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Smartglasses Versus Smartphones for Video-Assisted Dispatcher-Guided CPR in Simulated Paediatric Cardiac Arrest

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Highlights

What are the main findings?

- Video-assisted CPR using either smartglasses or smartphones significantly improved key components of paediatric CPR quality compared with conventional voice-only telephone assistance.
- Video-assistance doubled the number of effective ventilations and increased the proportion of chest compressions at correct depth, with no significant differences in time to CPR initiation.

What are the implications of the main findings?

- Real-time scene visualisation enhances dispatcher situational awareness, enabling more accurate feedback and guidance during paediatric cardiac arrest.
- Video-assisted dispatcher guidance appears feasible using widely available technologies and may improve the quality of paediatric CPR performed by lay bystanders in real-world settings

Abstract

Background/Objectives: Video-assisted CPR (V-CPR) improves the quality of CPR. Nevertheless, the available evidence has focused primarily on adult cardiac arrest scenarios and on compression-dominated resuscitation manoeuvres. In the paediatric setting, where ventilation is critical, the usefulness of V-CPR has scarcely been explored. We aimed to compare V-CPR using smartglasses and/or smartphones with each other and with voice-only assistance via smartphone in a simulated paediatric cardiac arrest. **Methods**: In this experimental pilot simulation study, thirty-four undergraduate sports science students without BLS training in the previous two years participated in a simulated cardiac arrest of an 8-year-old child, under dispatcher guidance. Participants received video-assistance using smartglasses (VA-SG), video-assistance using a smartphone (VA-Ph), or voice-only assistance (C). They performed 5 min of CPR (30:2 ratio). Assessments included CPR

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quality, response times, and CPR skills. **Results**: We showed that VA-Ph and VA-SG outperformed C in most outcomes. Significant differences were observed in the number of effective ventilations ($p = 0.010$) and chest compressions (CC) at correct depth ($p = 0.006$). Ventilation quality was 37.1 ± 32.9% in C, 70.1 ± 30.7% in VA-Ph, and 66.3 ± 28.9% in VA-SG ($p = 0.038$). CC quality reached 55.6 ± 28.0% in C, 74.0 ± 22.9% in VA-Ph, and 77.9 ± 16.6% in VA-SG ($p = 0.150$). Overall CPR quality was numerically higher in both video-assisted groups, although the difference was not statistically significant. V-CPR also improved correct CC hand placement ($p = 0.001$) and airway opening ($p = 0.036$). Response times did not differ significantly between groups. **Conclusions**: Video-assistance via smartglasses or smartphones improves key components of the quality of dispatcher-guided CPR during simulated paediatric cardiac arrest, doubling effective ventilations and improving the proportion of compressions at correct depth, with no significant differences in time to CPR initiation. Direct scene visualisation gives dispatchers better situational awareness, enabling more accurate, real-time guidance that could translate into higher-quality resuscitation and improved outcomes.

Keywords: paediatric emergency medicine; basic life support; telemedicine; airway management; smartglasses; laypeople

1. Introduction

Cardiopulmonary arrest in children remains a time-critical emergency in which early initiation of resuscitation is strongly associated with better survival [1,2]. Unlike adults, hypoxia is usually the initial mechanism of paediatric cardiac arrest, making ventilation a key factor for the return of spontaneous circulation [2,3].

Dispatcher teleassistance from an emergency call centre is a strategy aimed at improving the initial response time of bystanders as well as the quality of resuscitation measures until the arrival of emergency professionals [4]. However, conventional telephone-based teleassistance relies exclusively on verbal communication, which may limit the dispatcher's ability to accurately assess the victim's condition, identify technical difficulties, and guide bystanders through complex resuscitation manoeuvres such as airway opening and ventilations [5,6]. Recent advances in communication technologies have created the possibility for the dispatcher to directly visualise both the victim and the quality of the resuscitation manoeuvres, enabling video-assisted cardiopulmonary resuscitation (V-CPR). This modality offers a new opportunity to enhance situational awareness, improve communication between dispatchers and bystanders, and facilitate more accurate guidance during the critical early stages of resuscitation [7–10].

It is well established that V-CPR improves the quality of chest compressions, adherence to the BLS algorithm, and even survival [10–13]. Nevertheless, the available evidence has focused primarily on adult cardiac arrest scenarios and on compression-dominated resuscitation manoeuvres [14,15]. In the paediatric setting, where ventilation is critical, the usefulness of V-CPR has scarcely been explored [16]. Furthermore, little is known about whether different video communication modalities may influence the effectiveness of dispatcher assistance during paediatric resuscitation.

Based on the hypothesis that direct visualisation of the scene by the emergency dispatcher sharing the bystander's visual perspective contributes to improving the quality of initial paediatric life support (ventilations and chest compressions) performed by laypersons in a simulated paediatric cardiac arrest scenario, the aim of this study was to compare V-CPR using smartglasses and/or smartphones with each other and with conventional telephone assistance.

2. Methodology

2.1. Study Design

Experimental pilot simulation study of a paediatric cardiac arrest scenario with lay rescuers assisted by dispatchers under two V-CPR conditions: smartglasses (VA-SG) and smartphone (VA-Ph), compared with voice-only telephone assistance (C).

2.2. Participants and Ethical Aspects

Students from the Bachelor's Degree in Physical Activity and Sport Sciences at INEFC–Universitat de Barcelona were invited to participate in the study. The inclusion criterion was not having received any training related to BLS in the previous two years. Participants with visual or hearing impairments incompatible with video communication, or with physical limitations preventing them from performing CPR, were excluded.

This study followed the ethical principles of the Declaration of Helsinki and applicable international and local regulations. All participants signed informed consent prior to participation. The project was approved by the Bioethics Committee of the Universitat de Barcelona (reference number 00513-25).

2.3. Communication Between the Layperson and the Expert Emergency Dispatcher

Participants were allocated to one of the three dispatcher-rescuer communication conditions (Figure 1):

1. Video-assistance with smartglasses (VA-SG). Intervention group 1. Communication via video call using smart glasses (Blade 2, Vuzix, New York, NY, USA) and the Remote Eye app (Wideum, Barcelona, Spain), which were worn by the participant.
2. Video-assistance with smartphone (VA-Ph). Intervention group 2. Communications via video call with a smartphone (Samsung Galaxy S10 Lite, Samsung, Seoul, Republic of Korea) and the same app. The smartphone was mounted on a tripod to provide a frontal view of the rescuer, positioned 55 cm above and 65 cm from the chest compression point, according to expert consensus [17].
3. Voice-only assistance with smartphone (C). The control group was communicated through a conventional voice-only call using the same smartphone in speaker mode.

Data were collected in two sessions (n = 17 each), corresponding to the maximum number of volunteers available on each day. Before each session, the order of the three conditions was determined by drawing lots (session 1: VA-SG, VA-Ph, C; session 2: VA-Ph, VA-SG, C), and participants were allocated consecutively, in order of arrival, following this sequence in rotation. Participants were unaware of the existence of different conditions before the simulation. Each session was conducted by a different dispatcher.

2.4. Paediatric Cardiac Arrest Simulation

Each participant was presented with the following scenario:

"Imagine that you are alerted that this 8-year-old child shows no signs of life. You have assistance from an expert at the emergency call centre with whom you are communicating via X. They will guide you through everything you need to do to help the child until the ambulance arrives, which is already on its way. You should act as best as you can." (X depended on the assigned condition: video call using smartglasses, video call using a smartphone, or voice-only telephone assistance).

An expert emergency dispatcher guided the participants to perform 5 min cardiopulmonary resuscitation with 30:2 cycles, the compression-to-ventilation ratio recommended for rescuers not trained in paediatric basic life support [2], following a standardised instruction script based on the paediatric basic life support protocol, which was the same in the

three conditions; in the video-assisted conditions, dispatchers additionally corrected the rescuer's performance based on what they observed. Dispatchers were two experienced emergency nurses, blinded to the study purpose and trained in video-assisted CPR, with comparable professional experience in an emergency coordination centre and previous experience as dispatchers in video-assistance studies with smartglasses. "Resuscitation was performed on a Little Junior QCPR manikin (Laerdal Medical, Stavanger, Norway) connected to the QCPR app (Laerdal Medical, version 8.0.2)."

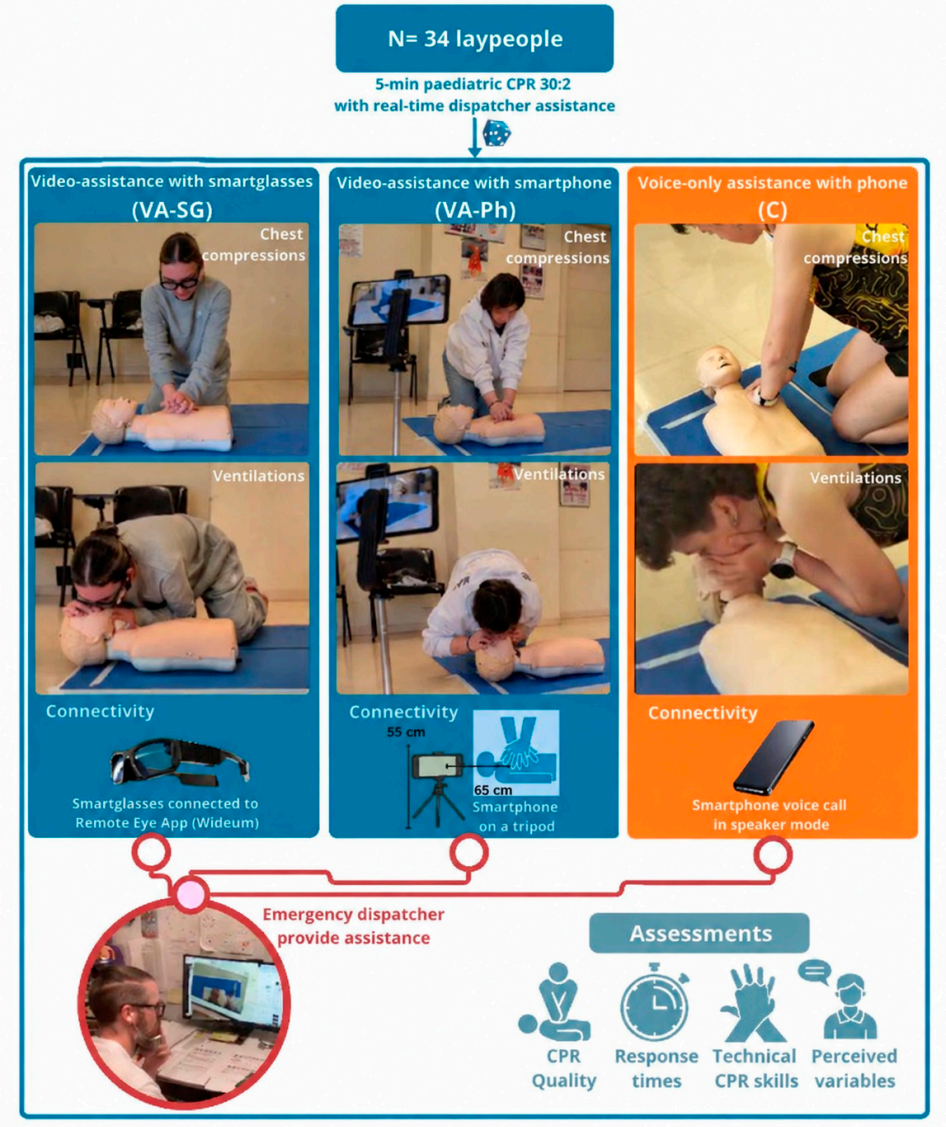


Figure 1. Flow chart design with three dispatcher communication conditions. Two video-assistance interventions: with smartglasses (VA-SG) and with a smartphone (VA-Ph), or voice-only assistance with a telephone (C).

2.5. Assessments and Variables

For each simulation, the following were evaluated: (A) Quality of CPR, (B) response times, (C) skills observations, (D) perceived variables, and (E) dispatcher opinion.

A. Quality of CPR was recorded and analysed automatically by the QCPR system. CPR quality criteria followed the 2025 ERC Paediatric Life Support guidelines [2], which recommend chest compressions of at least one third of the anteroposterior chest diameter, not exceeding 6 cm, at a rate of 100–120 min^{-1}, and rescue breaths of about

1 s producing visible chest rise. For the Little Junior QCPR manikin, the software operationalises these recommendations using the manufacturer's default ranges: compression depth 50–60 mm, compression rate 100–120 min^{-1}, and ventilation volume 100–240 mL. Participants and dispatchers had no access to the real-time feedback provided by the app. The variables were: Global Quality of CPR (%), Ventilation Quality (%), Number of Effective Ventilations (#), Chest Compression (CC) Quality (%), Mean Depth (mm), CC at Correct Depth (%), Reexpansion (%), Correct Rate (%), Average Rate (CC/min), CC Fraction (%), CC Time (s), Pause Time (s), Longest Time (s). This recording was performed continuously for 5 min.

B. Response times were measured from the start of the simulation to the first CC (s) and to the first ventilation (s). The scenario was already set up at the start (devices in place and video connection established), with the child in cardiorespiratory arrest, the absence of breathing already established and the instruction to initiate CPR.

C. Technical CPR skills were assessed during each simulation by a single researcher, with 15 years of experience in basic life support training, using a predefined observational checklist. Before data collection, the observer reviewed the operational definitions of each checklist item with the research team. Three dichotomous items (yes/no) were recorded according to the following criteria, based on the ERC guidelines [2]: correct CC location (hand(s) placed on the lower half of the sternum), correct airway opening (head tilt–chin lift manoeuvre performed before ventilation), and correct seal during ventilation (mouth-to-mouth ventilation with the nose pinched and no visible or audible air leak).

D. Perceived variables were assessed in each participant at the end of the simulation using a 5-point Likert scale (1 = lowest score, 5 = highest score) except for fatigue, which was assessed on a 0–10 scale. Participants were asked to rate the following items: perceived assistance ("To what extent do you think the assistance you received helped you?"), communication quality ("How would you rate the quality of the communication?"), comprehension ("To what extent did you understand the instructions provided?"), self-confidence ("How confident would you feel acting with this assistance in a real-life situation?"), ease of use ("To what extent did you find this communication method easy to use?"), and fatigue ("How fatigued do you feel?" assessed on a 0–10 scale).

E. Dispatcher opinion was assessed by asking about communication quality (1–5 scale) and the adequacy of visualisation to assist with mouth-to-mouth ventilation and CC (yes/no).

2.6. Statistical Analysis

Given the pilot nature of the study and the absence of a prespecified primary outcome variable for confirmatory hypothesis testing, the statistical analyses were considered exploratory.

Statistical analysis was performed using JASP (v.0.18.3.0). Variables are presented as mean (standard deviation) or absolute frequencies (relative frequencies). Normality was assessed using the Shapiro–Wilk test, and homoscedasticity using Levene's test, applying the Welch correction in case of non-compliance with homoscedasticity. For comparisons between groups, a one-way ANOVA with Bonferroni correction or the Kruskal–Wallis test (for non-parametric variables) was used. In cases with significant differences, post hoc tests with Bonferroni correction were performed. For the non-normally distributed variables with statistically significant differences in the overall test, post hoc comparisons were performed using Dunn's test with Bonferroni correction. Bonferroni correction was applied only to post hoc pairwise comparisons between groups within each outcome variable. For relevant pairwise comparisons, effect estimates and their corresponding 95% confidence intervals (CIs) were reported where applicable. No additional adjustment for multiplicity

across the different outcomes analysed was performed, given the exploratory nature of the study and the absence of a prespecified family of confirmatory hypotheses. The level of significance was set at $p < 0.05$. Effect size was calculated using eta squared (η^2) for continuous variables, following the thresholds defined for the test: trivial (<0.1), small (0.1–0.25), medium (0.25–0.37), and large (>0.37). Categorical variables were compared using the chi-square test, and effect sizes were calculated using Cramér's V.

3. Results

3.1. Participants

A total of 34 students (50% women) with a mean age of 21 ± 2 years, weight of 67.28 ± 11.02 kg, and height of 1.71 ± 0.10 m participated in the study.

3.2. Quality of CPR and Response Times

The results for CPR quality and response times are shown in Table 1. The mean (±SD) overall CPR quality was 49.1 ± 17.5% in C, 61.8 ± 22.4% in VA-Ph, and 67.9 ± 18.9% in VA-SG ($p = 0.098$). Chest compression (CC) quality was 55.6 ± 28.0% in C, 74.0 ± 22.9% in VA-Ph, and 77.9 ± 16.6% in VA-SG ($p = 0.150$), and ventilation quality was 37.1 ± 32.9% in C, 70.1 ± 30.7% in VA-Ph, and 66.3 ± 28.9% in VA-SG ($p = 0.038$).

Table 1. Quality of the cardiopulmonary resuscitation (CPR) and response times by condition. Two intervention conditions of video-assistance: with smartglasses (VA-SG) or smartphone (VA-Ph); or voice-only telephone assistance (C).

Variables	1: VA-SG N = 12	2: VA-Ph N = 12	3: C N = 10	*p* (ES)	Post-Hoc Conditions: p	IC95%
Quality of cardiopulmonary resuscitation (CPR)						
Global Quality CPR (%)	67.9 ± 18.9	61.8 ± 22.4	49.1 ± 17.5	0.098		
Ventilation Quality (%)	66.3 ± 28.9	70.1 ± 30.7	37.1 ± 32.9	0.038 (0.191)	(C)-(VA-Ph): 0.053 (C)-(VA-SG): 0.103 (VA-Ph)-(VA-SG): 1	(C)-(VA-Ph): −65.38/−0.59 (C)-(VA-SG): −61.55/3.25 (VA-Ph)-(VA-SG): −27.06/34.72
Number of Effective Ventilations (#)	14.0 ± 6.2	14.7 ± 6.5	6.7 ± 5.9	0.010 (0.257)	(C)-(VA-Ph): 0.016 (C)-(VA-SG): 0.030 (VA-Ph)-(VA-SG): 1	(C)-(VA-Ph): −14.51/−1.42 (C)-(VA-SG): −13.84/−0.76 (VA-Ph)-(VA-SG): −5.57–6.09
CC Quality (%)	77.9 ± 16.6	74.0 ± 22.9	55.6 ± 28.0	0.150 *		
Mean CC Depth (mm)	51.2 ± 7.5	51.4 ± 8.7	43.7 ± 5.5	0.036 (0.193)	(C)-(VA-Ph): 0.063 (C)-(VA-SG): 0.076 (VA-Ph)-(VA-SG): 1	(C)-(VA-Ph): −15.53/0.10 (C)-(VA-SG): −15.28/0.35 (VA-Ph)-(VA-SG): −7.20/7.70
CC at Correct Depth (%)	54.0 ± 28.2	60.3 ± 34.6	16.9 ± 31.8	0.006 * (0.274)	(C)-(VA-Ph): 0.008 (C)-(VA-SG): 0.029 (VA-Ph)-(VA-SG): 1	(C)-(VA-Ph): −76.77/−10.09 (C)-(VA-SG): −70.44/−3.76 (VA-Ph)-(VA-SG): −25.46/38.12

Table 1. *Cont.*

Variables	1: VA-SG N = 12	2: VA-Ph N = 12	3: C N = 10	*p* (ES)	Post-Hoc Conditions: p	IC95%
Reexpansion (%)	83.8 ± 30.3	85.4 ± 23.4	87.7 ± 16.8	0.995 *		
Correct CC Rate (%)	43.2 ± 20.9	56.3 ± 31.3	34.7 ± 34.3	0.226		
Average Rate (CC/min)	98.8 ± 6.0	103.6 ± 11.5	96.1 ± 10.5	0.191		
CC Fraction (%)	64.0 ± 4.7	60.4 ± 4.6	61.9 ± 2.9	0.128		
CC Time (s)	193.3 ± 13.8	179.9 ± 14.1	184.7 ± 8.8	0.045 (0.182)	(VA-Ph)-(VA-SG): 0.043	(VA-Ph)-(VA-SG): −26.16/−0.67
Pause Time (s)	108.1 ± 10.6	119.7 ± 13.8	114.8 ± 8.7	0.058		
Longest Pause (s)	31.3 ± 9.5	31.9 ± 12.0	32.5 ± 7.5	0.963		
Response times						
1st CC (s)	28.1 ± 5.8	32.3 ± 13.2	26.2 ± 5.2	0.560 *		
1st ventilation (s)	68.33 ± 7.43	74.58 ± 15.59	67.40 ± 10.53	0.350 *		

Data are presented as mean and standard deviation; 95% confidence intervals and *p*-values for pairwise comparisons were adjusted. Effect size (ES) was calculated using eta squared (η^2): trivial (<0.1), small (0.1–0.25), medium (0.25–0.37), and large (>0.37). *: Kruskal–Wallis Test. CC: chest compression.

In addition to ventilation quality, significant differences between conditions were found in the number of effective ventilations ($p = 0.010$), the percentage of CC at correct depth (0.006), and CC time ($p = 0.045$). Post hoc results generally showed advantages of VA-Ph and VA-SG compared with C. No statistically significant differences were found between conditions in the time to first CC or to first ventilation.

3.3. Technical CPR Skills Observed, Perceived Variables, and Dispatcher Opinion

The results of the technical CPR skills observed in the scenario, perceived variables, and dispatcher opinion are shown in Table 2. Regarding technical skills, statistically significant differences between conditions were found in correct chest compression (CC) location (C: 30.0%, VA-Ph: 91.7%, VA-SG: 91.7%, $p = 0.001$) and correct airway opening (C: 40.0%, VA-Ph: 91.7%, VA-SG: 66.7%, $p = 0.036$). For perceived variables, statistically significant differences were found only in communication quality ($p = 0.008$), which was lower in VA-Ph compared with VA-SG and C. Finally, according to the dispatcher's opinion, communication quality in VA-Ph was significantly lower than in VA-SG or C ($p < 0.001$), and with VA-Ph, the dispatcher was able to correctly visualise mouth-to-mouth ventilation in a greater number of participants than with VA-SG (Table 2).

Table 2. Technical CPR skills observed on scene during simulation, perceived variables, and dispatcher opinion by conditions: video-assistance with smartglasses (VA-SG), video-assistance with smartphone (VA-Ph), or voice-only telephone assistance (C). Subjective opinions in a 1–5 Likert score.

Variables	1: VA-SG N = 12	2: VA-Ph N = 12	3: C N = 10	*p* (ES)	Post-Hoc Conditions: p	IC95%
Technical CPR skills observed						
Correct CC location	11 (91.7%)	11 (91.7%)	3 (30.0%)	0.001 (0.637) ^		
Correct airway opening	8 (66.7%)	11 (91.7%)	4 (40.0%)	0.036 (0.443) ^		
Correct seal	5 (41.7%)	10 (83.3%)	5 (50.0%)	0.093		

Table 2. *Cont.*

Variables	1: VA-SG N = 12	2: VA-Ph N = 12	3: C N = 10	*p* (ES)	Post-Hoc Conditions: p	IC95%
Perceived variables						
Perceived help	4.5 ± 0.5	4.7 ± 0.5	4.9 ± 0.3	0.144 *		
Communication quality	4.9 ± 0.3	4.3 ± 0.7	4.9 ± 0.3	0.008 * (0.284)	(C)-(VA-Ph): 0.022 (VA-Ph)-(VA-SG): 0.017	(C)-(VA-Ph): 0.085/1.049 (VA-Ph)-(VA-SG): −1.043/−0.124
Comprehension	4.8 ± 0.5	4.7 ± 0.5	4.8 ± 0.4	0.777 *		
Self-confidence	4.0 ± 1.0	3.3 ± 1.0	3.9 ± 0.7	0.187 *		
Ease of use	4.5 ± 0.7	4.4 ± 0.5	4.9 ± 0.3	0.079 *		
Fatigue	4.3 ± 2.1	5.5 ± 1.8	4.2 ± 1.7	0.239		
Dispatcher opinion						
Dispatcher communication quality	3.6 ± 1.3	2.7 ± 1.6	5.0 ± 0	<0.001 * (0.357)	(C)-(VA-Ph): <0.001 (VA-Ph)-(VA-SG): 0.004	(C)-(VA-Ph): 0.887/3.13 (VA-Ph)-(VA-SG): 0.054/2.780
Vision mouth-to-mouth	3 (25.0%)	10 (83.3%)	-	0.004 (0.585) ^		
Vision CC	9 (75.0%)	11 (91.7%)	-	0.273 (0.224) ^		

Data are presented as mean ± standard deviation or n (percentage). Effect size (ES) was calculated using eta squared (η^2): trivial (<0.1), small (0.1–0.25), medium (0.25–0.37), and large (>0.37). *: Kruskal–Wallis Test. ^: Cramer's. CC: chest compressions.

4. Discussion

Telephone dispatcher assistance for laypeople has been established as a strategy to improve bystander activation of the chain of survival and thus improve victim outcomes [4]. However, its real-world results have not been as good as expected [18], highlighting the need to explore novel approaches that enhance the quality of remote guidance. Given the critical importance of timely intervention in paediatric cardiac arrest, strategies that strengthen communication between emergency medical dispatchers and bystanders may contribute to more effective delivery of resuscitation manoeuvres and better clinical outcomes for children. Therefore, other communication methods that could make remote guidance more effective in cases of witnessed cardiac arrest should be investigated.

Our study, conducted under controlled simulation conditions of a paediatric cardiac arrest scenario, provides findings that may help fill existing knowledge gaps: (1) with V-CPR, both using smartglasses and smartphones, better results were achieved in key CPR quality parameters compared with telephone-only voice assistance for both ventilations and chest compressions; (2) no significant differences in laypeople response times were observed with video assistance; and (3) the technical aspects of communication between the lay rescuer and the dispatcher using smartglasses and smartphones are simple, although communication quality was lower with the fixed smartphone.

In our scenario, when the emergency dispatcher was able to visualise the scene in real time, either through smartglasses or with the smartphone placed at a fixed position, the quality of CPR parameters was better than with voice-only instructions. To our knowledge, this is the first study to compare two different video communication modalities (smartglasses and a fixed smartphone) with voice-only assistance in paediatric CPR performed by lay bystanders, with a specific focus on ventilation, thus extending previous findings on smartphone-based video assistance in paediatric dispatcher-assisted CPR [16].

Visualisation of the scene allowed the dispatcher to guide the lay rescuer better, which was particularly evident in some of the monitored parameters. With V-CPR, the number of effective ventilations doubled compared with telephone assistance alone, an aspect that is especially important in paediatric basic life support given the relevance of hypoxia in paediatric cardiac arrest [19]. Although guidelines already recommend that the telephone dispatcher actively instruct ventilations during paediatric CPR [2,20], this type of telephone assistance alone has been associated with highly improbable rates of effective ventilations when the rescuer is a layperson, with previous studies reporting values around 10% effective ventilations [16,21]; in the present investigation, the values were somewhat higher but still low (37%). While these results represent an improvement compared with the absence of instructions, they remain far from the 70% arbitrary threshold used in the literature for CPR quality in simulation studies [22]. In this context, it is particularly noteworthy that participants in this study, despite having had no BLS training in the previous two years, achieved—with video assistance—ventilation quality levels close to this threshold (70% with a smartphone and 66% with smartglasses), comparable to the level usually expected in individuals trained in basic life support [23]. Our results suggest that V-CPR not only increases the number of ventilations but also enables laypeople to perform effective, high-quality ventilations, bringing their performance closer to that of trained rescuers, which could positively impact victim outcomes [16,24].

The improvement in ventilation quality with V-CPR may be explained by the fact that, unlike telephone assistance, where the dispatcher must infer what is happening based on often imprecise descriptions, real-time video allows recognition of the scenario, shared situational awareness, and immediate identification of critical errors (e.g., insufficient airway extension, inadequate seal, incorrect ventilation volumes, or excessively prolonged pauses between ventilations). In our study, both video-assistance modalities showed better airway opening (VA-Ph 92%, VA-SG 67%, C 40%), an essential step for effective ventilation. These findings are consistent with previous studies indicating that video assistance reduces reliance on verbal descriptions and that ventilation is particularly dependent on visual information, even more than chest compressions [25]. The possibility of observing the scene allows adaptation of both the approach and the content of instructions to the actual performance, with visual feedback enabling more specific, targeted, and understandable guidance based on what is observed (for example, instructions such as "tilt the head a bit further back—more, more"), rather than generic directions ("make sure the chin is lifted away from the chest by tilting the head back"). This likely contributed to the doubling of effective ventilations with V-CPR.

This same explanation applies to the quality of chest compressions. Consistent with previous evidence, V-CPR was associated with improved performance, particularly regarding compression depth and correct hand position. The proportion of compressions with adequate depth was clearly higher with video assistance (54% with smartglasses and 60% with a fixed smartphone camera) compared with the 17% observed with telephone assistance, reaching an overall CC quality of 78% with smartglasses and 74% with a fixed smartphone camera. This improvement may be related to the ability of video assistance to correct hand placement in real time, an aspect already highlighted in a meta-analysis showing a significant improvement in chest compression quality with V-CPR [10]. Accordingly, in our study, more than 90% of participants achieved correct hand position with video assistance, compared with 30% with telephone assistance, reinforcing existing evidence on the benefit of video assistance in compression-only CPR scenarios [14–16,26,27].

A potential drawback of video communication could be delays in the transmission of recommendations and in the initiation of basic life support manoeuvres [16,21]. This issue has been reported in real-world scenarios, emphasising that specific dispatcher training and

the use of structured protocols adapted to video assistance are key to avoiding unnecessary delays, including in paediatric protocols [28,29]. However, no significant differences in response times were observed in our study, where dispatchers had clinical experience in coordination centres and had previously participated in studies involving video assistance using smartglasses [7,8,30,31], which likely allowed them to effectively integrate visual information without negatively affecting response times.

In the VA-Ph group, lower auditory clarity was observed during the reception of instructions, probably because the smartphone microphone and speaker had to be placed farther from the rescuer to obtain an adequate camera viewpoint, which limited sound quality. In contrast, the smartphone provided a better lateral view of airway management thanks to a wider and more stable viewpoint compared with the subjective perspective of the smartglasses. However, these operational differences were not associated with significant differences in response times or overall CPR quality and therefore appear solvable through technical improvements in the devices or their configuration.

An essential aspect for the implementation of any technology is users' subjective perception of its usefulness. In our case, participants perceived video assistance, both with a fixed camera and with smartglasses, as easy to use, with understanding of instructions and perceived dispatcher support comparable to those of traditional telephone assistance. These results, derived from the evaluated perceptual variables, suggest that incorporating video would not represent a barrier for lay bystanders and reinforce the potential acceptability and feasibility of video-assisted CPR in clinical practice.

4.1. Implications for Practice

Our results, obtained under simulated and controlled conditions, suggest that video-assisted CPR may represent an important advancement in the prehospital management of paediatric cardiac arrest by enabling emergency medical dispatchers to improve the quality of critical manoeuvres—especially ventilations—with no significant differences in time to intervention. Its use appears simple and acceptable for laypersons, who are currently familiar with handling these types of devices (whether smartphones or smartglasses).

For the implementation of video-assisted CPR, it is essential to prioritise specific dispatcher training and the development of dedicated video-assistance protocols rather than focusing on the selection of a particular device. Overall, these findings support the progressive integration of V-CPR into emergency medical systems, aimed at improving CPR quality and potentially improving outcomes for paediatric patients experiencing out-of-hospital cardiac arrest, without increasing complexity for the lay bystander.

4.2. Limitations

This study has several limitations. It was conducted in a simulated environment, which does not fully reproduce the conditions of a real emergency (e.g., stress, noise, connectivity problems or device availability). It was performed under controlled conditions in which specific technical aspects of each video-assistance modality were not analysed in depth, and their performance could be affected in real-world environments. In addition, the smartphone was mounted on a tripod in an optimised position, which may not reflect real-world use. The intervention was conducted by a small number of dispatchers experienced in V-CPR; although this ensured methodological consistency, it limits generalisability and does not exclude the need for specific dispatcher training in real practice. Finally, the sample size was limited and homogeneous, so the results should be interpreted with caution. Additionally, the technical CPR skills were assessed through direct observation by a single researcher, and interobserver reliability was not formally evaluated. Therefore, some degree of observer-related measurement bias cannot be excluded.

5. Conclusions

In a simulated paediatric cardiac arrest scenario, video assistance delivered through smartglasses or smartphones improved key components of the quality of dispatcher-guided CPR, doubling the number of effective ventilations and improving the proportion of chest compressions at correct depth, with no significant differences in the time to initiation of resuscitation manoeuvres. These findings suggest that video communication may optimise remote assistance during paediatric cardiac arrest and support further evaluation in real-world clinical settings.

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Data Availability Statement: The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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Abbreviations

BLS: Basic Life Support; C: Voice-only telephone assistance (Control group); CC: Chest Compressions; CPR: Cardiopulmonary Resuscitation; V-CPR: Video-assisted Cardiopulmonary Resuscitation; VA-Ph: Video-assistance with Smartphone; VA-SG: Video-assistance with Smartglasses.

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