Home is where the heart is: the case for mobile defibrillators to improve out-of-hospital cardiac arrest survival

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Rapid defibrillation is vital in out-of-hospital cardiac arrest (OHCA) treatment. In Aotearoa New Zealand, trained responders dispatched by the 111 system (emergency medical services [EMS], Fire and Emergency New Zealand [FENZ] and dispatched first response groups) with defibrillators reach a patient in cardiac arrest an average of 8 minutes after a 111 call in urban areas and 11 minutes in rural areas.[1] However, odds of survival drop dramatically after a delay to defibrillation of only 2 to 5 minutes after collapse.[2–4]

Public access defibrillators have fallen short of expectations for addressing this gap in care, despite continued investment and technological improvements.[5] In Aotearoa, approximately 6% of OHCA patients are defibrillated by a bystander prior to EMS arrival, mirroring low rates of public defibrillator use worldwide.[1] In Aotearoa, female sex, Māori ethnicity and rural location are each associated with lower odds of bystander defibrillation and reduced 30-day survival.[1]

Importantly, the majority of cardiac arrests occur in the home,[1] yet static public access defibrillators save very few lives when placed in residential areas.[4] In Denmark, the probability of bystander defibrillation was five times lower when an arrest occurred in a private residence compared with a public location, even when a defibrillator was fewer than 100m away, with a rapid decrease in likelihood when a defibrillator was further away for either location type.[6]

GoodSAMs are smartphone-activated community responders who have knowledge of cardiopulmonary resuscitation (CPR) and automated external defibrillator (AED) application. In Aotearoa, at least one GoodSAM alert was accepted in 43% of all OHCA events in 2024/2025.[1] The GoodSAM mobile application includes a map of public access AED locations.

As portable and ultraportable AEDs become more easily available, the prospect of "mobile" defibrillators carried by an alerted responder have been increasingly considered as an alternative to underused static public access defibrillators. A scoping review by The International Liaison Committee on Resuscitation (ILCOR) in 2024 found no published evidence about ultraportable AEDs,[7] but a trial is currently underway in Australia and Aotearoa to evaluate the potential impact of these AEDs when carried by GoodSAM responders.[8]

In Aotearoa, the relationship between OHCA location and the likelihood of community interventions has not previously been examined. This study aims to compare the proportion of OHCA patients who were attended by a GoodSAM responder or who received bystander CPR and/or defibrillation, stratified by arrest location (public vs home), and to determine factors associated with likelihood of bystander defibrillation for home arrests.

Methods

This retrospective observational study analysed all OHCA events in the Aotearoa New Zealand Paramedic Care Collection (ANZPaCC) over 1 year from 1 July 2024 to 30 June 2025. Ethics approval was granted by the Northern B Health and Disability Ethics Committee (ANZPaCC, 2022 FULL 13415). ANZPaCC includes patient and emergency ambulance data, linked to National Health Index records.[9]

OHCA events witnessed by ambulance personnel, occurring in aged residential care or healthcare facilities, or where resuscitation was not attempted by ambulance personnel, were excluded.

Variables

Ethnicity was prioritised according to national Ethnicity Data Protocols.[10] Rurality of the incident location was classified according to the 2018 Geographic Classification for Health,[11] and patient address was used to estimate relative socio-

economic deprivation using the New Zealand Index of Deprivation 2023 (NZDep2023).[12]

Event characteristics (OHCA aetiology, arrest witnessed, initial cardiac rhythm) and community interventions (bystander CPR or defibrillation) are recorded by ambulance personnel in the clinical record. Mobile application data were used to determine events where at least one GoodSAM responder accepted an OHCA alert.

Analysis: full cohort

Patient demographics, event characteristics and community interventions were compared between OHCA cases occurring in residential (home) versus public settings using the Pearson Chi-squared test for categorical variables and the Mann–Whitney U test for age.

Sub-group analysis: home-based OHCA

Binary logistic regression was used to calculate the adjusted odds of community defibrillation in home-based OHCA stratified by GoodSAM acceptance (≥1 accepted alert vs no acceptance), witness status (bystander witnessed vs unwitnessed), ethnicity (Māori vs non-Māori), rurality (rural vs urban) and sex (female vs male). All statistical analyses were conducted using IBM SPSS Statistics (Version 30.0), with a significance threshold set at $p<0.05$.

Results

Among the 2,420 OHCA events, 1,842 (76%) occurred at home (Table 1). Compared to public arrests, these patients were older (median years: 66 vs 62, $p<0.001$) and more likely to be female, with a higher proportion of unwitnessed arrests (51% vs 35%, $p<0.001$) and non-shockable initial rhythms (68% vs 44%, $p<0.001$).

An accepted GoodSAM alert was recorded in 43% of the included OHCA events, with similar acceptance rates for home and public OHCA ($p=0.842$).

OHCA occurring at home had lower rates of bystander CPR (73% vs 84%, $p<0.001$) and defibrillation (2% vs 15%, $p<0.001$).

Sub-group analysis

The adjusted odds of community defibrillation in home-based OHCA were 3.8 times higher in the cohort with at least one accepted GoodSAM alert (95% confidence interval [CI]: 1.8–8.2, adjusted for age, sex, socio-economic deprivation, witness status and ethnicity) (Figure 1). Community defibrillation in home-based OHCA was significantly less likely among Māori (adjusted odds ratio [OR]=0.2, 95% CI: 0.0–0.8) and females (adjusted OR=0.3, 95% CI: 0.1–0.7) compared with non-Māori and males respectively.

Discussion

The observed proportion of OHCA occurring in the home (76%) is broadly consistent with other international registry studies.[13,14] Home arrests were associated with female sex and the poor prognostic indicators of older age, unwitnessed arrest and non-shockable initial rhythms. These patients received bystander CPR and community defibrillation less frequently compared with those who experienced OHCA in public locations but were equally likely to have an accepted GoodSAM alert.

Among home-based OHCA events, there was a higher likelihood of community defibrillation when at least one GoodSAM responder accepted the alert.

Our results are consistent with international research suggesting public access AEDs do not reach the majority of cardiac arrests, particularly when they occur in private residences.[6] However, though only 5% of OHCA patients in our study were defibrillated prior to ambulance arrival, nearly half of all arrests had an alert accepted by a nearby GoodSAM responder.

GoodSAM alert acceptance was associated with 3.8 times increased likelihood of pre-EMS defibrillation for OHCA occurring at home. While the time period of this study overlapped with the FIRST trial, which provided ~400 of >12,000 registered GoodSAMs with portable AEDs up to March 2025,[8] defibrillation by a GoodSAM is typically dependent on access to a nearby public access defibrillator, whose access to the public is often time-bound or restricted and can consume valuable minutes to retrieve.[15,16] While public access defibrillators have been shown to save lives in areas with high concentrations of OHCA and bystanders, health benefits appear to diminish as more static defibrillators are placed.[17] Recommended full coverage of OHCA events with public access AEDs requires placement at least every 200m—a costly approach that is unlikely to be feasible even in metropolitan settings.[18] In contrast, GoodSAM responders in Aotearoa have an activation radius of 1km in urban areas and 5km in rural areas, suggesting that fewer AEDs would be required to achieve effective population coverage with a community

responder model of AED delivery.

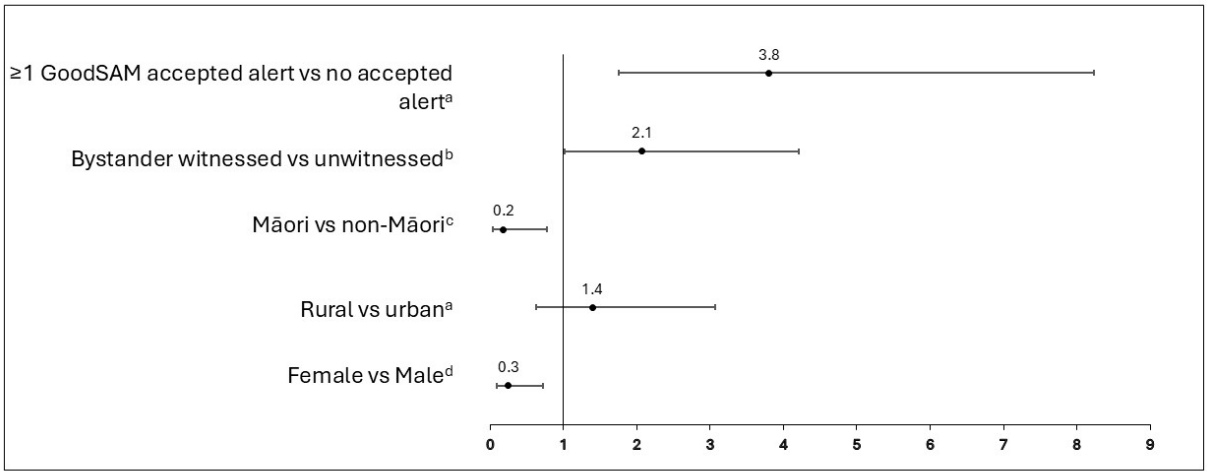
Longer response times are likely one of the contributors to lower 30-day survival rates in rural areas of Aotearoa.[1] As well as the increased importance of pre-EMS interventions when emergency services are delayed, the benefit of mobile over static defibrillators may have a larger impact in rural areas. In a study in the United States of America, defibrillators carried by community responders in a private vehicle were 172 times more likely to be used than those that were placed in fixed locations in a rural community.[19] Notably, 33% of Māori aged over 65 reside in rural areas,[20] and Māori experiencing home-based OHCA had 80% lower odds of community defibrillation compared with non-Māori in this study. Mobile defibrillators in rural communities could therefore help reduce this inequality.

Mobile defibrillators may also help to address inequity in cardiac arrest survival for women,[1] who were over-represented in home-based OHCA and had lower odds of community defibrillation compared with males in home-based OHCA.

This study was not powered to examine complex associations between rurality, deprivation or ethnicity and location arrest and defibrillation likelihood, but these factors should be considered in deployment of mobile defibrillators. Data were restricted to routinely collected variables, and information such as whether defibrillators were public access or privately owned, whether they were applied to a patient but not discharged and confirmation of GoodSAM attendance on scene were not able to be captured.

In summary, home-based OHCA have lower rates of bystander CPR and defibrillation than OHCA occurring in public places, despite similar GoodSAM engagement. GoodSAM attendance markedly improves the likelihood of community defibrillation. Equipping GoodSAM responders with AEDs to reduce their reliance on static public access defibrillators could significantly improve community defibrillation rates.

Figure 1: Sub-group analysis of community defibrillation in home-based out-of-hospital cardiac arrest (OHCA) events.



a. Adjusted for age, sex, deprivation, ethnicity and witness status
b. Adjusted for age, sex, deprivation and ethnicity
c. Adjusted for age, sex, deprivation and witness status
d. Adjusted for age, deprivation, ethnicity and witness status

Table 1: Out-of-hospital cardiac arrest (OHCA) patient and event characteristics and community interventions in relation to arrest location.

		Total OHCA[a]		Home location		Public location		Pearson Chi-squared test/ Mann–Whitney U test *p*-value
		n	%	n	%	n	%	
Total cases		2,420	100%	1,842	76.1%	578	23.9%	
Patient demographics								
Age		Median (inter-quartile range [IQR])	65 (51–75)	Median (IQR)	66 (52–77)	Median (IQR)	62 (49–71)	<0.001
Ethnicity	Māori	580	100%	454	78.3%	126	21.7%	0.279
	Pacific peoples	279	100%	218	78.1%	61	21.9%	
	Non-Maori/non-Pacific	1,541	100%	1,161	75.3%	380	24.7%	
	Missing data (residual/ non-stated)	20	0.8%					
Sex	Female	714	100%	610	85.4%	104	14.6%	<0.001
	Male	1,704	100%	1,230	72.2%	474	27.8%	
	Missing data	2	0.1%					
Rurality	Urban	1,688	100%	1,287	76.2%	401	23.8%	0.834
	Rural	583	100%	442	75.8%	141	24.2%	
	Missing data	149	6.2%					
New Zealand Deprivation Quintile	1	314	100%	232	73.9%	82	26.1%	0.131
	2	362	100%	275	76.0%	87	24.0%	
	3	412	100%	312	75.7%	100	24.3%	
	4	494	100%	386	78.1%	108	21.9%	
	5	742	100%	596	80.3%	146	19.7%	
	Missing data	96	4.0%					

Table 1 (continued): Out-of-hospital cardiac arrest (OHCA) patient and event characteristics and community interventions in relation to arrest location.

		Total OHCA[a]		Home location		Public location		Pearson Chi-squared test/ Mann–Whitney U test *p*-value
Event characteristics								
Aetiology	Presumed cardiac	1,908	78.8%	1,454	78.9%	454	78.5%	0.842
	Other	512	21.2%	388	21.1%	124	21.5%	
Witnessed	Bystander	1,277	52.8%	903	49.0%	374	64.7%	<0.001
	Unwitnessed	1,143	47.2%	939	51.0%	204	35.3%	
Initial rhythm	Shockable	898	38.1%	580	32.4%	318	55.7%	<0.001
	Non-shockable	1,462	61.9%	1,209	67.6%	253	44.3%	
	Missing data	60	2.5%					
Community interventions								
Bystander cardiopulmonary resuscitation	Yes	1,821	75.2%	1,336	72.5%	485	83.9%	<0.001
	No	599	24.8%	506	27.5%	93	16.1%	
GoodSAM accepted alert	Yes	1,048	43.3%	801	43.5%	247	42.7%	0.750
	No	1,372	56.7%	1,041	56.5%	331	57.3%	
Community defibrillation[b]	Yes	125	5.2%	37	2.0%	88	15.2%	<0.001
	No	2,295	94.8%	1,805	98.0%	490	84.8%	

[a] OHCA defined as out-of-hospital cardiac arrest where resuscitation was attempted by emergency medical services (EMS) or there was defibrillation prior to EMS arrival. EMS witnessed OHCA have been excluded. OHCA occurring in locations other than home or public have been excluded.
[b] Community defibrillation is defined as defibrillation before the arrival of EMS. EMS includes all dispatched responders (ambulance, Fire and Emergency New Zealand, police, etc.).

COMPETING INTERESTS
Authors HH, EG and SEM are paid employees of Hato Hone St John. AS is a paid employee of Wellington Free Ambulance.

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