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# Digital Media in Medical Emergency Response Systems: Out-of-Hospital Cardiac Arrest (OHCA)

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**Abstract**

Out-of-hospital cardiac arrest (OHCA) ranks among the primary causes of unexpected death globally, with survival rates often below 10% unless prompt and effective intervention occurs. Contemporary approaches to managing OHCA increasingly incorporate digital technologies, including mobile apps, telemedicine, and drone systems for delivering automated external defibrillators (AEDs), which promise to enhance the survival chain. This scoping review aimed to survey the literature on digital media types applied in OHCA care, their advantages for patients, and existing research shortcomings, without evaluating study rigor. Adhering to PRISMA-ScR guidelines, it searched six databases PubMed/MEDLINE, Embase, Scopus, CINAHL, Web of Science, and Cochrane Library from 2020 through October 2025, yielding seven relevant articles from an initial 525. Identified technologies encompass video telemedicine, AED delivery via drones, apps like GoodSAM for alerting responders, and GIS for optimizing drone routes. These innovations improve emergency responses by shortening times and boosting survival odds. Recommendations include interdisciplinary collaborations to refine regulatory frameworks and develop hybrid systems combining drones, telemedicine, and apps for equitable OHCA management, ultimately aiming to elevate global survival rates beyond the current 10%.

**Keywords:** Digital Media, emergency response, emergency medical services, out of hospital cardiac arrest.

## 1. Introduction

Out-of-hospital cardiac arrest (OHCA) is one of the leading causes of sudden death worldwide, with low survival rates if not treated quickly and effectively. According to global data, OHCA affects millions of people each year, with emergency response time being a critical factor in improving survival rates (Burns, 2022). Based on reports from around the world, there are 350,000 to 700,000 cases per year, equivalent to an incidence of approximately 55 cases per 100,000 adult population (Berg et al., 2020). The global survival rate is relatively low, less than 10%, although it varies between regions, with higher rates in high-income countries (up to 30-50%) and lower rates in low-income countries (Fang et al., 2025). In Indonesia, data on the prevalence and incidence of OHCA remain limited and uncertain due to the lack of a comprehensive

national data-collection system. However, the prevalence of heart disease in general is estimated at around 1.5% of the total population (Muharram et al., 2024).

The main challenge in treating OHCA is closely related to delays in providing CPR to victims. Slow response times and low levels of bystander intervention are standard in first aid for OHCA patients. This situation can reduce the chances of survival to less than 10% (Carlson et al., 2022). Therefore, innovative resuscitation strategies are needed to improve survival rates in patients with OHCA. Innovative approaches to resuscitation have evolved from a historical emphasis on basic life support (BLS) to the integration of advanced care systems (Kapoor, 2024). These innovations include optimized emergency medical services (EMS) team composition, rapid transport protocols, and community engagement initiatives, as outlined in recent guidelines advocating for data-driven improvements in pre-hospital interventions (Pozzi, 2022). These innovations, combined with developments in post-resuscitation care such as targeted temperature management and neuroprotective strategies, represent a multifaceted evolution aimed at bridging the gap between past limitations and future achievable milestones in OHCA management.

Modern management of OHCA patients currently involves the use of various digital media. The use of digital media such as mobile applications, telemedicine, and drone-based systems for the distribution of automated external defibrillators (AEDs) has emerged as a potential innovation to strengthen the chain of survival in response to OHCA. This technology aims to reduce defibrillation time, increase bystander intervention, and optimize coordination between EMS and the community (Kern et al., 2025). Drone-based AED delivery systems can arrive at the scene faster than traditional ambulances, enabling early intervention and potentially increasing survival rates (Roberts et al., 2023). In addition, digital technologies such as mobile applications increase bystander intervention by activating volunteer responders through geolocation notifications, mobilizing trained individuals to perform effective bystander CPR, which has been shown to increase initial CPR rates by 2-3 times in communities that have adopted systems such as PulsePoint or GoodSAM (Ball et al., 2023).

The use of digital media in OHCA management is the latest innovation in the field of medical emergencies. However, this comes with challenges faced by every element involved. As explained in Zègre-Hemsey et al., (2024), weather and technical conditions are often obstacles to the delivery of AED-carrying drone units. Other challenges, such as limitations in information and communication technology (ICT) infrastructure in health services, particularly in Indonesia, have resulted in low levels of digital maturity, requiring more context-specific adaptation strategies to address the gap between developed and developing countries (Multazam et al., 2024). This rapid development has also led to variations in implementation, regulatory

challenges, and access inequalities in various regions (Xie, 2023). Given these conditions, a scoping review is needed to map the latest literature, identify innovation trends, and uncover research gaps. This research is expected to pave the way for the adaptation of healthcare services in utilizing digital media innovations in emergency response, particularly in OHCA management.

## 2. Method

The present scoping review followed the methodological structure proposed Arksey and O'Malley, (2005), supplemented by the scoping review recommendations from the Joanna Briggs Institute (JBI) (Peters et al., 2020), while the reporting complied with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) extension designed explicitly for scoping reviews (PRISMA-ScR). The PRISMA method is highly relevant for scoping review articles because the PRISMA-ScR extension ensures transparency, consistency, and quality in research reporting through checklist screening, thereby ensuring the reliability of research results (Page et al., 2022). The primary objective was to map the existing literature on the types of digital media used in OHCA management, the benefits for OHCA patients, and knowledge gaps without a formal assessment of study quality. The review question was formulated as: "What digital media are used in OHCA management and what are their benefits on emergency response system?" Inclusion criteria were developed using a modified PICOS framework: Population (OHCA patients); Intervention/Exposure (use of digital media); Outcome (impact on EMS response); and Study design (all types of empirical studies, including observational, qualitative, mixed, and case/serial reports, published in peer-reviewed journals). Exclusion criteria were articles in languages other than English and Indonesian, and those that could not be downloaded in full text. No geographical restrictions were applied, but only articles from 2020 to 2025 were included.

A comprehensive literature search was performed across six electronic databases: PubMed/MEDLINE, Embase, Scopus, CINAHL, Web of Science, and Cochrane Library, from 2020 to October 2025. The search strategy employed a combination of MeSH terms and free-text keywords, such as ("Digital Media") AND ("Out-of-Hospital Cardiac Arrest" OR "OHCA") AND ("Emergency Response" OR "EMS"). Boolean operators, truncation symbols (e.g., * for variants), and proximity operators were utilized to enhance sensitivity. The article selection process is explained in Figure 1 below.

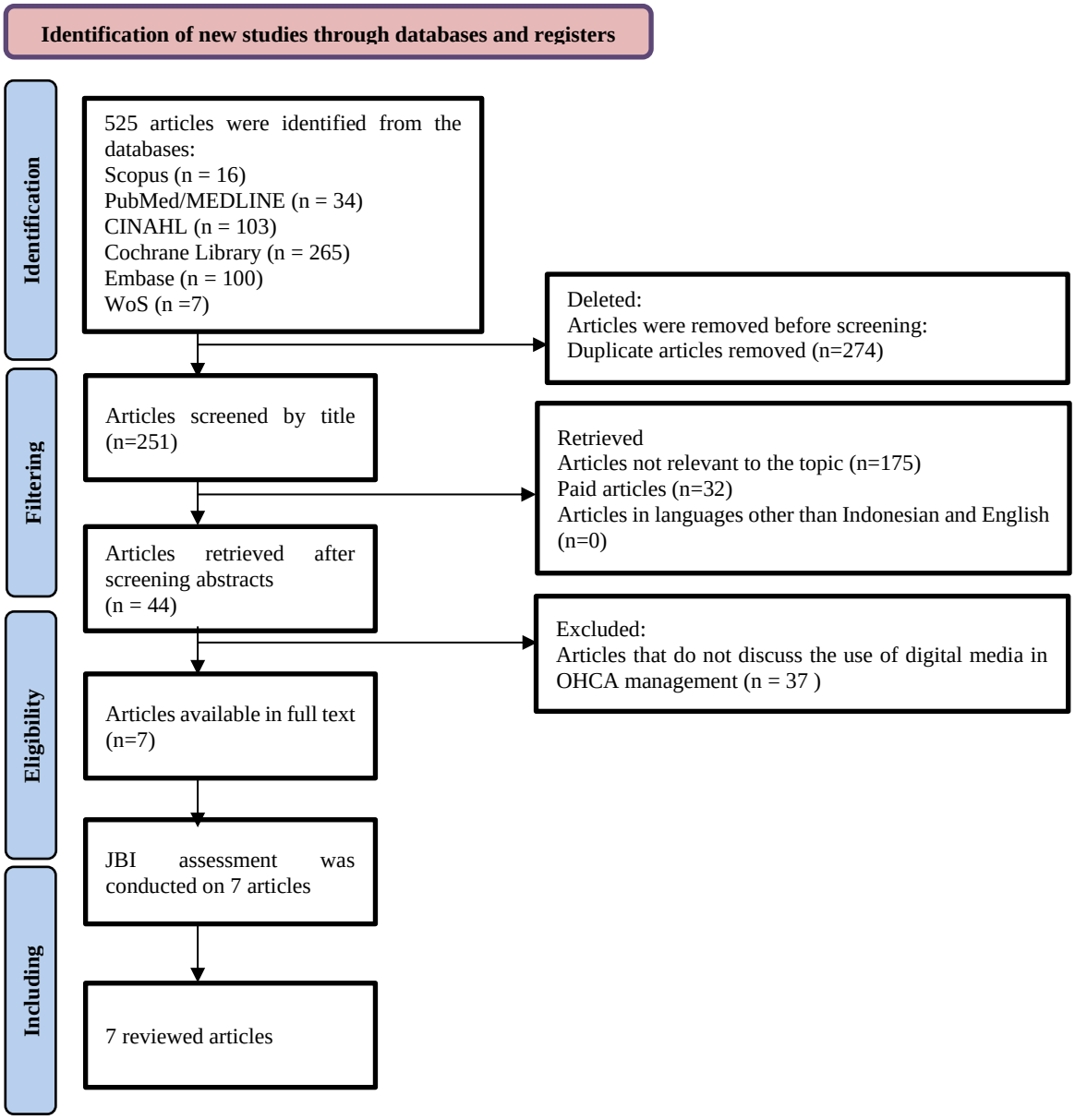


**Figure 1. Selection of articles included in the scoping review**

## 3. Results and Discussion

Based on the selection process using the PRISMA-ScR guidelines, 7 eligible articles were obtained from 525 articles found. The results of data extraction from the included articles are presented in Table 1.

**Table 1.Results of data extraction from the articles involved**

| No | Title | Author (Year) | Key Findings Related to Digital Media in OHCA Response |
|---|---|---|---|
| 1. | Could video assisted CPR improve treatment in complex cardiac | (Einvik et al., 2025) | Video-assisted CPR (V-CPR) enables a tailored approach to complex OHCA with high-quality continuous CPR, |

| No | Title | Author (Year) | Key Findings Related to Digital Media in OHCA Response |
|---|---|---|---|
| | arrest situations? – A case report | | without rescue breathing prior to EMS arrival, resulting in full neurological survival. |
| 2. | Challenges & barriers for real-time integration of drones in emergency cardiac care: Lessons from the United States, Sweden, & Canada | (Zègre-Hemsey et al., 2024) | AED drones promise to reduce response times by up to 10 minutes in rural areas, but challenges include aviation regulations, EMS integration, and weather variability; simulation studies show feasibility, but real-life evidence is limited. |
| 3. | No fear: Willingness of smartphone activated first responders to assist with cardiac arrest during the COVID-19 pandemic | (Ball et al., 2023) | The GoodSAM smartphone app maintained high responder readiness (>92%) to respond and provide CPR during the pandemic, with low COVID-19 fear (3.2% high level), although paramedics were less willing. |
| 4. | Telemedicine for the detection and management of in-hospital and out-of-hospital sudden cardiac arrest: Status quo and quo vadis | (Goyal et al., 2025) | Telemedicine, including wearable sensors, mobile applications, and AI, improves early detection, telecommunicator CPR, and post-resuscitation care; increases bystander CPR rates and survival, but is hampered by delays and infrastructure. |
| 5. | The use of drone-delivered Automated External Defibrillators in the emergency response for out-of-hospital cardiac arrest. A simulation study | (Smith, Powell, et al., 2025) | The AED drone was successfully delivered in the simulation with a flight time of 2:19 minutes, but there was a delay after arrival (4:35 minutes until shock) due to bystander interaction; real-time communication was effective, but bystanders had difficulty using the AED. |
| 6. | Semi-autonomous drone delivering automated external defibrillators during out-of-hospital cardiac arrest: A Danish feasibility study | (Jakobsen et al., 2025) | Semi-autonomous drones successfully delivered AEDs in 16 real OHCA cases without adverse events, with a median response time of 4:47 minutes; no AEDs were deployed due to rapid EMS arrival, emphasizing strategic placement. |
| 7. | National coverage of out-of-hospital cardiac arrests using automated external defibrillator-equipped drones — A geographical | (Schierbeck et al., 2021) | Geographical Information System (GIS) analysis shows that 61 drones in high-incidence areas cover 58.2% of OHCA with a time savings of 5:01 minutes; for 100% coverage, 2408 drones are needed, |

| No | Title | Author (Year) | Key Findings Related to Digital Media in OHCA Response |
|---|---|---|---|
| | information system analysis | | demonstrating the potential to improve the national response. |

Source: Processed data (2025)

Thematic mapping analysis of digital media used in OHCA management reveals several key themes. Video-based telemedicine, such as V-CPR for real-time resuscitation guidance, includes digital tools that provide direct assistance to bystanders, drone-delivered AEDs for automatic defibrillator delivery, smartphone applications such as GoodSAM to activate first responders, and GIS systems for drone location planning. These themes are interconnected through technological integration aimed at accelerating emergency response, with V-CPR and smartphone applications supporting bystander intervention, while drones and GIS address geographical challenges. The relationship between themes shows that these digital media not only improve AED accessibility but also require coordination with EMS, as seen in simulations where drones arrive faster than ambulances in rural areas. However, full integration is still limited by aviation regulations.

The impact of digital media use on emergency response systems raises the key themes of reduced response times and increased survival rates. This relates to AED drones potentially saving up to 5 minutes in OHCA hotspots, while telemedicine improves the quality of bystander CPR by up to 47% through telecommunicator guidance. However, negative themes such as regulatory barriers, weather, and connectivity issues reduce effectiveness, with 29% of drone cancellations due to weather and 27% due to technical issues. Mapping between themes highlights interconnections: positive impacts, such as OHCA coverage of up to 58% with 61 drones, depend on mitigating negative impacts, such as AI integration for more accurate heart rhythm prediction, thereby forming a more adaptive and inclusive emergency response system, especially in areas with slow EMS response times

### 3.1 Digital Media in OHCA Management and Its Impact

The scoping review highlights the transformative role of digital media in OHCA management. This is demonstrated through the drone-delivered AEDs, V-CPR, and smartphone applications for activating first responders. Studies demonstrate that drone systems, as analyzed in GIS models, can achieve national coverage of 58.2% of OHCAs with just 61 strategically placed drones, offering median time savings of over five minutes in high-incidence areas (Schierbeck et al., 2021). Feasibility trials in Denmark further confirm the safety of semi-autonomous drones for AED delivery in real OHCAs, with successful deployments in 33% of eligible cases and no adverse events. However, AED attachment was limited due to rapid EMS arrival (Jakobsen et al., 2025). Similarly, simulation studies in the UK demonstrate the effectiveness of

real-time communication during drone flights, with median hands-off CPR times of 2:32 minutes, underscoring the potential for drones to bridge geographical barriers in emergency response (Smith, Phillips, et al., 2025). Telemedicine, including wearable sensors and AI-driven platforms, enhances early detection and post-resuscitation care (Parizad et al., 2025). At the same time, V-CPR case reports illustrate improved treatment in complex scenarios by enabling tailored CPR without unnecessary interruptions (Einvik et al., 2025). Smartphone apps like GoodSAM maintain high responder willingness (>92%) even during pandemics, fostering community involvement in CPR (Ball et al., 2023).

Despite significant progress, implementation challenges remain. These include barriers to real-time drone deployment in the United States, Sweden, and Canada, including regulatory hurdles, weather-related cancellations (29%), and technical issues (27%), which limit wider adoption (Zègre-Hemsey et al., 2024). The positive impact on emergency response systems is significant, including reduced response times and increased bystander CPR rates through dispatcher guidance, potentially increasing survival rates by up to 47% in telemedicine-supported cases (Goyal et al., 2025). However, simulations show delays after drone arrival (e.g., 4:35 minutes until shock delivery) due to bystanders' lack of knowledge about AEDs, indicating a need for training and improved user interfaces (Jakobsen et al., 2025). Cross-country comparisons show that while drones excel in rural areas by arriving faster than ambulances, their efficiency in urban EMS settings often reduces their added value, highlighting the need for context-specific implementation (Grubic et al., 2023). Overall, digital media strengthens the chain of survival by optimizing coordination between EMS and communities. However, systemic barriers such as infrastructure limitations and data privacy concerns in telemedicine applications limit its full potential.

Key research gaps include the lack of large-scale prospective trials validating long-term clinical outcomes, such as neurological recovery after V-CPR or drone-integrated resuscitation, and the underexploitation of AI for predictive analytics across diverse settings (Einvik et al., 2025). Future studies should prioritize real-world integration in low-resource regions, where GIS-optimized drone deployments could maximize coverage, and address ethical issues such as responder safety during pandemics, as low fear levels (3.2%) suggest sustained engagement with proper support (Schierbeck, 2022). Recommendations include interdisciplinary collaborations to refine regulatory frameworks and develop hybrid systems combining drones, telemedicine, and apps for equitable OHCA management, ultimately aiming to elevate global survival rates beyond the current 10%. The limited database of accessible articles was one of the challenges in this research, so it could only present information based on what was available.

## 4. Conclusion

Digital media in OHCA management is currently a breakthrough that benefits patients. Real-time guidance tools such as V-CPR, telemedicine, smartphone applications, and even drones carrying AEDs are modern integrations that improve emergency response. New challenges accompany the positive impact this brings. Improving the quality of human resources and equalizing training opportunities can balance the development of technology in the pre-hospital emergency environment.

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