that the call distracted them from performing CCs. Participant U3 mentioned, "*During the conversation, you don't really have time to even think that you're tired*"; while participant U31 added, "*Calling at the same time is distracting, and I couldn't focus on how deep and fast I was compressing*". Additionally, participants emphasized that it was challenging to perform multiple tasks simultaneously and that they focused more on the call than on performing CPR. Participant U35 noted, "*It's hard to concentrate on doing CCs and listening on the phone at the same time*", and participant U10 shared, "*I focused more on the call than on the actual resuscitation*". Some participants expressed concern about providing information to the dispatcher, as they were afraid of saying something wrong or omitting important details. On the other hand, some participants felt a sense of security from the dispatcher during the call and felt better because they didn't feel alone. Participant U68 stated, "*It was a little stressful to think about my answers to the rescuer, but their presence and instructions helped me stay more focused and not dwell so much on the situation*", while participant U40 added, "*I didn't feel alone; the dispatcher's support was helpful*".

3.5 Obstacles affecting chest compression performance

Participants identified several obstacles during CCs, including the phone call, communication with the dispatcher, physical limitations, multitasking, inappropriate clothing and accessories, feelings of solitude, and environmental distractions.

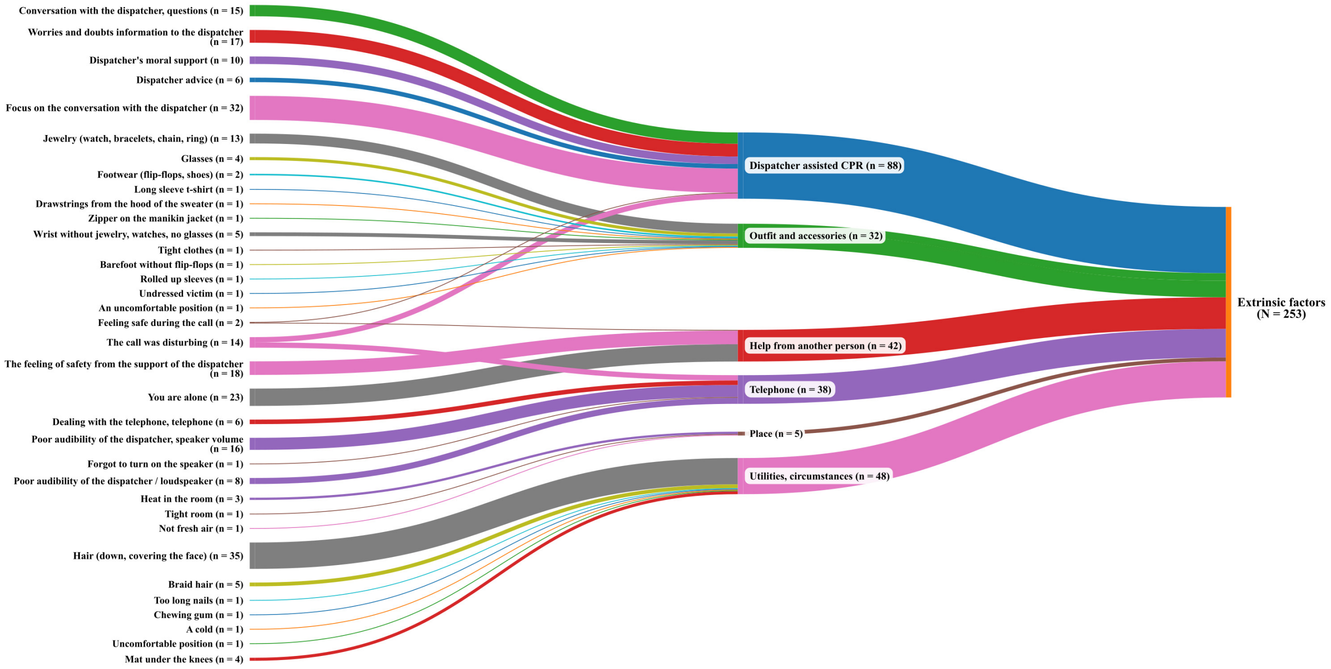

FIGURE 2. Sankey diagram illustrating participants' extrinsic factors affecting the performance of chest compressions with and without dispatcher communication. CPR: Cardiopulmonary Resuscitation.

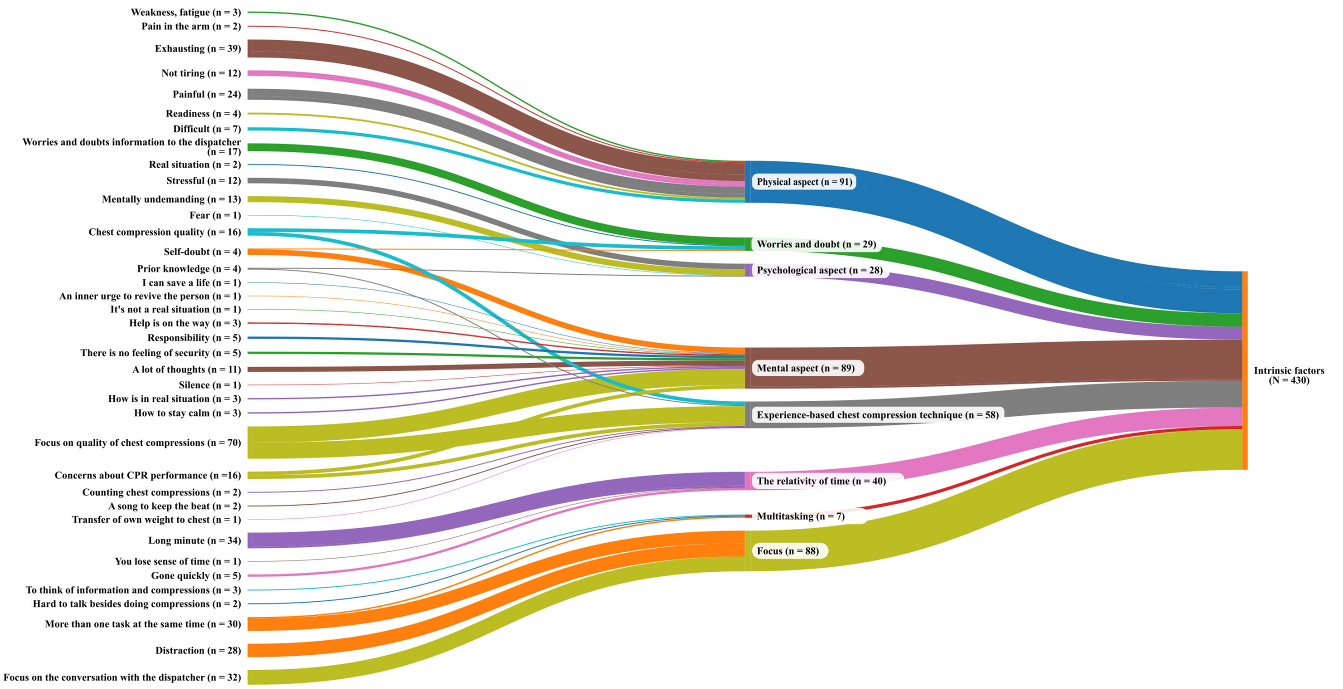

FIGURE 3. Sankey diagram illustrating participants' intrinsic factors affecting the performance of chest compressions with and without dispatcher communication. CPR: Cardiopulmonary Resuscitation.

The most common obstacle was loose hair obstructing vision, followed by issues with glasses. Participant U71 stated, "*I was bothered by my glasses, as they kept sliding down my nose, and my hair, which was covering my face*". The next most common obstacle was the poor audibility of the dispatcher. Some participants paused CCs to adjust the phone's volume, while others continued compressions despite struggling to hear the dispatcher clearly. Participant U42 remarked, "*I couldn't hear the phone well and had to pause briefly because of it*", while participant U55 added, "*I had to turn up the speaker on my phone*", and participant U78 noted, "*The low volume of the phone was a hindrance during resuscitation, as I couldn't hear the person on the other end*".

Another obstacle identified by participants was the phone call itself and the ongoing conversation with the dispatcher, as they had to do two things at once, making it harder to focus on CCs: participant U66 explained, "*The call distracted me in the sense that I couldn't concentrate as much on the* *compressions*". In addition to the call, participants were also bothered by jewelry, which pressed against their skin, causing discomfort and pain. Two participants were hindered by necklaces that bounced during compressions and hit them in the face: participant U36 noted: "*My hair got in my face, and the necklace was hitting me in the face*", while participant U42 added, "*The necklace bothered me as it bounced against my face*", and participant U57 shared: "*I was hindered by my wristwatch (pressing against my wrist)*".

3.6 Facilitators and strategies to improve performance

Participants identified several facilitators that improved CC performance, including guidance from the dispatcher, removing jewelry, wearing appropriate clothing, tying up hair, and using specific CC techniques. Participant U22 noted, "*The call helped me, I could ask if there was something I didn't know*". Jewelry can press against the skin during CCs and cause discomfort, while glasses often slip down the nose: participant U68 shared: "*It helped when I removed my watch, glasses, and rolled up my sleeves*". For many women, tied-up hair was especially helpful: participant U45 noted, "*Nothing was bothering me; it helped that my hair was tied up and my clothes were fitted enough not to get in the way*".

4. Discussion

Our results, although derived from a simulated cardiac arrest scenario, indicate that it is more effective for one rescuer to focus on performing CCs while other bystanders handle the EMS call. However, in both scenarios, the mean CCs depth (~65–70 mm) and rate (~120/min) slightly exceeded the current ERC 2025 recommendations for adult BLS (depth: 50–60 mm; rate: 100–120/min), suggesting that participants generally compressed harder and faster than recommended. Notably, when participants performed CCs without simultaneously speaking to the dispatcher, they demonstrated better compression depth, improved chest recoil, and higher overall QCPR scores. Performing CCs while communicating with the dispatcher also led to longer pauses between compressions. This finding is particularly relevant, as minimizing interruptions in CCs is a key determinant of high-quality CPR and patient survival; even brief interruptions can reduce overall CPR effectiveness [16]. Together, these findings provide further insight into the ongoing debate regarding whether to prioritize calling EMS or initiating CPR first [17]. Current International Liaison Committee on Resuscitation (ILCOR) recommends that EMS activation and CPR initiation should happen simultaneously whenever possible.

The qualitative findings revealed that participants experienced more intrinsic than extrinsic factors when performing CCs, both with and without dispatcher communication. A recent review showed that psychological barriers, such as reluctance or hesitation, are more prevalent in DA-CPR than physical barriers, such as bystanders' physical limitations [9]. This aligns with our findings, in which participants reported psychological and emotional responses, including stress, fear, and uncertainty. Notably, while some participants reported experiencing stress, while others perceived the task as mentally undemanding. This difference reflects inter-individual variation in how rescuers appraise the emotional and cognitive demands of DA-CPR. Performing CCs while simultaneously interacting with a dispatcher can be experienced either as stressful or as a straightforward procedural task, depending on the individual. As a result, rescuers may face significant acute mental stress when performing CPR [18]. Therefore, implementing debriefing sessions after both training exercises and real-life CPR events is crucial to mitigate the potential risk of post-traumatic stress disorder [19].

Performing CCs while speaking to the dispatcher represents a form of multitasking in which the rescuer must divide attention between answering questions and maintaining high-quality CPR. A recent study has shown that multitasking, such as simultaneously communicating with the dispatcher while performing CCs, leads to lower-quality CPR, as the rescuer's focus is split between providing information and maintaining the CPR [20]. Some evidence suggests that Generation Z nursing students may be more proficient at multitasking [21, 22]. However, multitasking skills vary among individuals and may not generalize to all older generations. Previous studies have shown that older adults often exhibit lower confidence and willingness to use smartphones in emergency situations, partly due to unfamiliarity with digital interfaces and lower perceived usefulness of such technologies [23, 24]. These differences highlight the importance of tailoring dispatcher-assisted CPR interventions and digital training tools to accommodate varying levels of technological familiarity across age groups. Our study suggests that, when possible, one rescuer should immediately begin performing CPR while a second person contacts EMS to provide necessary information. Although this sequence was not directly evaluated in our study, it represents a practical interpretation of our findings, given the challenges participants faced with multitasking. In real-life situations, once the call to EMS has been initiated, the phone can be placed on the ground near the victim, allowing the dispatcher to continue guiding the rescuer while another bystander retrieves an AED. However, this approach may present practical challenges. In many countries [24], AEDs are stored in locked cabinets, despite AHA recommendations that AEDs be clearly visible and readily accessible without locks [25]. This practice often requires the dispatcher to provide a code to unlock the cabinet, potentially causing delays in the emergency response.

High-quality CC requires significant physical exertion, and our results showed that rescuers frequently experienced pain, exhaustion, and fatigue. Owing to this physical strain, it is recommended that rescuers rotate every two minutes to maintain the effectiveness of CPR and ensure consistent CC quality [25]. Rotation may also help alleviate the perception that time passes slowly during CPR, as many participants reported that even one minute felt prolonged. Interestingly, while CPR is often a team-based activity, research shows that individuals spend approximately two-thirds of their waking hours in solitude [26]. This contrast highlights the psychological transition required when moving from solitary activities to high-stakes, teamwork-based emergencies. Our findings suggest that training should incorporate scenarios simulating this shift, allowing participants to practice rapid adaptation to time pressure, multitasking, and collaborative decision-making. Such approaches may enhance mental readiness and confidence, consistent with ERC 2025 guidelines thar emphasize teamwork and structured communication during resuscitation [27]. Previous research has demonstrated that effective leadership, mutual monitoring, and clear communication among team members significantly improve resuscitation performance [28]. Despite our participants having previous CPR training, they still expressed concerns and doubts about their performance. To address this gap, brief and frequent CPR training sessions should be implemented, perhaps through smartphone games [20] or CPR kiosks [29, 30] that are available around the clock. These methods can help regularly refresh CPR knowledge and skills.

Among the extrinsic factors affecting CCs' performance, participants frequently reported that long hair falling onto their faces was distracting during CCs. Therefore, ensuring hair is secured may help improve comfort and focus during CPR. Similarly, some participants noted that jewelry or wristwatches occasionally caused discomfort or impeded effective CCs. Adapting by removing or adjusting such accessories, when feasible, could help maintain comfort and performance during resuscitation. Although vibration-guided CPR devices worn on the wrist have shown benefits during hands-only CPR [31], it may be necessary to consider removing bulky wristwatches before performing CCs for comfort and optimal performance. Similar challenges occur when the rescuer is wearing items, such as goggles (especially sunglasses), snow gloves, and other gear. Serin and Caglar (2021) reported that protective masks, other than surgical masks, used as personal protective equipment, increase rescuer fatigue during CPR and negatively impact the quality of CCs. However, their use remains essential in certain situations [32].

Our research aligns with previous findings [33] that mobile smartphone-related issues can disrupt the DA-CPR process and create barriers to effective communication. Participants in our study experienced problems such as poor audio quality, low speaker volume, and forgetting to activate the speaker function. Similarly, Michiels *et al*. [34] (2021) reported that language comprehension difficulties or phone-related issues such as poor reception, unidentified speaker, or use of a landline can hinder DA-CPR communication. Among callers from Slovenia instructed to use speaker mode, a small percentage were unable to do so due to a lack of skills [35]. Steensberg *et al*. [24] (2017) reported that less than half of bystanders were unable to activate the speaker function. Given these challenges, adult BLS training should emphasize on proper mobile smartphone usage, including how to make hands-free emergency calls, with particular focus on training older adults. Birkenes *et al*. [36] (2013) found that more than fifty percent of older bystanders could activate the speaker function. Older individuals have expressed a willingness to learn how to recognize emergencies and use modern technology to contact EMS [37].

In our study, the dispatcher was identified as a key external factor influencing CPR performance. Dispatchers provided not only practical guidance but also emotional support, offering a sense of security to the rescuers. They played an essential role in encouraging and motivating the callers, particularly during moments of emotional distress, and were often instrumental in providing instructions on the correct speed and depth of CCs [38]. These findings are consistent with recent work highlighting the dyadic interaction between caller and dispatcher during DA-CPR, demonstrating how communication patterns influence both emotional regulation and CPR performance [23]. The presence of another person, even a dispatcher over the phone, was often mentioned as a key external factor positively influencing their ability to perform CPR. This aligns with the findings of Idland *et al*. [39], who reported that callers using video streaming felt that the dispatcher was "sort of in the room with me", emphasizing how real-time visual guidance can enhance perceived support and confidence during emergency calls. Similarly, recent findings by Imbriaco *et al*. [8] further highlight the crucial emotional dimension of DA-resuscitation, showing that dispatcher empathy and calm verbal tone can improve caller cooperation, reduce panic, and enhance the overall quality of bystander CPR performance. However, dispatchers were also perceived as a source of distraction. Participants reported increased physical and mental strain when communicating with dispatchers, particularly in terms of maintaining focus and high-quality CC simultaneously.

Future manikin studies should incorporate simulated dispatcher conversations with real dispatchers, as done in our study and others [20]. This approach provides learners with a realistic experience and offers valuable insights into the types of questions dispatchers need to include in their protocols. One study found that bystanders often feel they are being asked irrelevant questions, which they believe delays the arrival of EMS [34]. However, this perception is inaccurate. Dispatchers must follow a structured protocol to gather all essential information before effectively assisting the rescuer and victim. In practice, when a dispatcher receives a call from a bystander without a healthcare background, they adhere to established indexes [40–42]. Typically, if CCs are already being performed, the dispatcher may instruct the caller to reassess the victim's breathing, as this can help determine whether CPR is truly indicated. Studies show that among victims who received bystander CPR, a portion was later determined by EMS personnel not to be in cardiac arrest upon assessment [43]. For this reason, the AHA [25], the Netherlands Resuscitation Council [44], and the ERC guidelines from 2025 [3] prioritize calling EMS after checking the victim's responsiveness, then breathing assessment and initiation of CPR as instructed by the dispatcher. Importantly, the same adult BLS instructor also trains bystanders during BLS courses [45].

This study has several limitations. First, it was conducted as a simulated setting using a manikin in a controlled environment, which differs significantly from real-world CPR situations. The observed mean CC depth and rate slightly exceeded the current ERC 2025 guidelines for adult BLS [3]. This may be partly explained by manikin calibration, as the Resusci Anne QCPR Skill Guide manikin can slightly overestimate compression depth depending on its setup and placement on the floor. Additionally, participants, as primarily healthcare students, may have over-performed, consciously or unconsciously aiming to achieve what they perceived as "ideal" CPR quality during a supervised simulation. Such tendencies are common in simulation studies, where participants may exert greater effort than in real-life scenarios. In actual scenarios, factors such as background noise from traffic or bystanders can interfere with dispatcher-assisted communication. Furthermore, all participants had prior CPR training, which limits the generalizability of findings to untrained laypeople or the general population.

Although the one-minute CPR duration does not fully replicate a real-life OHCA situation and represents a limitation, it allowed us to focus on the effects of continuous dispatcher guidance without the confounding influence of physical fatigue. This controlled setting ensured that differences observed in CC quality were primarily attributable to the intervention itself rather than extraneous factors, thereby enabling a clearer understanding of the impact of dispatcher-assisted instructions. The fixed order of scenarios may have influenced participants' performance and emotional responses. All participants performed the EMS-call scenario first, followed by the scenario without a call. This order was chosen for standardization and to introduce the more complex task first, however, it may have introduced learning effects, fatigue, or emotional habituation. A further limitation is that both scenarios were performed in a fixed order, which may have introduced order-related biases such as learning, adaptation, or fatigue effects. Although the within-subject design reduces inter-individual variability, it does not eliminate the possibility that participants' performance in the second scenario was influenced by prior exposure to the first. The crossover design might have mitigated these effects and reduced participants' awareness of how the emergency call condition influenced their performance. Although participants had previously practiced CPR on a manikin, this practice did not include the full simulation scenario, and residual anxiety may still have affected performance. The presence of an assistant in the CC-only scenario may have introduced confounding factors, such as social support or reduced cognitive load, which could have influenced performance. Therefore, the results should be interpreted as associations rather than causal effects. Additionally, participants' recollections during the interviews may have been affected by recall bias, as they might remember the second scenario more clearly or confuse their feelings between the two conditions. Future studies should consider randomizing the order of scenarios to minimize these effects. Finally, the study focused exclusively on hands-only CPR; including rescue breaths in future research may yield different outcomes and provide a more comprehensive understanding of rescuer performance across diverse BLS procedures.

5. Conclusions

Our study highlights the complexity of performing CCs during DA-CPR in a simulated cardiac arrest scenario. Although it is ideal for CPR to begin immediately while another bystander contacts the EMS, our findings show that multitasking during resuscitation negatively impacts CC quality. Specifically, CC depth and total QCPR scores were significantly lower when participants performed compressions while communicating with the dispatcher, while CC rate showed no significant difference. Participants also demonstrated longer pauses and reduced chest recoil under dual-task conditions. In addition to physical exertion, psychological factors played an important role in influencing rescuer performance. Adequate training, especially in the use of smartphones and multitasking, as well as conducting debriefings after CPR, may help improve various outcomes. Finally, communication with the dispatcher is crucial for guidance but can also introduce distractions, suggesting the need for optimized protocols. These findings suggest that current DA-CPR protocols may need refinement to reduce cognitive overload and minimize interruptions caused by communication demands. Dispatcher instructions should therefore be optimized to support rescuers without compromising CC quality, especially during the critical first minutes of resuscitation. Future research should explore longer CPR durations, inclusion of rescue breaths, randomized study designs, and evaluation in more realistic OHCA settings to further validate these findings and improve the generalizability of results.

AVAILABILITY OF DATA AND MATERIALS

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

AUTHOR CONTRIBUTIONS

EDŠ—conceptualization, investigation, writing-original draft, methodology, writing-review & editing, formal analysis. NF—writing-original draft, methodology, writing-review & editing, formal analysis. JK—investigation, conceptualization, writing-review & editing, formal analysis. DS—conceptualization, review. All authors read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

In accordance with the internal standards of the Faculty of Health Sciences of the University of Ljubljana, the ethical appropriateness of the study was first assessed by the Chair of Public Health, who conducted a preliminary review to ensure compliance with ethical principles. As the study was an evaluation without the collection of personal or sensitive data, the Chair decided that approval from the National Medical Ethics Committee of the Republic of Slovenia was not required and written authorization from the Dean of the Faculty was sufficient. In accordance with this procedure, the study was authorized by the Dean (29 April 2024). This procedure reflects institutional practice for low-risk research that does not compromise the rights and integrity of participants. All participants were adults (≥18 years old) and provided written informed consent. Individuals who wished to withdraw from the study during training were free to do so at any time. Participants were assured of anonymity and the confidentiality of their data. Prior to performing the interviews, all subjects were informed about the objectives of the study, the voluntary nature of their participation, the data collection methods, the reason for recording the interviews, the role of the interviewer and the participants, as well as confidentiality and anonymity of the information. The present study was conducted in terms of the principles of the revised Declaration of Helsinki.

ACKNOWLEDGMENT

The authors would like to thank all participants who took part in the experiment for their cooperation and participation in the measurements.

FUNDING

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

CONFLICT OF INTEREST

Nino Fijačko is a member of the European Resuscitation Council Basic Life Support Science and Education Committee. Other authors declare that they have no conflict of interest.

REFERENCES

[1] Cummins RO, Ornato JP, Thies WH, Pepe PE. Improving survival from sudden cardiac arrest: the "chain of survival" concept. A statement for health professionals from the Advanced Cardiac Life Support Subcommittee and the Emergency Cardiac Care Committee, American Heart Association. Circulation. 1991; 83: 1832–1847.

[2] Semeraro F, Schnaubelt S, Olasveengen TM, Bignami EG, Böttiger BW, Fijačko N, *et al.*; ERC Systems Saving Lives Collaborator Group. European Resuscitation Council Guidelines 2025 System Saving Lives. Resuscitation. 2025; 215: 110821.

[3] Smyth MA, van Goor S, Hansen CM, Fijačko N, Nakagawa NK, Raffay V, *et al.*; ERC Adult Basic Life Support Collaborators. European Resuscitation Council Guidelines 2025 Adult Basic Life Support. Resuscitation. 2025; 215: 110771.

[4] Deakin CD. The chain of survival: not all links are equal. Resuscitation. 2018; 126: 80–82.

[5] Berg KM, Cheng A, Panchal AR, Topjian AA, Aziz K, Bhanji F, *et al.*; Adult Basic and Advanced Life Support, Pediatric Basic and Advanced Life Support, Neonatal Life Support, and Resuscitation Education Science Writing Groups. Part 7: Systems of Care: 2020 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Circulation. 2020; 142: S580–604.

[6] 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: 135–140.

[7] Wang J, Zhang H, Zhao Z, Wen K, Xu Y, Wang D, *et al*. Impact of dispatcher-assisted bystander cardiopulmonary resuscitation with out-of-hospital cardiac arrest: a systemic review and meta-analysis. Prehospital and Disaster Medicine. 2020; 35: 372–381.

[8] Imbriaco G, Galazzi A, Semeraro F, Ramacciati N. Experiences, challenges, and best practices of dispatcher-assisted cardiopulmonary resuscitation: a scoping review. Internal and Emergency Medicine. 2025; 20: 1869–1900.

[9] 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. Resuscitation Plus. 2022; 11: 100290.

[10] Park SO, Shin DH, Kim C, Lee YH. Commencing one-handed chest compressions while activating emergency medical system using a handheld mobile device in lone-rescuer basic life support: a randomised cross-over simulation study. Emergency Medicine Journal. 2022; 39: 357–362.

[11] Cheng A, Kessler D, Mackinnon R, Chang TP, Nadkarni VM, Hunt EA, *et al*. Reporting guidelines for health care simulation research: extensions to the CONSORT and STROBE statements. Advances in Simulation. 2016; 1: 25.

[12] 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. Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine. 2021; 29: 88.

[13] Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. International Journal for Quality in Health Care. 2007; 19: 349–357.

[14] Elo S, Kyngäs H. The qualitative content analysis process. Journal of Advanced Nursing. 2008; 62: 107–115.

[15] Laerdal. CPR scoring explained. 2015. Available at: https://laerdal.com/support/scoring/?srsltid=AfmBOorTQc9IYgxagtlJoy3xDAAIvlQyo7YOuRDLMlW1BX3nQomZPcQP/ (Accessed: 22 January 2026).

[16] Catalisano G, Milazzo M, Simone B, Campanella S, Romana Catalanotto F, Ippolito M, *et al*. Intentional interruptions during compression only CPR: a scoping review. Resuscitation Plus. 2024; 18: 100623.

[17] Olasveengen TM, Semeraro F, Ristagno G, Castren M, Handley A, Kuzovlev A, *et al*. European Resuscitation Council Guidelines 2021: basic life support. Resuscitation. 2021; 161: 98–114.

[18] Yaow CYL, Teoh SE, Lim WS, Wang RSQ, Han MX, Pek PP, *et al*. Prevalence of anxiety, depression, and post-traumatic stress disorder after cardiac arrest: a systematic review and meta-analysis. Resuscitation. 2022; 170: 82–91.

[19] Arriaga AF, Szyld D, Pian-Smith MCM. Real-time debriefing after critical events: exploring the gap between principle and reality. Anesthesiology Clinics. 2020; 38: 801–820.

[20] Fijačko N, Masterson Creber R, Metličar Š, Strnad M, Greif R, Štiglic G, *et al*. Effects of a serious smartphone game on nursing students' theoretical knowledge and practical skills in adult basic life support: randomized wait list–controlled trial. JMIR Serious Games. 2024; 12: e56037.

[21] Liu Y, Sun X, Zhang P, Han P, Shao H, Duan X, *et al*. Generation Z nursing students' online learning experiences during COVID-19 epidemic: a qualitative study. Heliyon. 2023; 9: e14755.

[22] Jiang J, Zeng L, Kue J, Li H, Shi Y, Chen C. Effective teaching behaviors in the emergency department: a qualitative study with Millennial nursing students in Shanghai. Nurse Education Today. 2018; 61: 220–224.

[23] Imbriaco G, Ramacciati N. Optimizing dispatcher-bystander dyadic collaboration in emergency medical communication to improve cardiac arrest response. Clinical and Experimental Emergency Medicine. 2024; 11: 233–237.

[24] Steensberg AT, Eriksen MM, Andersen LB, Hendriksen OM, Larsen HD, Laier GH, *et al*. Bystander capability to activate speaker function for continuous dispatcher assisted CPR in case of suspected cardiac arrest. Resuscitation. 2017; 115: 52–55.

[25] Panchal AR, Bartos JA, Cabañas JG, Donnino MW, Drennan IR, Hirsch KG, *et al*; Adult Basic and Advanced Life Support Writing Group. Part 3: adult basic and advanced life support: 2020 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Circulation. 2020; 142: S366–S468.

[26] Danvers AF, Efinger LD, Mehl MR, Helm PJ, Raison CL, Polsinelli AJ, *et al*. Loneliness and time alone in everyday life: a descriptive-exploratory study of subjective and objective social isolation. Journal of Research in Personality. 2023; 107: 104426.

[27] Nabecker S, de Raad T, Abelairas-Gomez C, Breckwoldt J, Chakroun-Walha O, Farquharson B, *et al.*; ERC Education for Resuscitation Collaborators. European Resuscitation Council Guidelines 2025 Education for Resuscitation. Resuscitation. 2025; 215: 110739.

[28] Farquharson B, Cortegiani A, Lauridsen KG, Yeung J, Greif R, Nabecker S; Education Implementation Team Task Force of the International Liaison Committee on Resuscitation ILCOR. Teaching team competencies within resuscitation training: a systematic review. Resuscitation Plus. 2024; 19: 100687.

[29] Chang MP, Gent LM, Sweet M, Potts J, Ahtone J, Idris AH. A novel

educational outreach approach to teach hands-only cardiopulmonary resuscitation to the public. Resuscitation. 2017; 116: 22–26.
[30] Ohle R, McIsaac SM. Impact of public CPR kiosks on bystander CPR rates in Northern Ontario. Resuscitation Plus. 2025; 27: 101150.
[31] Choi S, Han S, Chae MK, Lee YH. Effects of vibration-guided cardiopulmonary resuscitation with a smartwatch versus metronome guidance cardiopulmonary resuscitation during adult cardiac arrest: a randomized controlled simulation study. Australasian Emergency Care. 2021; 24: 302–307.
[32] Serin S, Caglar B. The effect of different personal protective equipment masks on health care workers' cardiopulmonary resuscitation performance during the COVID-19 pandemic. The Journal of Emergency Medicine. 2021; 60: 292–298.
[33] Case R, Cartledge S, Siedenburg J, Smith K, Straney L, Barger B, *et al*. Identifying barriers to the provision of bystander cardiopulmonary resuscitation (CPR) in high-risk regions: a qualitative review of emergency calls. Resuscitation. 2018; 129: 43–47.
[34] Michiels C, Clinckaert C, Wauters L, Dewolf P. Phone CPR and barriers affecting life-saving seconds. Acta Clinica Belgica. 2021; 76: 427–432.
[35] Metličar Š, Žula L, Fijačko N. One in ten emergency medical calls in Slovenia originate from different location. Resuscitation Plus. 2024; 20: 100766.
[36] Birkenes TS, Myklebust H, Kramer-Johansen J. Time delays and capability of elderly to activate speaker function for continuous telephone CPR. Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine. 2013; 21: 40.
[37] Dolenc E, Kolšek M, Slabe D, Eržen I. Tailoring first aid courses to older adults participants. Health Education & Behavior. 2022; 49: 697–707.
[38] Tuffley RH, Folke F, Ersbøll AK, Blomberg SNF, Linderoth G. Is dispatcher-assisted cardiopulmonary resuscitation affected by a bystander's emotional stress state in out-of-hospital cardiac arrest? Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine. 2023; 31: 82.
[39] Idland S, Häikiö K, Kramer-Johansen J, Hjortdahl M. "They were sort of in the room with me": a qualitative study about callers' experience of video streaming during medical emergency calls. Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine. 2025; 33: 5.
[40] Andersen MS, Johnsen SP, Sørensen JN, Jepsen SB, Hansen JB, Christensen EF. Implementing a nationwide criteria-based emergency medical dispatch system: a register-based follow-up study. Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine. 2013; 21: 53.
[41] Lexow K. The Norwegian medical dispatch system and the Norwegian index for emergency medical dispatch. Notfall + Rettungsmedizin. 2012; 15: 342–346.
[42] Torlén Wennlund K, Kurland L, Olanders K, Castrén M, Bohm K. A registry-based observational study comparing emergency calls assessed by emergency medical dispatchers with and without support by registered nurses. Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine. 2022; 30: 1.
[43] Haley KB, Lerner EB, Pirrallo RG, Croft H, Johnson A, Uihlein M. The frequency and consequences of cardiopulmonary resuscitation performed by bystanders on patients who are not in cardiac arrest. Prehospital Emergency Care. 2011; 15: 282–287.
[44] Bjørshol CA, Nordseth T, Kramer-Johansen J. Why the Norwegian 2021 guideline for basic life support are different. Resuscitation Plus. 2023; 14: 100392.
[45] Fijačko N, Masterson Creber R, Van Goor S, Strnad M, Greif R. Heterogeneity of teaching approaches to determine hand position for adult chest compressions among European basic life support instructors. Resuscitation. 2022; 180: 35–37.

How to cite this article: Slabe D, Košir J, Fijačko N, Dolenc Šparovec E. Effect of rescuer–dispatcher communication on chest compression quality during simulated cardiac arrest. Signa Vitae. 2026; 22(3): 129-139. doi: 10.22514/sv.2026.032.