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Clinical paper

The association of out-of-hospital cardiac arrest barriers to cardiopulmonary resuscitation initiation and continuation during the emergency call: A retrospective cohort study

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Abstract

Background: In a previous study, we identified eight types of potential barriers to bystander cardiopulmonary resuscitation (CPR) initiation and continuation until the arrival of emergency medical services (EMS) on scene, in the context of emergency calls for out-of-hospital cardiac arrest (OHCA). Many cases had multiple barriers. In this study, we aimed to estimate the independent effects of these barriers after adjusting for case characteristics.

Methods: We used data for the 295 non-trauma OHCAs from the St John Western Australian (SJ-WA) OHCA Database. Excluded cases were: EMS-witnessed OHCA, callers not with/close to the patient, OHCA not recognised during the emergency call, bystander CPR in progress prior to the call and calls coded as obvious death by SJ-WA. We conducted two multivariable logistic regression models including the eight barriers (callers: 1) perceived inappropriateness of CPR, 2) emotional distress, 3) reluctance to perform CPR, 4) physical limitations, 5) access to the patient, 6) leaving the scene, 7) communication failure, and 8) on-scene distractions) and case characteristics.

Results: The callers perceiving CPR as inappropriate (adjusted odds ratio [AOR] = 0.20, 0.11–0.37) and witnessed arrest (AOR = 2.88, 95% CI 1.48–5.60) were independently associated with CPR initiation. Caller distractions such as performing other tasks or relaying information to other bystanders were negatively significantly associated with callers continuing CPR to EMS arrival (AOR = 0.27, 0.10–0.73).

Conclusions: Perceptions of inappropriateness and caller distractions were independent risk factors for the delivery of bystander CPR. Further research around how call-takers navigate these barriers and encourage callers should be performed.

Keywords: Cardiopulmonary resuscitation, Out-of-hospital cardiac arrest, Emergency calls

Introduction

Bystanders are fundamental to the out-of-hospital cardiac arrest (OHCA) Chain of Survival,[1] as they can perform cardiopulmonary resuscitation (CPR) until the emergency medical services (EMS) arrive on scene.[2] Bystander CPR (B-CPR) can double OHCA survival[3] and the delivery of CPR instructions by emergency call takers/dispatchers (DA-CPR) is recommended by the International Liaison Committee on Resuscitation.[4,5] DA-CPR improves B-CPR rates, which in turn leads to improved patient outcomes.[6] However, even in systems with DA-CPR in place, case characteristics, (e.g., arrest witness status,[7] patient sex[8] and location of arrest[9]) and other barriers also influence whether bystanders commence and continue CPR.[7,10–13]

While previous studies[7,12,13] have identified important and modifiable barriers to CPR initiation and/or continuation, they have overlooked the potential effect modification and confounding of different barriers and case characteristics. Here, we build on a previous study of emergency ambulance calls[10] where we identified eight barriers to immediate B-CPR initiation and continuation until the arrival of EMS: (1) perceived inappropriateness of B-CPR, (2) emotional distress, (3)

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caller reluctance, (4) bystander physical limitations, (5) patient access, (6) caller leaving the scene, (7) communication failure and (8) caller distractions. We previously found that cases had multiple barriers to CPR initiation and/or continuation co-occurring within the call, and therefore the aim of this study was to estimate the independent effects of each of the eight different barriers on caller initiation and continuation of CPR, after adjusting for case characteristics.

Methods

Study design and setting

This study utilises the same study cohort and corresponding coded data as our previously reported study,[10] briefly reproduced here for clarity. We conducted a retrospective cohort study of consecutive emergency calls received by St John Western Australia (SJ-WA) for OHCA patients between 1 January and 30 April 2021. SJ-WA is the ambulance service provider for the whole of Western Australia (WA), a state of Australia with a land mass of 2.5 million km^2 and a population of 2.7 million residents.[14,15] All medical emergency calls in WA are managed by the SJ-WA State Operations Centre, which uses the Medical Priority Dispatch System (MPDS)[16] to triage calls. Approval to conduct this study was obtained from the Curtin University Human Research Ethics Committee (HR128/2013) and SJ-WA Research Governance Committee.

Study data

The study cohort of OHCA cases was identified from the SJ-WA OHCA Database, which is maintained by the Prehospital, Resuscitation and Emergency Care Research Unit (PRECRU), Curtin University. This database collates patient and arrest characteristics, clinical care provided and dispatch data for all OHCAs attended by SJ-WA. Emergency calls for OHCA cases within the four-month study timeframe were manually extracted from SJ-WA and screened. Cases were excluded if they met any of the following criteria: traumatic aetiology, EMS-witnessed OHCA, non-second party caller, OHCA not recognised during the emergency call, B-CPR in progress prior to the call and calls coded as obvious death by SJ-WA. Second-party callers were defined using the SJ-WA operational definition as callers in close proximity to the patient.[17] Case characteristics, and the presence of barriers to B-CPR initiation and continuation were abstracted from the call (by ESA), and the accuracy of coding was validated in 10% of cases (by TB).[10].

Barriers

In our previous study[10] we identified specific factors that delayed or prohibited the initiation or continuation of B-CPR and categorised these into eight broad barrier categories (Table 1). A barrier to B-CPR initiation was defined as any factor that impeded the flow of the call, causing the call-taker to repeat, redirect or pause B-CPR instructions. A barrier to B-CPR continuation was defined as any statement from the caller that indicated a reason for an interruption to, or cessation of, B-CPR; or where the caller expressed an intention to do so.[10]

Data analysis

In this study, the case characteristics included in all analyses were decided *a priori* by the research team, as those commonly described in the literature as affecting B-CPR.[7,9,12,18–21] The following case characteristic variables were included: call-taker sex, bystander sex, and patient sex (male vs. female); patient age (<65 years old vs. $\geq$ 65 years old); relationship between the caller and the patient (relative vs. non-relative); telephone type (mobile vs. landline); number of bystanders on the scene (n = 1 vs. n > 1); witness status (unwitnessed vs. bystander witnessed arrest); and EMS response time (<5 min vs. $\geq$ 5 min). We used binary variables (present in call vs. not present in the call) for each of the eight barriers described above.

To address our aim of estimating the independent effects of different barriers on CPR initiation and continuation, adjusting for case characteristics, we first conducted a 1) univariable analysis of all case characteristics and barriers; and then 2) multivariable logistic regression analyses, adjusting for all barriers and case characteristics. These analyses were performed for both CPR initiation (among all cases, N = 295) and CPR continuation (among cases where CPR was initiated, N = 205). Case characteristics and barrier categories were compared between: 1) those who initiated B-CPR and those who did not, and 2) those who initiated B-CPR and continued compressions until EMS arrival, with those who initiated B-CPR but stopped prior to EMS arrival. For the univariable analyses, all variables were compared using χ^2, unless expected counts were less than five, where a Fisher's exact test was utilised. Counts and percentages were used for description of quantitative variables.

All multivariable logistic regressions were single block analysis, with all variables added into the model at the same time.[22] Adjusted odds ratios (AOR) were reported with 95% confidence intervals. A $p < 0.05$ was considered statistically significant. Correlation tests were performed to assess for potential collinearity between variables with a threshold of 0.5, and reported if there was a correlation between variables.[23] All analyses were performed using SPSS v27 (IBM, Armonk, NY, USA).

Results

Study population

Case characteristics of the included calls are shown in Table 2. B-CPR was initiated for 69% (205/295) of patients, and 85% (175/205) of those who initiated B-CPR continued performing B-CPR until EMS arrival. Table 2 also shows the percentage of calls for each barrier, which ranged from as few as 6% (leaving the scene) to 65% (bystander physical ability).

Immediate B-CPR initiation

Univariable model

When modelled at the univariable level, two of the eight barriers showed a significant association with immediate CPR initiation: perceived inappropriateness and caller reluctance. Callers who perceived that resuscitation was inappropriate were less likely to immediately initiate CPR (OR = 0.18, 95% CI = 0.11–0.31), as were callers who were reluctant to perform CPR (OR = 0.50, 95% CI = 0.26–0.94), as shown in Table 3. Several case characteristics were found to be associated with immediate B-CPR initiation. As shown in Table 3, cases involving callers unrelated to the patient (OR = 1.98, 95% CI = 1.13–3.45), public arrests (OR = 4.25, 95% CI = 1.62–11.15), multiple bystanders present on scene (OR = 2.27, 95% CI = 1.37–3.75), and bystander-witnessed OHCAs (OR = 2.53, 95% CI = 1.48–4.32), were more likely to have CPR initiated immediately. If the caller was calling from a landline

Table 1 – Definitions of the eight barriers to CPR initiation and continuation utilised from Aldridge et al. 2023.[10]

Barrier	Definition
Caller reluctance	Caller reluctance is defined as spoken hesitation or resistance to performing CPR, where subcategories were: not wanting to perform ventilations, body fluids were present, perceived inability to perform CPR and general reluctance towards performing CPR.
Caller perceived inappropriateness	Perceived inappropriateness of resuscitation was defined as when callers expressed doubts about the appropriateness of performing CPR on the patient because they perceived the patient to be dead and beyond help, or alternatively alive and breathing, or they thought the patient would not want resuscitation or had a Not For Resuscitation (NFR) order in place
Emotional callers	Emotional callers described where callers expressed, either through words (e.g. no, no, no, I can't do that) or sounds (screaming, yelling, crying), that they were not coping with the situation. Fear of contact or hurting the patient, aggressiveness and emotional distress were all categorised as emotional callers.
Bystander physical ability	Bystander physical ability was documented where the caller expressed an inability to position the patient in preparation for CPR (e.g. flat on their back on a flat, hard surface) or to perform compressions. Callers expressing tiredness or exhaustion from performing compressions were subcategories of bystander physical ability.
Patient access	Patient access was defined by callers being unable to access the patient and perform CPR, being due to the patient being in a difficult position (e.g. wedged between two surfaces or objects), having no portable phone or the caller is not next to the patient.
Leaving the scene	Callers either seeking help from others (e.g. neighbours) or to retrieve an automated external defibrillator (AED), were categorised as leaving the scene, thus delaying CPR initiation.
Communication failure	Communication failure was defined as a breakdown in communication between the caller and the call-taker, through a lack of understanding, language barriers, telecommunication issues, or a chaotic on-scene environment.
Caller distractions	Caller distractions were where the caller hindered the flow of the call through inattention given to the call-taker, e.g. relaying information to other bystanders, hanging up, performing other tasks or not listening to the call-taker

(OR = 0.51, 95% CI = 0.28–0.94) immediate B-CPR was less likely to be initiated; as were calls involving older patients (OR = 0.59, 95% CI = 0.35–0.99).

Multivariable model

After adjusting for all barriers and case characteristics in the multivariable model, callers perceiving that CPR is inappropriate was the only independently significant barrier (Table 3). If the caller expressed doubts about the appropriateness of performing resuscitation, then B-CPR was less likely to occur immediately (AOR = 0.20, 95% CI = 0.11–0.37). Bystander-witnessed OHCAs (compared to unwitnessed arrests) were more likely to have immediate B-CPR initiated (AOR = 2.88, 95% CI = 1.48–5.60). No other factors were statistically significantly associated with B-CPR initiation.

B-CPR continuation

Univariable model

The models of the univariable and multivariable effect of the eight barriers on CPR continuation until EMS arrival for callers who initiated B-CPR (n = 205) are shown in Table 4. Unadjusted models showed that caller distractions (such as the caller is asked to perform another task, or the caller is providing instructions to other bystanders) occurring after CPR was initiated by the caller, reduced the likelihood of CPR continuing until EMS arrival (OR = 0.19, 95% CI = 0.08–0.43). If multiple bystanders were present B-CPR was more likely to continue till EMS arrival (OR = 4.36, 95% CI = 1.92–9.94).

Multivariable model

Only one of the eight barriers was significantly associated with B-CPR continuation after adjustment for all barrier categories and case characteristics in the multivariable model. Caller distractions had a negative association with B-CPR continuing to EMS arrival (AOR = 0.27, 95% CI = 0.10–0.73) (Table 4). None of the case characteristics were significantly associated with B-CPR continuation.

Discussion

In this study, we estimated the independent effects of eight predefined barriers on callers' immediate initiation and continuation of CPR. When adjusted for other barriers and case characteristics, callers perceiving that resuscitation was inappropriate was associated with decreased likelihood of callers initiating CPR immediately and caller distractions were likely to cause callers to stop performing CPR prior to EMS arrival. OHCA witness status was significantly associated with CPR initiation, with bystander witnessed arrests more likely to have callers initiate CPR immediately.

OHCA calls present challenges for call-takers, due to the sudden and alarming nature of cardiac arrest and the necessity of persuading callers to perform B-CPR.[24] While the call-takers goal is to have bystanders perform CPR and continue doing so until EMS arrives on scene, understanding the relationship that potential barriers have on immediate CPR initiation and continuation can assist call-takers in their management of OHCA calls. We found that callers expressing doubts about the appropriateness of CPR were less likely to initiate B-CPR. Riou et al.,[21] found that when callers expressed that the patient was "dead and beyond help", call-takers were more likely to ask them if they wanted to perform CPR instead of issuing a command to perform CPR, potentially accounting for why callers' perception of appropriateness is a strong predictor of no CPR initiation. Call-takers' phrasing of questions and statements in the call can have significant impacts on the performance of B-CPR.[25,26] However, information about the strategies call-takers

Table 2 – Study cohort case characteristics and CPR initiation and continuation barrier categorisation.

Case characteristics (N = 295)	N (%)
Call-taker sex	
Male	80 (27%)
Female	215 (73%)
Bystander sex	
Male	103 (35%
Female	192 (65%)
Patient sex	
Male	203 (69%)
Female	92 (31%)
Mean patient age (SD)	65 (19.5)
<64 years old	164 (56%)
≤65 years old	131 (44%)
Patient relationship to bystander	
Relative	195 (66%)
Colleague/Friend	59 (20%)
Stranger	36 (12%)
Relationship unknown	5 (2%)
Calling from	
Landline	53 (18%)
Mobile	237 (80%)
Unknown	5 (2%)
Location of arrest	
Private	249 (84%)
Public	25 (8%)
Residential/Nursing Facility	21 (7%)
Multiple bystanders on scene	
No (1 bystander)	126 (43%)
Yes (2 + bystanders)	169 (57%)
OHCA witness status	
Bystander-witnessed	126 (43%)
Unwitnessed	169 (57%)
EMS response time	
≤5mins	18 (6%)
>5mins	277 (94%)
Patient outcomes	
ROSC any	41 (14%)
Patient survival 30 days post OHCA	17 (6%)
Bystander CPR was performed	205 (69%)
Bystander CPR continued till EMS arrival	175 (85%)
AED applied	17 (6%)
Barriers occurring within the call[1]	
Bystander physical ability	191 (65%)
Communication failure	160 (54%)
Emotional distress	137 (46%)
Perceptions of CPR inappropriateness	133 (45%)
Caller distractions	80 (27%)
Caller reluctance	75 (26%)
Patient access	35 (12%)
Leaving the scene	17 (6%)

[1] Multiple types of barriers may have been identified in individual calls.

use or have at their disposal to encourage callers to perform CPR is limited. Further understanding of how call-takers navigate different scenarios to promote CPR performance and continuation is needed to enable integration into training programs.

Our study found that the caller distraction barrier was the only independent factor associated with callers stopping CPR prior to EMS arrival on scene. Caller distractions can arise from the order in which call-takers ask callers to perform tasks, with the most prevalent being callers asked to perform another task as part of pre-arrival instructions, such as unlocking the entrance door.[10] The call-taker shares these instructions with the caller usually towards the end of the call when the ambulance is close by, however, it is call-dependent and sometimes call-takers ask callers to quickly open the front door or put pets away before commencing CPR. The order and timing of instructions is largely prompted by the emergency call script, however call-takers in our study appeared to judge each situation and re-arrange if appropriate. For example, if there were significant barriers impeding CPR initiation, callers were often asked to prepare the property for EMS arrival and then asked again if they were willing or able to initiate CPR. This flexibility in the call-taker script enabled call-takers to judge what is appropriate for each caller and each scene. To maximise OHCA patients' chances of survival, it is best that CPR be performed as soon as possible.[2] However for OHCAs that occur at private locations with a solo rescuer, initiating CPR and preparing for EMS arrival could be argued to compete for priority. Is it better to initiate CPR and then pause to prepare for EMS arrival or ask the caller to unlock/open the front door and put pets away prior to initiating CPR? Either order of instructions potentially impacts on the chain of survival. Preparing for EMS arrival too late could result in delays to advanced resuscitation, whereas each minute delayed in CPR initiation is associated with decreased odds of patient survival.[27]

Limitations

There are several potential limitations of this study. First, the cohort utilised a modest sample size (N = 295), with some barrier categories having less than 30 cases. Thus, our ability to detect statistical effects for some barrier categories may have been compromised by reduced statistical power. Unfortunately, it was not possible to expand the sample size due to the intensive nature of coding calls relative to our available resources. Analysis of barriers and facilitators to CPR involves considering many factors, and the ability to separate the statistical effects of these factors may benefit from analysing a larger dataset for increased statistical power. Secondly, in this study we have reduced the barriers that occurred in the calls into eight categories. Whilst this facilitated analyses, and there was consensus amongst the authors about the categorisation, we acknowledge that other authors might have classified the groups differently. Finally, the data used in this study are from a single EMS, which uses MPDS for triaging emergency calls. Therefore, some aspects of our findings may not be applicable to other EMS that utilise different call triage and scripting protocols. This study uses a cohort of calls placed in an Australian setting, where English is the primary language, therefore the findings may differ in settings where English is not the primary language, and it would be worth repeating a similar study to examine if the same results are found in a non-English setting.

Conclusion

When callers perceived that resuscitation was inappropriate, CPR was less likely to be initiated. If callers were distracted while performing CPR, either through being directed to perform another task, or providing instructions to other bystanders, CPR was less likely to continue till EMS arrival. Witnessed status of OHCA arrests was the only case characteristic significantly associated with immediate CPR initiation, with bystander witnessed arrests increasing callers' likelihood of initiating CPR prior to EMS arrival. Understanding how

Table 3 – Crude and adjusted associations between the eight pre-defined barriers and case characteristics and CPR initiation.

Barriers	N	CPR initiated (N = 205)	CPR not initiated (n = 90)	P value	Univariable odds ratio (95% CI)	Adjusted odds ratio (95% CI)
Bystander ability						
Barrier present	171	126 (43%)	45 (15%)	0.07	1.60 (0.97, 2.63)	1.58 (0.86, 2.92)
Barrier not present	124	79 (27%)	45 (15%)		*reference category*	
Caller distractions						
Barrier present	46	32 (11%)	13 (4%)	0.80	1.20 (0.55, 2.20)	0.94 (0.41, 2.17)
Barrier not present	249	172 (58%)	77 (26%)		*reference category*	
Caller reluctance						
Barrier present	48	27 (9%)	21 (7%)	0.03	**0.50 (0.26, 0.94)**	0.49 (0.22, 1.07)
Barrier not present	247	178 (60%)	69 (23%)		*reference category*	
Communication failure						
Barrier present	154	114 (39%)	40 (14%)	0.08	1.57 (0.95, 2.58)	1.48 (0.79, 2.76)
Barrier not present	141	91 (31%)	50 (17%)		*reference category*	
Emotional						
Barrier present	122	79 (27%)	43 (15%)	0.14	0.69 (0.42, 1.13)	0.93 (0.49, 1.77)
Barrier not present	173	126 (43%)	47 (16%)		*reference category*	
Leaving the scene						
Barrier present	16	12 (4%)	4 (1%)	0.62	1.34 (0.42, 4.26)	3.29 (0.82, 13.28)
Barrier not present	279	193 (65%)	86 (29%)		*reference category*	
Patient access						
Barrier present	35	21 (7%)	14 (5%)	0.20	0.62 (0.30, 1.28)	0.44 (0.17, 1.12)
Barrier not present	260	184 (62%)	76 (26%)		*reference category*	
Perceived inappropriateness						
Barrier present	121	59 (20%)	62 (21%)	<0.001	**0.18 (0.11, 0.31)**	**0.20 (0.11, 0.37)**
Barrier not present	174	146 (49%)	28 (9%)		*reference category*	
Case characteristics						
Call taker sex						
Female	215	149 (51%)	66 (22%)	0.91	0.97 (0.55, 1.69)	1.02 (0.53, 1.96)
Male	80	56 (19%)	56 (19%)		*reference category*	
Bystander sex						
Female	192	132 (45%)	60 (20%)	0.71	0.90 (0.54, 1.53)	0.95 (0.49, 1.86)
Male	103	73 (25%)	30 (10%)		*reference category*	
Patient sex						
Female	94	66 (22%)	28 (9%)	0.85	1.05 (0.62, 1.79)	1.28 (0.65, 2.54)
Male	201	139 (47%)	62 (21%)		*reference category*	
Patient age						
>65	164	106 (65%)	70.46 (17.62)	0.04	**0.59 (0.35, 0.99)**	0.59 (0.31, 1.12)
≤65	131	99 (34%)	32 (11%)		*reference category*	
Relationship						
Non-relative	102	80 (27%)	22 (7%)	0.02	**1.98 (1.13, 3.45)**	1.33 (0.60, 2.97)
Relative	193	125 (42%)	68 (23%)		*reference category*	
Location						
Public	46	41 (14%)	5 (2%)	0.002	**4.25 (1.62, 11.15)**	2.77 (0.82, 9.34)
Private	249	164 (56%)	85 (29%)		*reference category*	
Phone type[1]						
Landline	53	30 (10%)	23 (8%)	0.03	**0.51 (0.28, 0.94)**	0.47 (0.21, 1.06)
Mobile	238	171 (58%)	67 (23%)		*reference category*	
Multiple bystanders on scene						
Yes (2 + bystanders)	169	130 (44%)	39 (13%)	0.001	**2.27 (1.37, 3.75)**	1.78 (0.95, 3.32)
No (1 bystander)	126	75 (25%)	51 (17%)		*reference category*	
Witness status						
Bystander-witnessed	126	101 (34%)	25 (8%)	<0.001	**2.53 (1.48, 4.32)**	**2.88 (1.48, 5.60)**
Unwitnessed arrest	169	104 (35%)	65 (22%)		*reference category*	
Response time in minutes						
≥5 mins	277	195 (70%)	10.47 (5.35)	0.19	0.99 (0.94, 1.04)	0.98 (0.92, 1.04)
<5 mins	18	10 (3%)	8 (3%)		*reference category*	

Note: Results that are statistically significant are bolded.

[1] Phone type was not identified in four cases.

Table 4 – Crude and adjusted associations between the eight pre-defined barriers and case characteristics and CPR continuation until EMS arrival – for cases where CPR was initiated.

Barriers	N	CPR continued to EMS arrival (N = 175)	CPR stopped prior to EMS arrival (N = 30)	P value	Univariable odds ratio (95% CI)	Adjusted odds ratio (95% CI)
Bystander ability						
Barrier present	58	46 (26%)	12 (40%)	0.12	0.54 (0.24, 1.20)	0.47 (0.18, 1.23)
Barrier not present	147	129	18		*reference category*	
Caller distractions						
Barrier present	43	28 (16%)	15 (50%)	<0.001	**0.19 (0.08, 0.43)**	**0.27 (0.10, 0.73)**
Barrier not present	162	147	15		*reference category*	
Caller reluctance						
Barrier present	32	30 (17%)	2 (7%)	0.14	2.90 (0.65, 12.82)	1.79 (0.35, 9.15)
Barrier not present	173	28	145		*reference category*	
Communication failure						
Barrier present	23	22 (13%)	1 (3%)	0.14	4.17 (0.54, 32.16)	4.18 (0.44, 39.71)
Barrier not present	182	153	24		*reference category*	
Emotional						
Barrier present	53	42 (24%)	11 (37%)	0.14	0.55 (0.24, 1.24)	0.57 (0.19, 1.71)
Barrier not present	152	133	19		*reference category*	
Leaving the scene						
Barrier present	2	1 (1%)	1 (3%)	0.272	0.17 (0.01, 2.74)	0.31 (0.01, 9.61)
Barrier not present	203	174	29		*reference category*	
Patient access[1]						
Barrier present	0	0	0		Not estimable	
Barrier not present	205	175	30			
Perceived inappropriateness						
Barrier present	18	13 (7%)	5 (17%)	0.10	0.40 (0.13, 1.22)	0.46 (0.11, 1.92)
Barrier not present	187	162	25		*reference category*	
Case characteristics						
Call taker sex						
Female	149	127 (73%)	22 (73%)	0.93	0.96 (0.40, 2.31)	1.23 (0.44, 3.41)
Male	56				*reference category*	
Bystander sex						
Female	132	109 (62%)	23 (77%)	0.13	0.50 (0.20, 1.24)	0.84 (0.28, 2.49)
Male	73	66	7		*reference category*	
Patient sex						
Female	66	60 (34%)	6 (20%)	0.12	2.09 (0.81, 5.38)	2.07 (0.66, 6.51)
Male	139	115	24		*reference category*	
Patient age						
>65	106	92 (88%)	14	0.55	1.27 (0.58, 2.75)	0.98 (0.35, 2.79)
≤65	99	83	16		*reference category*	
Relationship						
Non-relative	80	72 (41%)	8 (27%)	0.13	1.92 (0.81, 4.56)	1.58 (0.41, 6.18)
Relative	125	103	22		*reference category*	
Location						
Public	41	36 (21%)	5 (17%)	0.62	1.30 (0.46, 3.62)	3.97 (0.075, 2.10)
Private	164	139	25		*reference category*	
Phone type[2]						
Landline	30	26 (15%)	4 (13%)	0.85	1.11 (0.36, 3.46)	1.43 (0.33, 6.16)
Mobile	171	146	25		*reference category*	
Multiple bystanders on scene						
Yes (2 + bystanders)	130	120 (69%)	10 (33%)	<0.001	**4.36 (1.92, 9.94)**	2.68 (0.91, 7.88)
No (1 bystander)	75	55	20		*reference category*	
Witness status						
Bystander witnessed	101	85 (49%)	16 (53%)	0.63	0.83 (0.38, 1.8)	2.82 (0.46, 2.92)
Unwitnessed arrest	104	90	14		*reference category*	
Response time in minutes						
≥5mins	195	168 (88%)	9.16 (3.38)	0.16	1.08 (0.97, 1.2)	1.16 (0.54, 14.59)
<5mins	10	7	3		*reference category*	

Note: Results that are statistically significant are bolded.

[1]No callers experienced a patient access barrier after CPR initiation, hence analysis is not possible.

[2]Phone type was not identified in four cases.

barriers impact CPR initiation and continuation may enable call-takers to tailor their instructions to callers, assist callers in overcoming barriers, reducing delays to CPR initiation and ensuring CPR is performed until EMS arrival. Further research is needed to understand how call-takers navigate barriers to CPR performance and encourage callers to inform training and support for call-takers.

CRediT authorship contribution statement

Emogene S Aldridge: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Visualization, Writing – original draft. **Stephen Ball:** Conceptualization, Data curation, Methodology, Supervision, Writing – review & editing. **Tanya Birnie:** Data curation, Writing – review & editing. **Nirukshi Perera:** Writing – review & editing. **Austin Whiteside:** Data curation, Writing – review & editing. **Janet Bray:** Writing – review & editing. **Judith Finn:** Conceptualization, Methodology, Supervision, Writing – review & editing.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Three authors are affiliated with St John WA: JF (Adjunct Research Professor and recipient of research funding), SB (Adjunct Research Fellow), AW (SJ-WA Operations Manager). JB is an Editor with Resuscitation Plus.

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