Rapid response systems

Community first response and out-of-hospital cardiac arrest: Identifying priorities for data collection, analysis, and use via the nominal group technique

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Abstract

Aim: Community First Response (CFR) is an important component of Out-of-hospital Cardiac Arrest management in many countries, including Ireland. Reliable, strategic data collection and analysis are required to support the development of CFR. However, data on CFR are currently limited in Ireland and internationally. This research aimed to identify the most important CFR data to record, the most important uses of CFR data, and barriers and facilitators to CFR data collection and use.

Methods: The Nominal Group Technique structured consensus process was used. An expert panel comprising key stakeholders, including volunteers, clinicians, researchers, policy-makers, and a patient, completed a survey to generate lists of the most important CFR data to record and the most important uses of CFR data. Subsequently, they participated in a consensus meeting to agree the top ten priorities from each list. They also identified barriers and facilitators to CFR data collection and use.

Results: The top ten CFR data items to record included volunteer response time, interventions/activities completed by volunteers, and the mental/physical impact on volunteers. The top ten most important uses of CFR data included providing feedback to volunteers, improving volunteer training, and measuring CFR eectiveness. Barriers included time constraints and limited training. Facilitators included having appropriate software/equipment and collecting minimal data.

Conclusion: The results can guide CFR research and inform the development of CFR data collection and analysis policy and practice in Ireland and internationally. Ultimately, improving CFR data collection and use will help to optimise this important intervention and enhance its evidence base.

Introduction

Out-of-hospital cardiac arrest (OHCA) is one of the foremost causes of mortality worldwide.[1] Survival largely relies on resuscitation being initiated within approximately 5–10 minutes of collapse.[2,3] However, it can be challenging for the emergency medical services (EMS) to achieve such response times, particularly in remote areas.[4,5] Therefore, many countries have implemented Community First Response (CFR) programmes, including Australia, Canada, Denmark, Singapore, and the United Kingdom.[6,7] These programmes entail the mobilisation of volunteers by EMS to respond to OHCAs in their vicinity.[6] They can increase rates of cardiopulmonary resuscitation (CPR) or defibrillation performed prior to EMS arrival.[8]

Community First Response is an important component of OHCA management in Ireland.[7,9,10] Many group and individual CFR schemes have been established throughout the country.[6,10] Group schemes comprise of trained laypeople or members of county fire services, whilst individual schemes include off-duty paramedics, members of An Garda Síochána (i.e. police service), and general practitioners.[6,10] They receive accreditation and support from the National Ambulance Service (NAS).[7,10] They are alerted via text message to medical emergencies, including OHCA, stroke, and choking, in their local communities. In addition to caring for patients, they can provide emotional support to patients' relatives, as well as valuable resources and knowledge to their communities, such as availability of Automated External Defibrillators (AEDs), and CPR training.[7]

Currently, data on CFR are limited in Ireland and internationally. In particular, it has proven difficult to assess its impact on OHCA outcomes, including survival, neurological function, and quality-of-life.[7,8] Recommendations have been published to guide data collection for OHCA trials and registries, including data about the response provided by EMS personnel and bystanders.[11,12] However, guidance is scant on the collection of data about CFR specifically, despite its important role in OHCA management. It can be argued that systems that dispatch volunteers to critical emergencies in community settings based on limited information have a responsibility to study and understand this complex intervention. In Ireland, many CFR schemes gather information about their activities, though this data collection can be inconsistent. EMS professionals also record data about CFR but these data capture limited information about the scene prior to EMS arrival or about broader aspects of CFR, such as volunteer recruitment and wellbeing. Reliable and accurate data collection and analysis are required to support the development and evaluation of CFR. This collection and analysis must also be strategic and feasible given that CFR is a voluntary service. Therefore, this research aimed to achieve consensus amongst key stakeholders regarding priorities for the collection and use of CFR data in Ireland. The primary objectives were to identify and prioritise:

- The most important CFR data items to record and analyse.
- The most important uses of CFR data.

The secondary objectives were to identify:

- Facilitators and barriers to CFR data collection and use.
- Indicators that improvements to CFR data collection and use have been achieved.

This will inform policy and practice surrounding CFR data collection and use and will guide research in Ireland and internationally. Ultimately, improvements to CFR data collection and use will enhance its evidence base and will help to improve its outcomes, including OHCA survival.

Methods

Design

A full study protocol has been published previously.[13] The study was approved by the National University of Ireland, Galway Research Ethics Committee (Reference: 18-Sept-13). The study used the Nominal Group Technique (NGT): a small group method commonly used in the development of healthcare priorities.[14–16] It entails an expert panel of stakeholder representatives (e.g. clinicians, patients) engaging in a structured consensus process, which typically involves independently generating ideas, discussing the ideas as a group, and privately ranking the ideas.[16–18] The NGT facilitates the discussion of complex issues, emphasises the equal importance of all stakeholder views, ensures participants can provide input without fear of criticism, prevents outspoken individuals from dominating decision-making, and limits the influence of the researcher.[19,20] The specific NGT procedure used in the present study (Fig. 1) was derived from previous research that prioritised target behaviours for diabetes research.[18] It comprised a survey to generate suggestions for the primary and secondary objectives followed by a consensus meeting to prioritise the suggestions for the primary objectives. They were conducted virtually due to the COVID-19 pandemic. Supplementary Table 1 describes their design and piloting.

Participants

The target sample was stakeholders with expertise and experience relevant to CFR in Ireland, particularly at least one of the main CFR schemes in the country. These are:

- Community scheme: Teams of volunteers, including trained laypeople, who respond to emergencies in the community in which they live or work.
- Off-duty NAS staff scheme: Off-duty ambulance service personnel who respond to emergencies in their local community.
- Fire service scheme: Fire service personnel who are mobile in an emergency vehicle and thus can respond to emergencies in a region of the NAS's operational area.
- Medical Emergency Responders Integration and Training 3 (MERIT 3) project: General practitioners who respond to emergencies in their own community.

Other schemes are formed of individual healthcare professionals and police officers.[10,21] Typically, the NAS Community Engagement team validate new CFR groups/volunteers once they have fulfilled

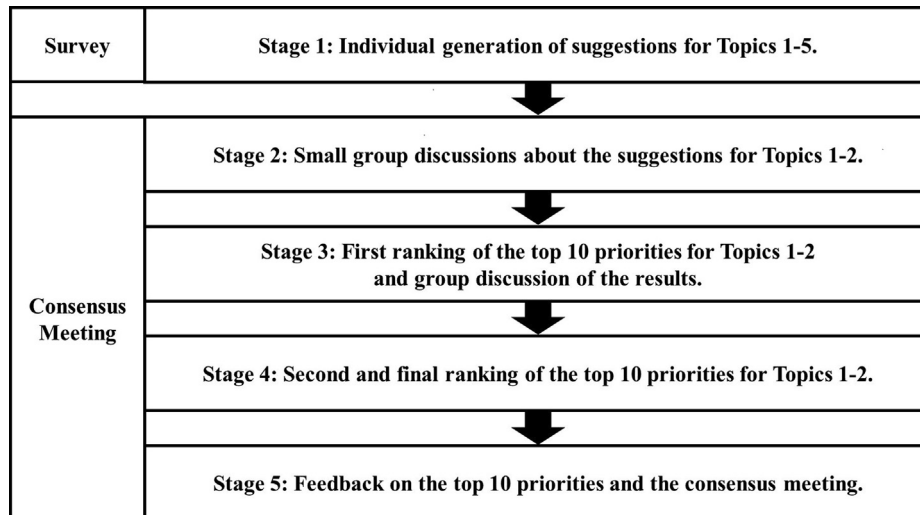| Survey	Stage 1: Individual generation of suggestions for Topics 1-5.
	⬇
Consensus Meeting	Stage 2: Small group discussions about the suggestions for Topics 1-2.
	⬇
	Stage 3: First ranking of the top 10 priorities for Topics 1-2 and group discussion of the results.
	⬇
	Stage 4: Second and final ranking of the top 10 priorities for Topics 1-2.
	⬇
	Stage 5: Feedback on the top 10 priorities and the consensus meeting.

Fig. 1 – Nominal Group Technique Procedure.

the necessary requirements (e.g. accredited first response training, An Garda Síochána vetting) before arranging for their integration with NAS communication and dispatch systems. NAS alert CFR volunteers to emergencies to complement and enhance their emergency medical provision, rather than to replace it. They request that CFR volunteers notify NAS if they decide to respond to an emergency. The Community Engagement team provide ongoing support and guidance, including access to Critical Incident Stress Management.[10,21]

A purposeful sampling strategy was used to recruit a national panel comprising representatives of key stakeholder groups: CFR volunteers, EMS personnel, clinicians, OHCA survivors and their relatives/partners, policy-makers, and researchers. The NGT literature recommends a sample size of 12–30 participants in order to facilitate meaningful group discussions with contributions from each participant whilst ensuring that each stakeholder group is represented.[18,22] Eighteen individuals, identified through consultation with researchers and practitioners from the Scientific Advisory Group of this study, received a study invitation email. Two did not respond (i.e. OHCA survivor, EMS professional). The remaining 16 individuals (12 men, four women) represented a range of roles and organisations (Table 1). The CFR volunteers included laypeople and professionals from rural and urban areas. All participants received a study information sheet, which gave them detailed information about the study. In addition, a researcher contacted each participant via telephone or email to explain the background, purpose, and procedure of the study and to give them the opportunity to raise any questions. This ensured that all participants had sufficient knowledge to take part and enabled them to provide informed consent. One participant (i.e. ambulance service manager/supervisor) completed the survey but could not attend the meeting.

Procedure

Stage 1: Idea Generation - Participants completed a survey that asked for three suggestions for each of the following:

- Topic 1: The most important CFR data items to record and analyse.
- Topic 2: The most important uses of CFR data.

- Topic 3: Facilitators for CFR data collection and use.
- Topic 4: Barriers to CFR data collection and use.
- Topic 5: Indicators that CFR data collection and use have been improved.

The importance of their personal views and experiences was emphasised. The survey was distributed one month before the meeting. Participants completed it within two weeks. One researcher collated the responses, including eliminating duplicate suggestions. This analysis was reviewed by two other researchers to ensure that the responses had been interpreted fairly and accurately.[23,24] This generated a comprehensive list of suggestions for each topic. Partic-

Table 1 – Participant Roles and Organisations in Prehospital Care.

Role(s)	N
CFR Volunteer	8
Paramedic	4
Nurse	4
Medical doctor	1
Garda (i.e. Police officer)	1
Fire service personnel	1
Off-duty first responder	3
Ambulance service manager/supervisor	2
Researcher	3
Educator	1
OHCA survivor	1
Partner/relative of OHCA survivor	1
Organisation(s)	**N**
National Ambulance Service	4
CFR Ireland	1
Pre-hospital Emergency Care Council	1
Irish Heart Foundation	1
An Garda Síochána	1
Out-of-hospital Cardiac Arrest Registry	1
Medical Emergency Responders: Integration and Training 3 (MERIT 3) programme	1
County Fire Service CFR Group Scheme	1
Other CFR Group Scheme	4

ipants received the lists for Topics 1–2 to review one week before the meeting.

Stage 2: Group Discussion - Participants attended a three-hour meeting to identify priorities for Topic 1 (i.e. most important CFR data items to record and analyse) and Topic 2 (i.e. most important uses of CFR data). Supplementary Table 2 displays the meeting timeline. The meeting commenced with a presentation from the research team outlining its aims and format. Small group discussions then took place in virtual break-out rooms. There were three groups, each comprising two facilitators and five participants from different stakeholder groups. Participants discussed their top priorities from each list. They could also suggest additions to the lists. Afterwards, each small group provided feedback to the entire group.

Stage 3: First Ranking - Participants privately identified their top ten priorities from the list for Topic 1 (i.e. most important CFR data items to record and analyse) and ranked them in order of importance using Slido: an online polling platform (https://www.sli.do). Slido calculated the top ten priorities for the entire group. Specifically, each participant's highest ranked item received ten points, the second highest received nine points, and so on. The average, ranked score for each item was then obtained. The ten highest ranked items were displayed to participants. In a subsequent group discussion, participants were asked to comment on the top ten priorities, especially items with rankings they considered unexpected or interesting. This process was later repeated for Topic 2 (i.e. most important uses of CFR data).

Stage 4: Second Ranking - Stage 4 was similar to Stage 3. For a second time, participants privately ranked their top ten priorities from the Topic 1 list. They were informed that they could amend or maintain their selection as they wished following the discussion about the 1st ranking results. The final top ten priorities for the entire group were then calculated and displayed. This process was later repeated for Topic 2.

Stage 5: Feedback - The meeting closed with an optional online feedback form that asked for comments on the final top ten priorities for Topics 1–2 and on the meeting itself.

Results

Stage 1: Idea generation
The survey (N = 16) produced comprehensive lists of suggestions for Topics 1–2 (i.e. primary objectives), which are available in Supplementary Tables 3 and 4. Lists were also generated for Topics 3–5 (i.e. secondary objectives), which are available in Supplementary Tables 5–7. Table 2 displays examples and the number of suggestions.

Stage 2: Group discussion
The meeting discussions (N = 15) generated one additional suggestion, which was for Topic 1: '*What were the patient outcomes that could be shared with the CFR volunteer, with permission from the patient/family?*'

Stages 3 & 4: First & second ranking
Table 3 displays the final top ten suggestions for Topics 1–2 following the 2nd ranking (N = 15). Table 4 displays the results of the 1st and 2nd ranking for Topic 1 (i.e. most important CFR data items to record and analyse). The top four suggestions maintained their positions, two had lower positions, and four were replaced following the 2nd ranking. At least 80% of participants placed the highest ranked suggestion ('*What was the response time of the CFR volunteer?*') in their top ten in both rounds. Furthermore, over 70% placed it in their top three in both rounds. Over 70% placed the 2nd highest ranked suggestion ('*What interventions or activities did the CFR volunteer carry out at the scene?*') in their top ten in both rounds, though

Table 2 – Number of Topic Suggestions.

Topic	Survey Suggestions	Meeting Suggestions	Total Suggestions	Example Suggestions
1. Most important CFR data to record and analyse	38	1	39	– Did the patient survive to discharge? – What was the quality of the CPR performed? – How many calls did the CFR scheme attend?
2. Most important uses of CFR data	27	0	27	– To facilitate research. – To improve the experience of CFR volunteers. – To identify locations that require new CFR schemes.
3. Facilitators for CFR data collection and use	24	NA	24	– Using the data to provide a justification for the CFR service. – Ensuring that data collection is as easy and simple as possible. – Providing relevant training and practice opportunities.
4. Barriers to CFR data collection and use	23	NA	23	– Volunteers having other work or personal commitments to manage. – The results of the data analysis not leading to changes in procedures or training. – CFR schemes feeling anxious about being compared to other CFR schemes.
5. Indicators that CFR data collection and use have been improved	24	NA	24	– Improved data quality and accuracy. – Increased availability and publication of the data. – Greater numbers of CFR volunteers recruited.

Table 3 – Top 10 Priorities for CFR Data Collection, Analysis, and Use.

Rank	Topic 1 Priorities: Most Important CFR Data to Record and Analyse
1	What was the response time of the CFR volunteer?
2	What interventions or activities did the CFR volunteer carry out at the scene?
3	What time was CPR first initiated?
4	Who first initiated CPR?
4	Was the patient's initial rhythm shockable or non-shockable?
6	Who performed CPR at the scene (e.g. bystanders, CFR volunteers)?
7	What time did the cardiac arrest or other emergency occur?
8	What mental or physical effects does being part of a CFR scheme have on its members?
9	How much time elapsed between the emergency occurring and the emergency services being called?
9	Did the CFR volunteer use an AED to deliver a shock to the patient?
Rank	Topic 2 Priorities: Most Important Uses of CFR Data
1	To provide feedback to CFR volunteers.
2	To increase bystander participation in resuscitation.
3	To provide evidence about the value of CFR schemes to key stakeholders (e.g. the public, ambulance service).
4	To accurately assess the contribution made by CFR volunteers.
5	To improve CFR training.
6	To encourage inter-operability and coordination for CFR schemes and the emergency services.
7	To assess the impact of CFR schemes on patient outcomes.
8	To measure the effectiveness of CFR schemes.
9	To identify improvements that can be made to CFR schemes.
10	To determine the level of awareness and the training requirements related to OHCA in the community.

Table 4 – Topic 1 Ranking Results.

1st Ranking Priorities	Rank	Score	Top 10 Votes (%)	Top 3 Votes (%)
What was the response time of the CFR volunteer?	1	7.79	85.71	78.57
What interventions or activities did the CFR volunteer carry out at the scene?	2	5.57	78.57	35.71
What time was CPR first initiated?	3	2.64	35.71	28.57
Who first initiated CPR?	4	2.57	42.86	14.29
Did the CFR volunteer use an AED to deliver a shock to the patient?	5	2.50	42.86	7.14
What was the response time of the ambulance service?	6	2.36	35.71	7.14
Was the emergency as described when the CFR volunteer arrived at the scene?	7	2.29	42.86	14.29
How much time elapsed between the emergency occurring and the emergency services being called?	8	2.14	28.57	14.29
Did the patient survive to discharge?	9	2.00	28.57	14.29
What was the outcome of the emergency?	10	1.93	42.86	14.29
2nd Ranking Priorities	Rank	Score	Top 10 Votes (%)	Top 3 Votes (%)
What was the response time of the CFR volunteer?	1	7.53	80.00	73.33
What interventions or activities did the CFR volunteer carry out at the scene?	2	4.93	73.33	33.33
What time was CPR first initiated?	3	3.53	53.33	26.67
Who first initiated CPR?	4	2.60	60.00	6.67
Was the patient's initial rhythm shockable or non-shockable?	4	2.60	40.00	13.33
Who performed CPR at the scene (e.g. bystanders, CFR volunteers)?	6	2.33	46.67	20.00
What time did the cardiac arrest or other emergency occur?	7	2.20	33.33	20.00
What mental or physical effects does being part of a CFR scheme have on its members?	8	2.13	33.33	13.33
How much time elapsed between the emergency occurring and the emergency services being called?	9	2.07	33.33	6.67
Did the CFR volunteer use an AED to deliver a shock to the patient?	9	2.07	40.00	0.00

just 30% placed it in their top three in both rounds. Consensus for the 3rd highest ranked suggestion ('*What time was CPR first initiated?*') increased, as it was placed in the top ten by 35.71% in the 1st ranking and by 53.33% in the 2nd ranking. Similarly, the 4th highest ranked suggestion ('*Who first initiated CPR?*') was placed in the top ten by 42.86% in the 1st ranking and by 60% in the 2nd ranking.

Table 5 displays the results of the 1st and 2nd ranking for Topic 2 (i.e. most important uses of CFR data). Two suggestions had higher positions, two had lower positions, and three were replaced following the 2nd ranking. Additionally, three suggestions maintained their position, including the two highest ranked suggestions. The highest ranked suggestion ('*To provide feedback to CFR volunteers.*') was

Table 5 – Topic 2 Ranking Results.				
1st Ranking Priorities		**Rank**	**Score**	**Top 10 Votes (%)**	**Top 3 Votes (%)**
To provide feedback to CFR volunteers.	1	7.40	100.00	46.67
To increase bystander participation in resuscitation.	2	5.47	73.33	46.67
To assess the impact of CFR schemes on patient outcomes.	3	5.40	73.33	40.00
To improve CFR training.	4	4.07	53.33	33.33
To accurately assess the contribution made by CFR volunteers.	5	3.20	53.33	26.67
To encourage inter-operability and coordination for CFR schemes and emergency services.	6	3.00	66.67	13.33
To amend procedures in order to increase survival from OHCA.	7	2.53	53.33	6.67
To facilitate auditing and quality improvement.	7	2.53	40.00	20.00
To identify locations that require new CFR schemes.	9	2.33	46.67	0.00
To identify improvements that can be made to CFR schemes.	10	2.13	46.67	6.67
2nd Ranking Priorities	**Rank**	**Score**	**Top 10 Votes (%)**	**Top 3 Votes (%)**
To provide feedback to CFR volunteers.	1	7.07	86.67	66.67
To increase bystander participation in resuscitation.	2	5.53	73.33	53.33
To provide evidence about the value of CFR schemes to key stakeholders (e.g. the public, ambulance service).	3	5.13	73.33	40.00
To accurately assess the contribution made by CFR volunteers.	4	3.93	73.33	26.67
To improve CFR training.	5	3.73	53.33	26.67
To encourage inter-operability and coordination for CFR schemes and emergency services.	6	3.53	66.67	13.33
To assess the impact of CFR schemes on patient outcomes.	7	3.40	66.67	13.33
To measure the effectiveness of CFR schemes.	8	3.20	46.67	20.00
To identify improvements that can be made to CFR schemes.	9	2.93	60.00	13.33
To determine the level of awareness and the training requirements related to OHCA in the community.	10	1.73	26.67	13.33

placed in the top ten by 100% of participants in the 1st ranking and by 86.67% in the 2nd ranking. It was placed in the top three by 46.67% in the 1st ranking and by 66.67% in the 2nd ranking. The 2nd highest ranked suggestion ('*To increase bystander participation in resuscitation.*') was selected for the top ten by 73.33% and for the top three by over 45% in both rounds. The 3rd highest ranked suggestion ('*To provide evidence about the value of CFR schemes to key stakeholders (e.g. the public, ambulance service.*') was added to the top ten following the 2nd ranking, when it was selected by 73.33% of participants.

Stage 5: Feedback

The complete feedback form results (N = 12) are available in Supplementary Fig. 1–2 and Supplementary Tables 8–9. The majority (n = 9) agreed/strongly agreed that they were satisfied with the top ten priorities for Topic 1. Two were neutral and one disagreed. One participant commented: "*[The Topic 1 top ten] is currently being collected and gives no more insight into community response…- Some of the options in particular in [Topic 2] were very similar and might have been grouped together. However, overall I believe it was a fair and accurate account of everyone's opinions.*"

For Topic 2, the majority (n = 10) agreed/strongly agreed that they were satisfied with the top ten priorities, whilst two were neutral. Additionally, the majority positively rated the meeting itself, including the materials (n = 11), facilitation (n = 12), and value of taking part (n = 12). One said:

"*I feel honoured to have been part of this, as it is such valuable information to aid us in strengthening the Chain of Survival…The meeting was fantastic to meet and hear what other people from different walks of life – but yet all with the same goal – had to suggest.*"

Discussion

This research established priorities for the collection and use of data needed for the development and evaluation of CFR in Ireland by consulting a national expert panel. It found that the most important CFR data item to record and analyse was the CFR volunteer response time. Other priorities were the patient's initial rhythm and information about interventions performed at the scene, including when CPR was initiated, who performed CPR, and whether an AED was used. These priorities differed from the core outcome set for reporting on effectiveness studies of cardiac arrest (COSCA) in adults, which comprises survival, neurological function, and health-related quality-of-life.[12] Unlike COSCA, the current study focused on CFR, targeted both research and practice, and considered all data items, rather than outcomes alone. Several priorities corresponded to core data elements from the Utstein reporting template for OHCA registries (e.g. response times, first monitored rhythm).[11] However, CFR volunteers do not fit neatly within the Utstein responder categories (i.e. bystanders, EMS personnel).[25] Firstly, bystanders are individuals who do not respond as part of an organised emergency response system, whereas CFR volunteers are often mobilised by the EMS.[6,25] Secondly, whilst some CFR programmes are part of the EMS response, others supplement or replace the EMS response and do so on a voluntary basis.[6,7] The current study underlines the importance of collecting data that are specific to CFR and highlights that existing reporting guidelines may overlook this important link in

the Chain of Survival. This is timely given that an update to the Utstein template was recently commissioned, which is expected to review the conceptualisation of 'bystander' and to facilitate the capture of the impact of CFR schemes.[26]

Another priority was to collect and analyse data about the mental or physical impact of volunteering in a CFR scheme. Previous research indicates that some volunteers experience negative effects, including intrusive thoughts, emotional distress, sleep disturbance, and weight loss.[7,27–31] Therefore, there is a wide array of possible mental and physical effects to be assessed. However, these effects are likely to be challenging to operationalise and measure routinely in comparison to the other priorities, which are more specific and concrete (e.g. response time, time CPR was initiated). Furthermore, these effects can be influenced by other factors, such prior health status. It is also possible that some volunteers would feel uncomfortable sharing information about their mental and physical health, as this is a somewhat sensitive subject. In relation to this, concerns about data confidentiality and privacy and about data being used to evaluate and compare volunteers were identified as barriers to measurement in the current study (Supplementary Table 6).

Previous research on CFR schemes suggests that there can be notable discrepancy between the number of emergency alerts received and the number of emergencies attended.[32] This can be due to volunteers being unavailable (e.g. work, childcare, illness) or missing the alert (e.g. phone switched off, poor network coverage). It can also be due to volunteers receiving subsequent cancellation or 'stand-down' notices.[32] A qualitative study from the UK found that, for some volunteers, being 'stood-down' can lead to frustration and can even undermine their relationship with the ambulance service.[31] Despite the potential importance of this issue, the difference between the number of alerts and the number of attends was not prioritised in the current study. However, the number of calls attended and the reasons why calls were not attended were included in the longlist of potential data items to be collected, which was generated by the survey (Supplementary Table 3).

This study found that the most important use of CFR data was providing feedback to CFR volunteers. Previous international research reported that volunteers desire more feedback, including debriefing from EMS professionals, reassurance from peers, and information about CFR programme outcomes.[7,31,33] However, feedback must be provided without compromising patient confidentiality.[7] Another priority was improving CFR training. Currently, there is no international consensus regarding optimal training level, mode, and frequency.[6,34] Several priorities concerned measuring the effectiveness of CFR schemes, pinpointing their contribution to patient outcomes, and demonstrating their value to different stakeholders. Whilst recent evidence suggests that CFR increases early CPR and/or defibrillation rates, its impact on survival, neurological function, and quality-of-life requires further research.[7,8] Another priority was encouraging inter-operability and coordination between CFR schemes and EMS, which past international research identified as an area requiring improvement.[31,35] Other priorities were determining OHCA awareness and training requirements in the community and increasing bystander resuscitation. This finding, coupled with previous research, suggests that the role and value of CFR schemes encompass not only first response but also health promotion and emergency preparation within the community.[7]

A secondary objective of this study was identifying barriers and facilitators to CFR data collection and use (Supplementary Tables 5 and 6). The importance of suitable technology was highlighted,

such as electronic forms, mobile applications, CPR feedback sensors, and AED download equipment. Many countries alert volunteers via mobile applications that can also be used to record data (e.g. response times).[34] Additionally, volunteers in many countries use AEDs, which can record valuable data (e.g. shock time, initial rhythm). However, barriers to retrieving AED data include limited storage capacities, heterogeneous models and download options, and costly, obsolete, or defective hardware and software.[36–38] The current study underlined the need for relevant training, especially regarding data regulations and the purpose and benefits of data collection, as well as concerns about confidentiality or data being used to compare or penalise CFR schemes. Another secondary objective was to establish indicators that CFR data collection and use have been improved (Supplementary Table 7). Suggestions included positive feedback from volunteers, regular dissemination of data to stakeholders, enhanced data quality, and improved CFR outcomes.

A potential limitation of this study is that the NGT is a small group technique that may not reflect the views of the wider population. Nevertheless, it is an established method in healthcare research for developing recommendations and priorities.[14–16] Additionally, just four of the 16 participants were female. The purposeful sampling strategy was designed to recruit representatives of each stakeholder group, rather than participants with diverse demographics. However, some professions (e.g. medical doctor, fire-fighter) had just one representative. Moreover, only one OHCA survivor and one relative participated. Unfortunately, the pandemic necessitated the scaling-back of the recruitment plan, which originally included face-to-face recruitment strategies. Furthermore, the OHCA survivors/relatives stakeholder group could be regarded as a hard-to-reach population because OHCA has a low survival rate and many survivors and relatives subsequently experience mental health difficulties, including post-traumatic stress.[39,40] Nonetheless, there was at least one representative from each stakeholder group. Another limitation of this research was that, as it focused primarily on CFR in Ireland, its findings are less applicable to international CFR programmes.

A strength of this research is that it engaged a variety of stakeholders in a structured consensus process to identify CFR data collection and use priorities. Recruiting an array of stakeholders, including patients and the public, can generate unique ideas that would not have been produced by researchers and clinicians alone.[41,42] In the present study, the stakeholders, who included lay CFR volunteers and an OHCA survivor, had many novel suggestions, such as recommending that data be collected about patients' and families' views of CFR schemes, volunteer utilisation of psychological support, and volunteer retention rates. Furthermore, developing recommendations through stakeholder consultation can increase their likelihood of implementation.[43,44] The findings of the present study are currently being utilised by NAS and the Out-of-Hospital Cardiac Arrest Register (OHCAR) of Ireland to amend their data collection and reporting practices. This includes incorporating the top ten data items into the OHCAR annual report. Another strength was that this study provided evidence that NGT consensus meetings, which are typically a face-to-face, can be informative and positively received when undertaken virtually.

Conclusions

This study established priorities for CFR data collection and use and identified barriers, facilitators, and indicators of improvement for

these processes. The findings provide a foundation for the development of CFR data collection and use policy and practice in Ireland. The findings also apply to international CFR programmes, especially those with similar compositions (e.g. group and individual schemes, lay and professional volunteers). Furthermore, the findings will inform future research in this field. In particular, they underscore the need to collect and analyse data that are specific to CFR, as this important link in the Chain of Survival may not be adequately captured by existing reporting guidelines. The advancement of CFR data collection and use will help build the evidence base of this intervention and improve its outcomes, including survival and patients' and families' experience of prehospital care.

CRediT authorship contribution statement

Eithne Heffernan: Conceptualization, Formal analysis, Investigation, Writing – original draft, Writing – review & editing, Project administration, Data curation. **Dylan Keegan:** Conceptualization, Validation, Investigation, Data curation, Writing – review & editing. **Jenny Mc Sharry:** Conceptualization, Methodology, Investigation, Writing – review & editing. **Tomás Barry:** Conceptualization, Investigation, Writing – review & editing. **Peter Tugwell:** Methodology, Resources, Writing – review & editing. **Andrew W. Murphy:** Conceptualization, Supervision, Writing – review & editing. **Conor Deasy:** Conceptualization, Writing – review & editing. **David Menzies:** Conceptualization, Writing – review & editing. **Cathal O'Donnell:** Conceptualization, Writing – review & editing. **Siobhan Masterson:** Conceptualization, Methodology, Validation, Writing – review & editing, Supervision, Project administration, Funding acquisition.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data availability

No additional data are available.

Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.resplu.2021.100197.

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