



# Addressing Challenges of Implementing Community First Responder Models Based on National and International Experiences: A Systematic Scoping Review

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## Abstract

**Background:** This systematic scoping review aimed to investigate and delineate the dimensions of the Community First Responder (CFR) model implemented in emergency medical services (EMS) across different countries. The primary focus was on identifying key components and characteristics associated with CFR programs.

**Methods:** This study conducted an extensive search across multiple databases (PubMed, Scopus, and Web of Science) and grey literature sources (Google Scholar, official sites) until Mar 2023 using keywords related to community first responders. Initially, 14,135 articles were found. After removing duplicates and similar titles, 37 articles were reviewed. The analysis covered training, motivation, public awareness, emotional support for responders, coordination with ambulance staff, program development, and the impact on patient outcomes.

**Results:** This review revealed key dimensions and components common to CFR models worldwide. Notable findings included insights into the significance of training, the motivating factors for individuals joining CFR groups, public awareness regarding the role of CFRs, the importance of emotional support for CFRs, effective coordination with ambulance staff, development requirements of CFR programs, and the consequential effects of plan implementation on patient outcomes.

**Conclusion:** This systematic scoping review offers valuable insights into CFR models worldwide, enhancing understanding of their effectiveness, challenges, and capabilities. Its recommendations can influence policy, guide future research, and strengthen CFRs' contributions to emergency medical services.

**Keywords:** Community first responder; Emergency medical services; Trained volunteers

## Introduction

Quick access to prehospital care and minimizing response time in emergencies are crucial for improving patient prognosis and treatment out-

comes (1, 2). Out-of-hospital cardiac arrest, a common time-sensitive emergency, accounts for a significant portion of coronary heart disease-



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related deaths (3, 4). Early initiation of cardiopulmonary resuscitation (CPR) is essential and significantly enhances survival rates; for each minute of delay, survival rates decrease by 10% (5). Initiation of CPR before the patient reaches emergency medical services (EMS) substantially increases the likelihood of survival (6, 7). Trauma events, responsible for around 6 million deaths and 40 million injuries yearly, are another time-sensitive emergencies (8, 9). Bleeding is often the leading cause of preventable death in trauma cases, with five minutes of bleeding can be lethal (10). However, by training citizens and providing supplies like gauze and tourniquets to control bleeding before emergency staff arrive, mortality rates can be significantly reduced (11). Therefore, to decrease response times in emergencies, EMS organizations are adopting various approaches (12). Global experience indicates that models like Community First Responders (CFRs) can effectively reduce response times (1, 13, 14). CFRs, comprising trained individuals in basic life support, voluntarily offer initial assistance at accident scenes near their residence or workplace before ambulances arrive (15). These professionals include those with clinical expertise, such as physicians and nurses, as well as police officers, firefighters, and trained civilians acting as CFRs voluntarily (16).

CFR models originated in the 1990s and exist in various regions like Australia, Europe, and the United States, featuring different deployment approaches where local volunteers are summoned by emergency dispatch centers for specific tasks (17-20). These models offer cost-effective advantages, allowing deployment in both advanced and underdeveloped EMS settings (20).

CFR models are often designed based on the unique needs and conditions of the respective communities, and one of the prerequisites for designing and implementing CFRs in any country is gaining a full understanding of the foundations and experiences of other countries in this regard (21). Therefore, the purpose of this scoping review was to extract and integrate the important dimensions of the existing CFR models, which include implementation strategies, as well as chal-

lenges and obstacles to the enhancement of these models.

## **Methods**

The present study was a systematic scoping review conducted based on PRISMA for scoping reviews (22).

### *Eligibility criteria*

Publications that addressed the design, implementation, evaluation or development of CFR models and used terms related to CFR models in the title, abstract, or keywords were included in this review. Review articles; articles published in languages other than English; and those whose full text was unavailable were excluded from our search.

### *Databases*

Reference databases, including PubMed, Web of Science, Scopus, and Google Scholar, were searched. In addition, reference books and reliable scientific websites in the field of EMSs, such as the *Yorkshire Ambulance Service NHS Trust* and *Community First Responders Australia*, were also searched to find resources related to our objective.

### *Search strategy*

Keywords and their synonyms were included in our search strategy. The following terms and keywords were searched. An example of the strategy used is provided in Scopus.

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(TITLE-ABS-KEY ("emergency responder*") OR TITLE-ABS-KEY ("lay responder*") OR TITLE-ABS-KEY ("the first person on the scene") OR TITLE-ABS-KEY ("community first responder*") OR TITLE-ABS-KEY ("community respon*") OR TITLE-ABS-KEY ("first respon*") OR TITLE-ABS-KEY ("first-respon*") OR TITLE-ABS-KEY ("medical first responder*") OR TITLE-ABS-KEY ("citizen first responder*") OR TITLE-ABS-KEY ("volunteer first responder*") OR TITLE-ABS-KEY
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("community") AND TITLE- ABS-KEY ("first") AND TITLE-ABS-KEY ("responder")

**Selection of studies and data extraction**

After completing the database search and removing duplicate articles, two researchers (AN and MS) independently screened the remaining titles

and abstracts. Any disagreements between the researchers were resolved with assistance from a third researcher (HR.KH) during the review of full-text articles. Data extraction followed a prepared checklist, focusing on study date, location, methodology, and key findings (Fig. 1).

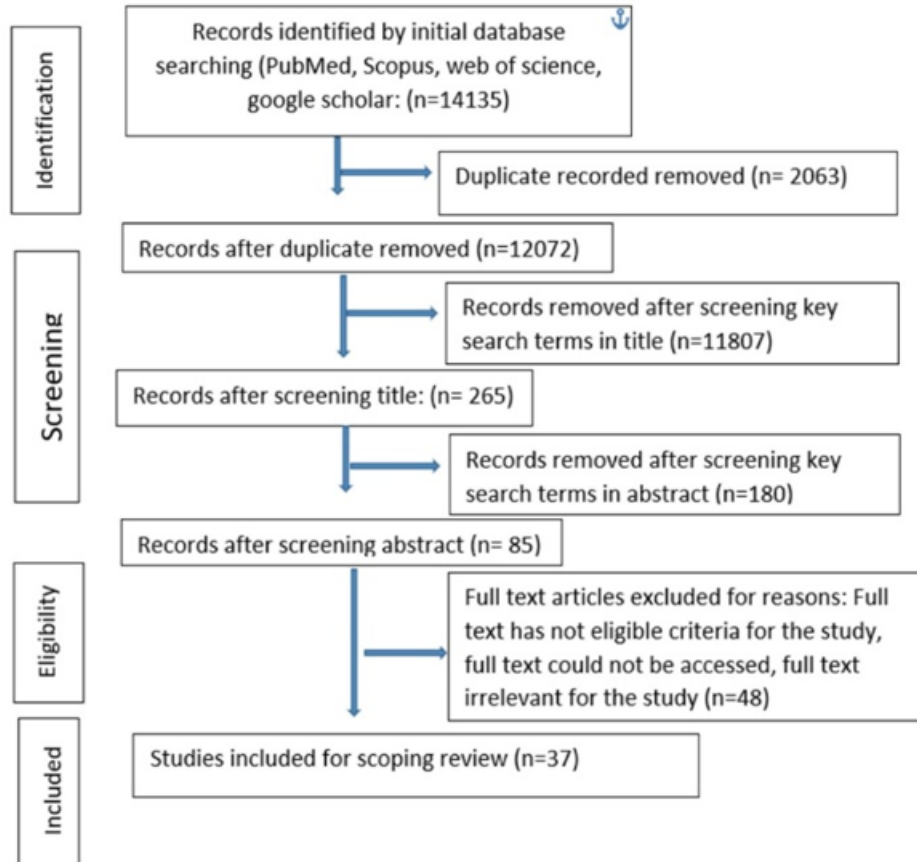


Fig. 1: Results of the PRISMA flow of the systematic scoping literature search

**Ethical approval**

This study is part of a Ph.D. dissertation approved by the Ethics Committee of the University of Social Welfare and Rehabilitation Sciences (USWR. REC.1402.043).

**Results**

Out of an initial pool of 14,135 documents, 2,063 duplicates were removed. The remaining 12,072

articles underwent title screening, resulting in the removal of 11,807 more. Abstract screening further narrowed down the selection to 265 articles. After excluding 180 irrelevant articles, 85 were chosen for full-text review. Ultimately, 37 articles met the criteria for data extraction and categorized in (Table 1) based on the author’s name, year of publication, country and a conclusion of the article.

**Table 1:** General characteristics of the studied articles

| <i>First author</i>     | <i>Year</i> | <i>Country</i> | <i>Methods</i> | <i>Conclusion</i>  |
|-------------------------|-------------|----------------|----------------|--|
| Högstedt et al. (23)    | 2022        | Sweden         | Quantitative   | The study finds that people join first responder systems primarily driven by an inner desire to help. Emphasizing this motivation over external rewards in recruitment campaigns is advised.   |
| Barry et al. (24)       | 2021        | Ireland        | Quantitative   | Ireland's merit 3 program showcased how volunteer doctors swiftly aid ohca patients, offering advanced interventions like end-of-life care. The success highlights the necessity for ongoing advancements and enhancements in this approach.   |
| Smith et al. (25)       | 2022        | England        | Quantitative   | The good sam volunteer first-responder system saw a notable increase in survival rates upon hospital discharge. Analyses considered multiple factors influencing cardiac arrest outcomes, yet uncertainties exist about this finding.  |
| Stieglis et al. (26)    | 2022        | Holland        | Quantitative   | Implementing volunteer responders accessing aeds via text messages led to notable improvements: quicker defibrillation, more bystander cpr, and higher survival rates for ohca patients in vf-detected households.   |
| Ming et al. (27)        | 2021        | Singapore      | Quantitative   | The responder mobile app improves community response to ohca by encouraging bystander cpr and aed use. Future goals include increasing active responders, enhancing response rates, improving app performance, and refining data collection for quality enhancement.   |
| Andelius et al. (28)    | 2020        | Denmark        | Quantitative   | When citizen responders dispatched via the app arrived before the ems, it was linked to higher chances of bystander cpr and over a threefold increase in the likelihood of bystander defibrillation.   |
| Auricchio et al. (29)   | 2019        | Swiss          | Quantitative   | Sending lfrs (lay first responders) directly to the scene of ohca without prior aed retrieval significantly reduces the time taken to initiate cpr. Further research is required to evaluate the potential impact on survival and neurological outcomes in terms of prognosis.   |
| Sarkisian et al. (30)   | 2019        | Denmark        | Quantitative   | Using a smartphone gps-tracking system for vfr (volunteer first responders) dispatch results in vfrs arriving at the scene before ems in over 80% of cases, with quicker response times. Additionally, the 30-day survival rate for ohca patients in rural areas surpasses expectations.   |
| Stroop et al. (14)      | 2019        | Germany        | Quantitative   | Simultaneously alerting cpr-trained volunteers and professional ems teams nearby reduces response times and minimizes the duration without resuscitation efforts. This approach can also improve hospital discharge rates and neurological outcomes after ohca.  |
| Berglund et al. (31)    | 2018        | Sweden         | Quantitative   | A mobile app can alert cpr-trained individuals about ohca, aiming to improve defibrillation response times before ems arrival, highlighting the necessity for further improvements in this aspect.   |
| Yafe et al. (32)        | 2018        | Israel         | Quantitative   | Using vfrs is particularly advantageous in rural and isolated regions worldwide. Although our study concentrated on mass casualty incidents (mcis), it's crucial to underscore their importance for regular emergency medical responses too.   |
| Barry et al. (33)       | 2018        | Ireland        | Quantitative   | Cfrs (community first responders ) can greatly improve ohca survival rates in ireland. It's crucial to prioritize scientific research exploring cfr involvement procedures, experiences, and outcomes in ohca resuscitation.   |
| Caputo et al. (34)      | 2017        | Swiss          | Quantitative   | Utilizing a mobile app system to recruit first responders, particularly laypeople, during ohca incidents is highly effective. It notably decreases response times and accelerates cpr initiation compared to sms-based systems.  |
| Barry et al. (35)       | 2017        | Ireland        | Quantitative   | Text alerts to nearby gps for ohca incidents were feasible, showing significant activity during setup. However, the survival rate remains low, similar to the national average. Many alerts do not involve situations suitable for resuscitation.  |
| Hendrickson et al. (36) | 2016        | Denmark        | Quantitative   | The first aed solution has significantly reduced response times, with over 60% of first responders arriving on-site within five minutes. In 96% of cases, multiple individuals are available to assist. Cfrs also receive peer support and feedback.   |
| Pijles et al. (37)      | 2016        | Netherland     | Quantitative   | The tm (text message)-alert system significantly boosts ohca survival rates, with around 90% of survivors returning home after hospital discharge. Increased citizen rescuer numbers and accessibility are expected to further enhance survival rates.   |
| Brooks et al. (38)      | 2016        | Usa            | Quantitative   | Pulse point respond encounters technical notification issues (sound volume, location accuracy), large activation areas, low community engagement, and imperfect alert accuracy.  |
| Seligman et al. (39)    | 2016        | England        | Quantitative   | Implemented a program providing medical students with hands-on prehospital care experience in a well-organized environment. This ensures quick responses to critical incidents like cardiac arrests, especially in rural regions and during peak demand periods, benefiting both patients and ambulance services. Additionally, the program greatly assists medical students in preparing for hospital duties. |

Table 1: Continued ...

|                        |      |             |              |   |
|------------------------|------|-------------|--------------|---|
| Hansen et al. (40)     | 2015 | usa         | Quantitative | After statewide measures in north carolina, more ohca patients received bystander cpr and first responder defibrillation, leading to higher survival rates. Bystander cpr was also associated with better neurological outcomes.  |
| Ringh et al. (41)      | 2015 | Sweden      | Quantitative | A mobile-phone-based positioning system used to send trained lay volunteers for cpr was linked to a substantial rise in the occurrence of bystander-initiated cpr for individuals experiencing out-of-hospital cardiac arrest.  |
| Hansen et al. (42)     | 2015 | Usa         | Quantitative | Prompt defibrillation within 5 minutes relied on bystanders and first responders, significantly boosting survival rates. Increasing both bystander and first-responder defibrillation is vital for improving ohca outcomes.   |
| Kindness et al. (15)   | 2014 | Scotland    | Quantitative | The study's conclusion provides insights into cfr challenges, informing ambulance services' strategies to mitigate stressors. These findings shape a new educational program in scotland for cfrs, aiming to enhance support and improve well-being for both patients and providers.  |
| Dennis et al. (43)     | 2013 | England     | Quantitative | The paper outlined stress factors for cfrs and classified emotional support statements. It suggests a study where participants will generate emotional support phrases based on these validated statements. The goal is to create an algorithm for an eca (emotional chat assistant) aiding cfrs during stress, focusing on person-centeredness and emotional well-being. |
| Toyokuni et al. (20)   | 2013 | Japan       | Quantitative | By educating the community about the cfr system and putting in place necessary infrastructure, japan successfully implemented and operated an effective cfr system.   |
| Ringh et al. (44)      | 2011 | Sweden      | Quantitative | In urban environments, mobile positioning systems can be employed to locate and engage nearby cpr-trained individuals when there is a suspected ohca situation, ensuring that bystander cpr is initiated before the ambulance arrives.  |
| Patel et al. (45)      | 2023 | England     | Qualitative  | To improve public safety and offer clearer guidance for cfrs in prehospital care in england, the research suggests enhancing collaboration between nhs trusts. This involves trusts working together to assess the cfr role and establish unified policies and approaches.  |
| Kallestedt et al. (46) | 2022 | Sweden      | Qualitative  | Cfrs were eager to assist but felt unprepared for emotional responses during emergencies. Enhanced system support and additional training could improve their effectiveness in managing challenging situations.   |
| Barry et al. (3)       | 2020 | Ireland     | Qualitative  | Gps volunteer to provide early ohca emergency care because of their relationship to the community. Care provided is complex and includes both resuscitation and end-of-life care.   |
| Barry et al. (47)      | 2019 | Ireland     | Qualitative  | This research suggests that the structures that underpin cfr are sophisticated, and the care provided is complex. This is a striking finding in the context of a voluntary and community enterprise.  |
| Phung et al. (48)      | 2018 | England     | Qualitative  | This study provides insights into cfr experiences, informing ways to better support the role. Given the voluntary nature and localized focus of cfr schemes, decisions about training, priorities, and goals should be made at the local level.   |
| Oscan et al. (49)      | 2017 | Usa         | Qualitative  | Additional barriers impacting responder involvement in targeted cardiac arrest response programs, extending understanding beyond previously known factors. These barriers, categorized into commitment, notification, leave, and performance, offer a framework for designing and addressing barriers in responder programs and similar crowdsource initiatives.          |
| Timmons et al. (50)    | 2015 | England     | Qualitative  | Altruism drove volunteering, alongside motivations like social interaction, skill improvement, and career advancement. While cfr groups are financially independent, ensuring their long-term sustainability warrants further investigation.  |
| O'meara et al. (51)    | 2012 | Australia   | Qualitative  | The necessity of volunteer ambulance systems in locations unsuitable for paid staff. It stresses the importance of modernizing perceptions of volunteers' roles and promoting successful integration with paid staff by understanding the community context.  |
| Zsifkovits et al. (52) | 2012 | Australia   | Qualitative  | Frics (first responder information and communication software) for improving first responder systems through advanced technologies, providing optimized communication and navigation integration. However, its implementation necessitates transitioning coordination from local to national levels.  |
| Oving et al. (53)      | 2019 | Netherlands | Mixed-method | Regional policy differences in first responder (fr) systems, impacting survival rates. While a standardized fr system across europe may be unlikely due to local circumstances, comprehending frs' role in the chain of survival is essential in ohca research.   |
| Campbell et al. (1)    | 2016 | England     | Mixed-method | The role of first responders in fostering community, particularly in rural areas where volunteerism defies expectations despite widespread participation.   |
| Roberts et al. (2)     | 2014 | Scotland    | Mixed-method | The intricate role of cfrs, acknowledging the challenges of balancing community expectations with professional standards. It stresses the importance of support and organization within cfr schemes and expresses optimism for their enhanced effectiveness as they become more accepted within communities and healthcare teams.   |



These included 25 quantitative, 9 qualitative, and 3 mixed-methods studies. Geographically, 29 articles were from Europe, 4 from America, 3 from

Asia, and 2 from Australia. Most studies were conducted in high-income countries (Fig. 2).

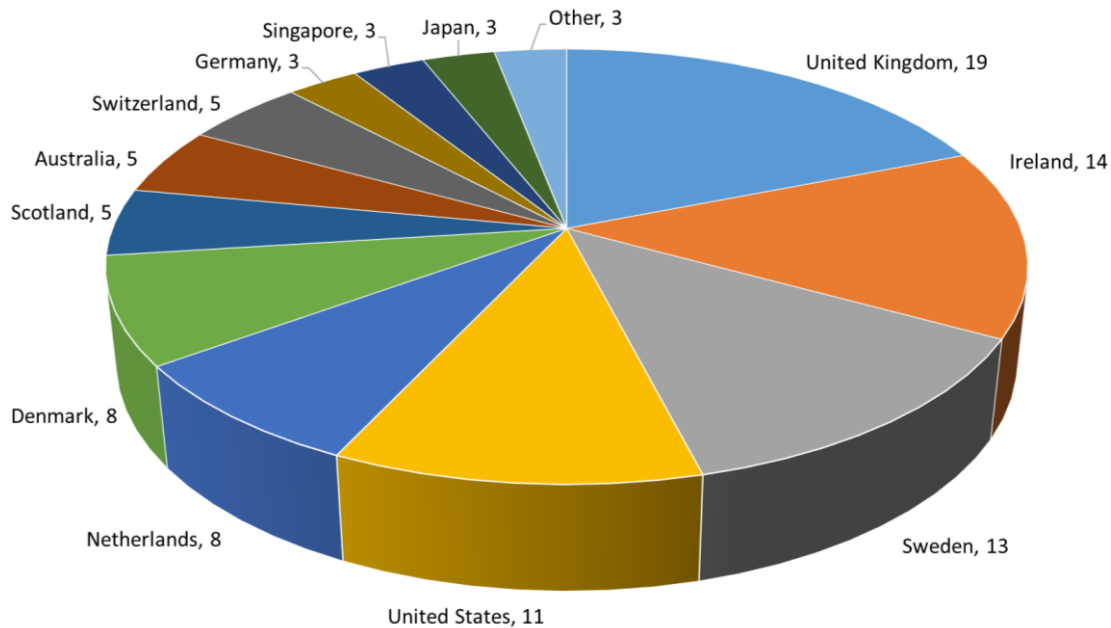


Fig. 2: Distribution of models by country

The research team used a narrative approach to summarize key findings from selected articles on the CFR model. They highlighted education, volunteer motivation, CFR perceptions and experiences, public awareness, communication with ambulance staff, call handling, participant eligibility, promotion strategies, and impact on arrival time and patient outcomes.

### Education

Related studies highlight the importance of CPR and basic life-saving training, emphasizing periodic retraining (1, 12, 33, 41, 53). Some models also include basic prehospital care (39), typically delivered through lectures and practical sessions (46). Preferences for scenario-based or communication-focused training vary among CFRs (48).

### Motivation to volunteer

Reviewed studies indicate diverse motives for joining CFR groups, with intrinsic values like altruism and the desire to help others being key factors (2, 3, 23, 43, 47, 48, 50). Personal experiences with emergencies involving relatives also motivate participation (2, 23, 47), along with flexibility and independence in scheduling (50). Some view CFR involvement as a pathway to future employment opportunities (2, 39).

### Perceptions and experiences of being a CFR

CFRs encounter emotionally challenging situations and ethical dilemmas (46, 48). Some reported doubts about this role (48), with some expressing doubts but many finding value in the experience and educational opportunities (2). Medical students acting as CFRs find the experience valuable for learning hospital patient care skills and desire information on patient outcomes

(15) and the possibility of detailed and operational reports about their activities (43).

### ***Public awareness about CFRs***

Public awareness of CFR roles is limited, leading to confusion between CFRs and EMS workers (2, 43, 48). Clarity in defining CFR roles is essential to address concerns about the substitution of ambulance staff (54). Close cooperation between CFRs, stakeholders, and the community is necessary to enhance understanding (2, 50).

### ***Communication and interaction between CFRs and the ambulance staff***

The understanding of communication and interaction between CFRs and ambulance staff is vague (34), possibly due to role confusion (54), which can be partly caused by confusion about the allocation of roles and responsibilities between EMSs and CFR models (15). The emergency services of CFRs were at times neglected by the ambulance staff (15).

### ***Calling CFRs***

Calling CFRs by the dispatch center enhances coordination with ambulance staff (55) and ensures scene safety (1). In some missions, the CFRs described inadequate information as stressful (56), and this stress was reduced by contacting the dispatch center and obtaining additional information. This led to the CFRs' sense of gratitude and satisfaction toward the dispatch center (21).

### ***Variety of calls***

In most models, CFRs are called primarily for cardiac arrest (14, 20, 23-27, 29-31, 33-35, 37, 38, 40, 41, 44). However, they also provide emergency services in limited models for other emergencies, such as trauma, mass casualty incidents, and respiratory problems (1, 15, 36, 52, 42). In cases where the clients were under 8 yr of age or suffered from cardiac arrest following trauma (26, 31, 39) or cardiac arrest occurring in residential areas, CFRs were not sent to protect the privacy of the clients (38).

### ***Eligibility of participants***

CFRs were selected from among citizens trained in cardiopulmonary resuscitation and basic life skills (20, 23, 25-27, 29-31, 33, 37, 38, 40, 41, 44). According to some models, general practitioners and nurses (24, 35, 36) and others, medical students work as CFRs (1, 39). Additionally, in certain models, paramedics (52, 42) and people with a medical background were used as CFRs (14).

### ***Requirements of and suggestions for the promotion and sustainability of the model***

Measures such as providing funds, creating a suitable call system (20), supporting CFRs, and raising awareness about their services were important requirements for maintaining the CFR model (45, 48). Additionally, the establishment of performance feedback systems for CFRs, effective training (46), and efficient recruitment and retention strategies have been highlighted (50). Involving volunteers in decision-making and integrating them into organizational structure and processes enhances model success (51).

### ***Arrival time and patient outcomes***

In most studies, CFRs arrived earlier than ambulance staff (1, 2, 14, 20, 24, 26-28, 30, 32, 34, 36, 44). One study reported a 14% decrease in resuscitations not performed before ambulance arrival after CFR implementation (26). Another study showed increased admissions to resuscitation facilities from 1.07% to 2.91% and nearly threefold defibrillation with CFR presence (28). Researchers found survival rates increased from 7.3% to 11% in Ireland and from 26% to 39% in the Netherlands after CFR implementation (24, 26). Stroop reported favorable neurological outcomes in 11% of patients resuscitated by CFRs compared to 4% by ambulance staff. In North Carolina, survival rates with favorable neurological outcomes increased from 7.1% in 2010 to 9.7% in 2013 after CFR implementation (14, 40).

## Discussion

This scoping review offers a thorough insight into CFR models and their diverse roles in patient care. It emphasizes the significance of ongoing education, varied volunteer motivations, educational experiences, and enhancing public awareness. Additionally, it underscores the vital impact of CFRs' actions on patient outcomes, with education being a key aspect for many CFRs to feel their role's importance through continuous training (48). Education should cover patient care, safety, confidentiality, communication skills, and emotional management (2, 15, 18, 48, 56). Motivations for joining CFR groups vary based on cultural, political, religious, and social contexts, potentially differing from this review's findings (58). CFRs are recruited from diverse volunteer pools, including off-duty medical staff, police, firefighters, and community members. Recruiting poses challenges, like financial constraints requiring medical staff to work extra shifts, potentially limiting their participation in CFR programs (59). In some countries, the absence of protective laws like the Good Samaritan law may deter individuals from joining CFR groups due to legal worries (60). Informing people about CFR models can involve showcasing how these emergency services save lives in diverse situations (2). Moreover, many volunteers anticipate recognition for their assistance and services, impacting their ongoing commitment as CFRs (18). Regular meetings and brainstorming sessions for volunteers can boost their involvement in CFR groups (61). In fact, in such groups, there is greater cohesion and stronger motivation among group members (50).

In established models, calling CFRs via GPS-based smartphone apps is common, relying on high smartphone penetration and reliable, high-speed internet. However, the selection of calling systems should align with each society's infrastructure due to varying smartphone penetration and telecom setups (62). The debate over utilizing laypeople as CFRs necessitates careful consideration of the cost–benefit balance. While a

wide network of trained laypeople offers advantages, potential drawbacks must be weighed due to variations in service quality compared to professionals (63, 64). Initially focused on out-of-hospital cardiac arrest, many reviewed models expanded volunteers' roles over time to include additional missions like trauma response (18). When designing CFR models, it's essential to consider various emergency scenarios and provide appropriate equipment accordingly (65, 66). While some CFR models involve calling CFRs for children's emergencies, it's less common in most models (7). Although CFRs perceive caring for children as more challenging than for adults, their initial resuscitation efforts may be more advantageous for children than for adults (56). Considerations regarding patient privacy (67) and the need for same-sex caregivers in certain religious contexts should be factored into CFR model design (68). Funding for CFR models was mostly provided by collecting financial aid or receiving government funding (47). Some CFR models are integrated into official EMS structures, while others are supplementary or serve as substitutes (53, 61). In summary, global CFR models vary in technology, education, funding, and call methods (53). Even within a country, diverse models exist (18, 53), which can occasionally impact effectiveness, safety, and volunteer retention adversely (64). Therefore, there's a need for a unified national strategy tailored to each country's needs and capabilities (55). Most CFR models are found in high-income, developed nations, creating a gap in generalizing findings from this review to middle or low-income countries with varying infrastructural, social, and cultural contexts.

The main limitation of this research was that it was not possible to review related articles published in languages other than English.

## Conclusion

CFRs can enhance patient prognosis by providing primary care before ambulance arrival. Effective strategies for attracting and retaining CFRs,



along with technology utilization, significantly impact model effectiveness. This review highlights opportunities for future research, including investigating patient experiences and evaluating program efficiency, costs, and support requirements. Findings can inform the development of CFR programs worldwide, considering diverse infrastructural, cultural, and social contexts.

## Journalism Ethics considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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## Conflict of interest

The authors declare that there is no conflict of interests.

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