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Use of telephone CPR advice in Ireland: Uptake by callers and delays in the assessment process☆

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ABSTRACT

Introduction: Telephone CPR (T-CPR) has significant variations in time from call receipt to first compression, with reported delays of up to five minutes. Ireland's National Ambulance Service (NAS) uses T-CPR based on standard AMPDS questions; we aimed to identify the time to first compression and the times needed for question blocks. Ireland has a low survival rate from out-of-hospital cardiac arrest, (6% in 2013).

Methods: A retrospective review of all cardiac arrests in a two-year period was carried out in one NAS region. All cardiac arrests were identified from the national registry and audio tapes and Patient Care Reports reviewed, together with survival data. Times from call handover were noted and categorised in terms of the key question items.

Results: 202 cardiac arrests occurred in the period ($36/10^5$/year); 30 (14.9%) patients were not in cardiac arrest at the time of the call. Records were available for 145/172 patients in cardiac arrest at the time of the call. In 63/145 (43.4%) cases, the caller was not at the patient's side. Of the remaining 82 cases, in 13/82 (15.8%) CPR was underway (two survivors), in 22/82 (26.8%) the caller would not attempt T-CPR (one survivor); in 47/82 (57.3%), T-CPR was carried out (two survivors). Median time to first compression was 05:28 min (range 03:18–10:29).

Repeated questioning in relation to the patient's condition caused most of the delays.

Conclusions: Many callers are willing to attempt T-CPR but the questioning/instruction process causes significant delays. A focused, brief questioning process is required.

Introduction

The role of telephone assisted cardiopulmonary resuscitation (T-CPR) has been well described, with evolving evidence that simplified procedures improve outcomes.[1–5] The American Heart Association has recently summarised the data supporting the role of T-CPR in an advisory on improving survival in the community.[6]

However, limited data has been published on the effectiveness or outcomes of T-CPR. In 2014 Dameff et al. developed an audit framework for evaluation of 911 calls in a US dispatch centre which uses an automated computer aided dispatch system (Incident Management, version 8.1.3, Intergraph, Huntsville, AL).[7] Of 317 cases in which CPR was indicated, it was already underway in 29.7%, and only 14% of cases had T-CPR delivered; where T-CPR was delivered the median time from start of call to first compression was 04:11 min (minutes:seconds format used throughout this paper). Lewis et al., reported in 2013 that median time to first T-CPR compression was 02:56 min, using a locally developed dispatcher training system in Seattle; they identified significant delays due to the questioning process and called for major improvement in this process.[8]

Stipulante et al. reported in 2014 on the implementation of a T-CPR regime in Belgium, using a French language, compression-only phone CPR algorithm and found that 22.5% of out-of-hospital cardiac arrest (OHCA) patients received T-CPR. They found that median time from call to first compression was 02:48 min after implementation of the regime, a significant improvement from the non-T-CPR situation.[9]

A 2013 study by Clegg et al. in the UK examined 50 consecutive suspected OHCAs by analysis of the times taken for each phase of the T-CPR interaction, using the Medical Priority Dispatch System Version 12 (Priority Dispatch Systems, Salt Lake City UT, US).[10] They reported that mean time from call receipt to first compression was

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04:45 min and that the time taken to determine if the patient was breathing was the longest single component (median 00:59 min).

A key issue in the appropriate use of T-CPR is the ability of dispatchers to recognise cardiac arrest. Dameff's study reported that dispatchers recognised the need for T-CPR in 79% of cases. Vaillencourt et al. reported in 2015 that dispatchers had a 'fair sensitivity' (65.9%) and 'modest specificity' (32.3%) in correctly diagnosing cardiac arrest during 911 calls in Canada, using dispatch algorithms developed by the Ontario Ministry of Health and Long-term Care.[11]

Ireland's National Ambulance Service (NAS) is undergoing rapid modernisation of its command and control systems. The NAS serves a population of 4.6 million in settings ranging from dense urban areas to remote and sparsely populated rural areas; around one-third of the population live in rural or small town environments. Highly effective dispatch systems are required to maximise the use of limited NAS resources; T-CPR, volunteer Cardiac First Responders, use of off-duty staff in OHCA, centralisation of command and control and high quality audit are among the measures which have been introduced.[12]

The NAS control systems use the Advanced Medical Priority Dispatch System (AMPDS) Version 12.0 which requires a call-taker to complete a series of 21 questions/items in order to diagnose cardiac arrest and then offer T-CPR.[13] The AMPDS protocols are installed within a computerised system known as ProQA (Priority Dispatch Corporation, Salt Lake City, UT, US) which was used throughout this study; manual cards with the same questions are available in the control room if required. The NAS version includes all of the standard questions in the AMPDS protocol, with a number of repeated questions on address and appearance of the patient. It does not use specific questions about agonal breathing but has one additional question – 'is the patient changing colour?' Table 1 outlines the questions which essentially fall into four blocks:

1. Location
2. General assessment/what happened?
3. Additional assessment/is there an AED nearby?
4. Breathing assessment/establish cardiac arrest

At the time, call-takers/dispatchers within NAS control centres came from both clinical paramedic and non-clinical backgrounds. All received five days training in the use of the ProQA system, which is the computerised package based on the AMPDS protocols. This was followed by five days training on the overall Computer Aided Dispatch system. In 2015, the NAS moved to a single national control centre with almost exclusively non-clinical call-takers/dispatchers. We did not investigate the relationship between T-CPR and the characteristics or backgrounds of the call-takers/dispatchers involved.

This study aimed to examine the frequency of use of T-CPR in one regional control centre and to assess the time periods used for blocks of questions.

Methods

The national Out of Hospital Cardiac Arrest Register (OHCAR) provided details of all cardiac arrests reported in the study area between January 1st 2011 and December 31st 2012. The study area is served by a single regional ambulance control centre, at the time one of eight in Ireland. The area has a population of approximately 280,000 in predominantly rural settings. All calls identified by OHCAR use the unique identifier established at call receipt; this identifier is also used for recordings of calls and for the Patient Care Report (PCR) compiled by the treating paramedics. PCRs were sought for each of the calls included and the digital recording of each call was retrieved from the ambulance control centre, using the 'Freedom Playback' archive manager programme version 2.0.5.0.[14] All data was anonymised with no data collected on individual callers, patients or call-takers.

A standard Microsoft Windows Media Player (version 9) on the control centre computer was used to listen to each call. The media player shows the timing of the recording and was used to log the times used in the study. Each call was listened to in full at least twice by a single researcher.

All timing data was inputted to Excel (Microsoft Corporation, Redmond, WA, US) and SPSS v20 (IBM Corporation, Armonk, NY, US) was used for calculation of descriptors.

The start time of the call taker's conversation with the caller was taken as the point at which the 999/112 operator handed the call over to the control centre. Times are reported in the minutes: seconds' format. For paediatric cases, times to first compressions were not included as the resuscitation sequence emphasises the need for adequate initial ventilations; however all other aspects of paediatric calls were included.

University College Dublin Human Research Ethics Committees provided ethical approval and permission for the study was given by the National Ambulance Service.

Results

In the two year period, OHCAR identified 202 cases of cardiac arrest which had been dealt with by the ambulance service in the region, a rate of $36/10^5$/year. This included 30/202 (14.9%) cases in which the patient was not in cardiac arrest at the time of the call for help to the Ambulance Service but arrested at some later point (seven in the presence of paramedics). Of the remaining 172 potential cases for T-CPR, complete PCRs and audio recordings were available for 145 individuals; the incomplete cases included those in which either the PCR or the audiotape could not be located (22 cases) or the quality of the audiotape was unsuitable for any meaningful analysis (five cases). Fig. 1 summarises identification of cases. All callers spoke English. Fig. 2 identifies the cases included in the 'Time to CPR' analysis.

In 45/145 (31%) cases the call was made by a person who was not with the patient at the time (police, GP receptionist, relative, etc.) and in 18/145 (12.5%) cases the caller was in the same building but not in the same room (usually because a fixed line phone in the home was being used). Overall there was no practical option to deliver T-CPR in 63/145 (43.4%) cases.

Therefore in 82/145 (56.6%) cases, the patient was in cardiac arrest and had a potential rescuer nearby who could deliver CPR. Overall 5/82 (6%) patients survived to hospital discharge.

Of those incidents in which the caller was beside the patient, 13/82 (15.9%) had CPR underway at the time of the call – two patients survived to hospital discharge. In 22/82 (26.8%) cases the caller would not attempt telephone assisted CPR – one patient survived to hospital discharge. In 47/82 (57.3%) cases the caller attempted CPR with the assistance of the controller – two patients survived to hospital discharge.

Four of the 47 cases in which T-CPR was attempted were excluded from further analysis of time to first compression because two were paediatric incidents in which the initial ventilations were the key intervention and in two cases, the audio recordings were of insufficient quality to allow accurate timings, leaving 43 cases for analysis of time from receipt of call to first compression.

We identified no 'false-positive' cases in which T-CPR advice was given when the patient was not in cardiac arrest; cardiac arrest was confirmed in each of the cases.

The median time from handover of the call to first compression was 05:28 min (range 03:18–10:29). In 50% of cases, T-CPR was

Table 1
Standard NAS/AMPDS questions/instructions in suspected cardiac arrest.

No.	Question/instruction	Group
1.	Emergency call Answering Service give phone number of caller.	Location
2.	Where do you need the ambulance?	Location
3.	Repeat your phone number?	Location
4.	*What is the address?*	Location
5.	*What is the name of patient?*	Location
6.	*Name of location or business?*	Location
7.	Tell me exactly what happened?	General assessment /what happened
8.	*Confirm details.*	General assessment /what happened
9.	*Advise that the ambulance is being dispatched.*	General assessment /what happened
10.	Are you with the patient now?	General assessment /what happened
11.	How old is the patient?	General assessment /what happened
12.	Is he awake?	General assessment /what happened
13.	Is he breathing normally?	General assessment /what happened
14.	*Is he changing colour?*	Additional assessment /AED
15.	*Did you see what happened?*	Additional assessment /AED
16.	Is there a defibrillator available?	Additional assessment /AED
17.	Lie the patient for on his back and remove any pillows.	Breathing assessment
18.	Kneel next to him and check in his mouth for food or vomit?	Breathing assessment
19.	Place your hand on his forehead and the other hand on the his neck and tilt his head back	Breathing assessment
20.	Put your ear close to his mouth	Breathing assessment
21.	Can you hear any breathing?	Breathing assessment
	Cardiac Arrest is diagnosed at this point.	
22.	I will tell you how to do resuscitation. Place the heel of your hand on the breast bone in the centre of the chest between the nipples.	CPR instructions
23.	Put the other hand on top of that hand, push down firmly 2 inches with only the heel of your lower hand. Push the chest hard and fast at least twice per second. Let the chest come all the way back. Count out loud so I can count with you	CPR instructions

NAS, National Ambulance Service; AMPDS, Advanced Medical Priority Dispatching System; AED, Automated External Defibrillator; Questions in italics are NAS variations from the standard AMPDS format, identified during analysis.

initiated between 04:23 and 06:32 min (interquartile range); the 90th percentile was 08:36 min.

Table 2 summarises elapsed time periods; the complex and distressed nature of calls meant that the question and answer sequence sometimes varied so exact elapsed times for all callers in some groups of questions were not established. Table 2 shows that questions 13–21 (additional assessment including AED nearby and breathing checks) took a median time of around 02:20 min to complete. The table also indicates the numbers of sections of the call-taker protocol in which the questions, responses and timings could be clearly identified and indicates generally good compliance with the protocol.

In 32/45 (71%) cases, review of the tapes suggests that the dispatcher had identified the address of the incident and had collected sufficient information to be highly concerned that the patient was in cardiac arrest within one minute of the start of the call.

Discussion

The finding that 202 cardiac arrests were managed by the Ambulance Service in a two year period indicates an incidence rate of 3/100,000/year, which is similar to that reported nationally.[15,16]

It is notable that in 14.9% of cases, a caller had contacted the ambulance service before the patient suffered their cardiac arrest, so that in seven cases the arrest happened in the presence of the paramedic crew. Takei at el have recently suggested that survival rates are higher in such cases.[17]

It is also striking that in 73.1% cases, bystander CPR was delivered to the patient, in 57% of all cases with the assistance of the dispatcher. T-CPR was not performed by 22/82 (26.8%) callers when prompted to do so (confirmed by review of PCRs on which pre-arrival CPR is recorded). Eight individuals said they were unwilling to attempt T-CPR; in the other cases it appeared from the recordings that the remaining 14 callers were either unable to understand or physically undertake what was being asked of them. However, further study is required to explore the barriers to non-intervention, perhaps involving skilled de-briefing of all callers.

A key concern arising from this study is that the elapsed time from handover of the call to delivery of the first compressions was protracted. At a median of 05:28 min, this is far too long. The time taken to complete the 21 standard questions/items is obviously dependent on many factors including the co-operation of the caller, the quality of the telephone line, the skill of the call-taker, ambient noise and distraction for the caller and the clarity of the instructions given. While a justification for gathering more information can be offered, a system which does so at the expense of initiating CPR is difficult to justify. Our study was not structured to evaluate precisely when the call-taker believed that the patient was in cardiac arrest. However it appeared that in over 70% of cases, cardiac arrest was identifiable within one minute of call receipt. Call takers went on to complete the sequence of questioning in these cases but there appeared to be significant verbal cues that they were highly concerned about the likelihood of cardiac arrest before completion of the question protocol.

This study indicates that:

1. Half of the elapsed time is taken up with patient assessment including repeated breathing checks and that

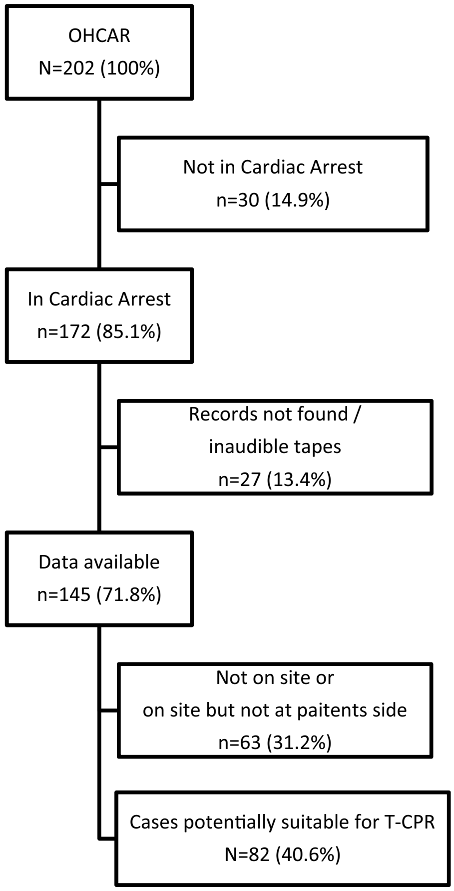

Fig. 1. Summarises identification of cases.

2. Controllers appeared to have both the location of the incident and sufficient information to be concerned that the patient was in cardiac arrest within a minute of taking the call.

Together, these findings indicate that amendments to the AMPDS sequence are required. Beginning chest compressions as soon as possible is essential; although multiple checks may offer reassurance about the diagnosis of cardiac arrest, delaying first compressions for over five minutes reduces the chance of survival significantly. In Ireland the current non-availability of telephone technology to link GPS/coordinates to fixed line phone or mobile phones makes it difficult to reduce the questions based on location. Therefore, a focus on other components is needed. Lewis et al. have proposed that the AMPDS question process should be significantly reduced and should require very little time. Our data indicates that within a minute of taking the call, dispatchers usually had enough information to indicate probable cardiac arrest. A more focused and flexible questioning process should enable dispatchers to act on those suspicions and initiate chest compressions immediately.

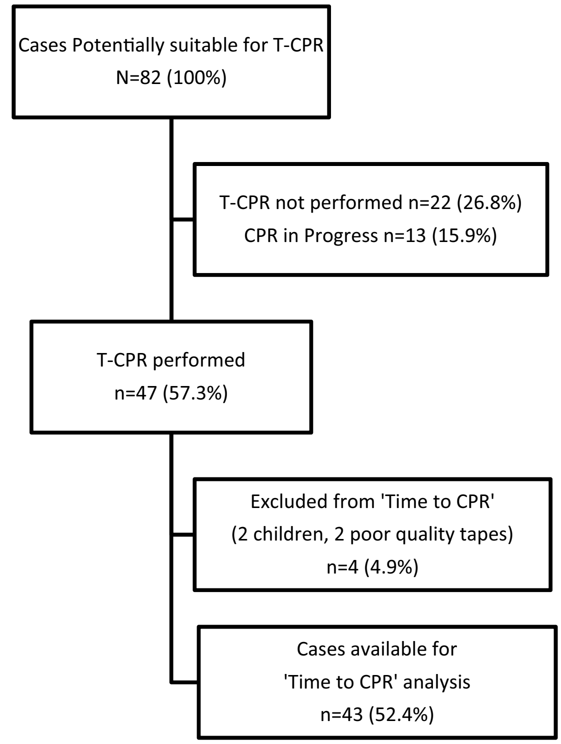

Fig. 2. Cases included in the 'Time to CPR' analysis.

Study limitations include the absence of information on the characteristics of rescuers, potential rescuers or call takers, the low survival rates in each of the categories and the absence of feedback from those who carried out T-CPR (or who refused to do so). Nonetheless the study indicates issues which should be addressed within the current NAS structures and areas which require further research.

Ambulance control centres should hold electronic registers of the location of Automated External Defibrillators (AEDs) and should link these to local alerting systems to bring help to the scene, without having to interrupt the delivery of T-CPR. Such developments are in progress in Ireland and elsewhere but must be prioritised given the clear message in our data that delays are occurring in starting T-CPR.

It is of concern that in spite of the apparent willingness of almost three-quarters of callers on scene to deliver CPR, those who depend on T-CPR advice are being delayed in doing so. The delays seem to be due to call centre questions and directions which may have other more appropriate solutions than the protocols in use at the moment.

Table 2
Median elapsed times for responses to blocks of questions ($n = 47$ patients).

Questions numbers	1–6	7–13	14–16	17–21	22–23
Question headings	Location	General assessment	Additional assessment/AED nearby	Breathing assessment	CPR instructions
Number of cases in which the elapsed time could be clearly established	45	33	36	44	43
Median elapsed time to complete these sets of questions (minutes)	00:42	00:57	00:35	01:46	01:28
Median elapsed time (cumulative) to complete these questions (minutes)	00:42	01:39	02:14	04:00	05:28

AED, Automated External Defibrillator.

Conflict of interest statement

Neither author has any conflict of interest in this study. Neither has any financial or other influences in this piece of work. No funding has been provided for the study.

Gearóid Oman works as an Advanced Paramedic with the National Ambulance Service but does not work within the ambulance control centre where the data was gathered.

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