

# Epidemiology of out-of-hospital cardiac arrests, NSW, 2012:

Time, place and person



Health

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# Introduction

Cardiac arrest is an important cause of sudden death in NSW. The aim of this report is to provide a preliminary analysis of the epidemiology of out-of-hospital cardiac arrests in NSW during 2012, in order to inform policy considerations related to placement of automatic external defibrillators (AEDs) in the community.

## Methods

### *Data sources*

Two NSW public health surveillance databases were used: the NSW Ambulance Service Dispatch Database, and the NSW Emergency Department Data Collection (EDDC). The Ambulance Service Dispatch Database contains information on all triple zero emergency calls to the Ambulance Service of NSW, and includes patient age and sex, where available, and details related to the call such as call date and time, call problem, call disposition, call location, and operator comments. The EDDC contains data for all patient presentations to more than 89 public hospital emergency departments in NSW, and captures approximately 89% of public hospital emergency department activity. It includes information on patient age and sex, and clinical details including date and time of patient presentation, triage category, provisional diagnosis, and status on departure from the emergency department.

### *Calls to the NSW Ambulance Service for cardiac or respiratory arrest or death*

Using data for the calendar year 2012, all triple zero calls to the NSW Ambulance Service that were assigned a problem within the chief complaint category 'Cardiac, respiratory arrest or death' were identified. This category may include death for many reasons other than sudden cardiac arrest, such as deaths that were expected due to a terminal illness. Calls for patients who were classified as 'deceased on examination' were included, and calls that were cancelled, such as duplicate calls, or where the patient was not transported for reasons other than 'deceased on examination' were excluded.

The location of each included incident was categorised in three ways:

1. by manually reviewing and classifying all calls where the call 'location name' field was completed. Calls with no location name, or where location type was not evident from the location name recorded, were categorised as 'Not stated'.
2. by using the land use category of the 2006 census mesh block of the call location. Call locations where a land use category could not be assigned were classified as 'Not stated'. A mesh block is the smallest geographic unit used by the Australian Bureau of Statistics (ABS) in its Australian Standard Geographic Classification (ASGC). It consists of approximately 30–60 households. Land use category is an indicator of the planned land use for a particular mesh block. The planned land use of the mesh block, therefore, will not always reflect the actual land use of the call address. For further information see: [www.abs.gov.au/ausstats/abs@.nsf/mf/1209.0.55.002](http://www.abs.gov.au/ausstats/abs@.nsf/mf/1209.0.55.002).
3. a consolidated location type was assigned by first using the manually assigned location type, and if that was not available, the census land use category.

Calls were further categorised according to the call disposition, patient age, sex, time of day, and day of the week, and the proportion of calls that occurred outside normal business hours (9.00 a.m. to 5.00 p.m. weekdays) was calculated.

### *Presentations to NSW emergency departments for cardiac arrest*

All unplanned presentations to 89 NSW public hospital emergency departments in the 2012 calendar year, assigned a provisional diagnosis of cardiac arrest, were extracted from the EDDC. The diagnosis codes used to define cardiac arrest were: International Classification of Diseases (ICD) version 9 code 427.5; ICD version 10 codes beginning with I46; and Systematised Nomenclature of Medicine Clinical Terminology (SNOMED-CT) concept IDs: 162710004, 16574001, 195085006, 195087003, 213213007, 213215000, 233926006, 233927002, 234172002, 24841007, 251189000, 261195002, 30298009,

309809007, 309810002, 397829000, 397912004, 410429000, 410430005, 410431009, 86152005, and 95281009.

Related conditions such as ventricular fibrillation were not included.

The presentations were categorised according to the patient's age, sex, mode of arrival, time of day, and day of the week, and the proportion of presentations that occurred outside normal business hours (9.00 a.m. to 5.00 p.m. weekdays) were calculated. Finally, the triage category and the patient's status on departure from the emergency department were examined.

## Results

### *Calls to the NSW Ambulance Service for cardiac or respiratory arrest or death*

In 2012, there were 8,965 triple zero calls to the NSW Ambulance Service that were assigned a problem within the chief complaint category 'Cardiac, respiratory arrest or death'. Of these, 2,440 were excluded because they represented dispatches that were cancelled or calls where the patient was not transported for reasons other than being deceased on examination. Thus, 6,525 calls were included in the analysis. Examples of reasons for call cancellation or non-transport were: duplicate calls, handling by other agencies, or where ambulance transport was declined or refused.

Of the 6,525 calls analysed, ambulance transport was not required for 3,851 calls (59%) because the patient was classified as deceased on examination by the ambulance team. The remaining patients, 2,613 (40%), were transported to hospital. Where sex was recorded, a larger proportion of calls were for male patients (3,976; 63%). Where age was recorded, over half of calls (3,188; 54%) were for patients aged 65 years and over. Another one-third of calls were for patients aged 35–64 years (1,956; 33%). The majority of calls occurred on weekdays (4,582; 70%) and between 6.00 a.m. and 6.00 p.m. regardless of weekday (4,421; 68%). More calls occurred outside business hours (4,422 calls; 68%) than during business hours (Table 1).

Call location was manually classified for 1,579 call records (24%) that had an incident 'location name' that could be classified. Thirteen records (0.2%) had location names that could not be classified. The remaining 4,933 call records (76%) did not have a location name recorded (Table 2).

When census mesh block land use categories were used to classify the location of the incident, 77% of incidents were classified as calls from residential areas (Table 3). When call location was assigned using a combination of location name and land use category, call locations included commercial locations (459; 7%), aged or disabled care facilities (400; 6%), and public or community areas (396; 6%, Table 4). Of the 3,851 calls where the patient was found deceased on examination by the ambulance team, 3,049 (79% of deceased patients) were located in a residential area (Table 5).

### *Cardiac arrest presentations to NSW public hospital emergency departments*

In 2012, there were 1,314 presentations to the 89 participating NSW public hospital emergency departments, which were assigned a provisional diagnosis of cardiac arrest. Most patients were assigned the most urgent triage category (medical urgency category)—category 1 (1,147; 87%).

Similar to the ambulance calls, 54% (716 presentations) were in persons aged 65 years or more. Patients aged 35–64 years accounted for another 36% (471 presentations). Males accounted for almost two-thirds (65%) (858 presentations). Most presentations occurred on weekdays (1,128; 86%) and between 6.00 a.m. and 6.00 p.m. regardless of weekday (801; 61%). More presentations occurred outside business hours (907; 69%) than during business hours (Table 6).

Of the 1,314 presentations, 795 patients (61%) either died in the emergency department or were deceased on arrival. The remaining patients, 447 (34%), were admitted to a ward, including a critical care ward. Most patients arrived by ambulance (1,191; 91%), but a small proportion arrived by private car (85; 6%, Table 7).

## Limitations

The best available categories representing cardiac arrests were identified from the NSW Ambulance Dispatch Database and the EDDC. The ambulance dispatch data provides the best available information about the location of the patient at the time of the call. However, these data are only able to provide limited information about cardiac arrests. For example, the number of presentations to emergency departments for cardiac arrest who arrived by ambulance (1,191, Table 7) was much smaller than the number of emergency calls for patients with cardiac or respiratory arrest or death who were transported by ambulance (2,613, Table 1). This most likely reflects a lack of specificity of this ambulance call category. The category 'cardiac or respiratory arrest or death' may include many patients who were assigned diagnoses other than cardiac arrest following assessment by emergency department staff. The ambulance call category is assigned using information from the caller and a structured questioning procedure aided by emergency management software. There is no direct clinical assessment of the patient at the time the emergency call information is recorded.

Further, the diagnosis of cardiac arrest in the EDDC is likely to be highly specific, as closely related conditions such as ventricular fibrillation are coded separately and were not included as part of this analysis. In addition, patients who are dead on arrival to an emergency department may not be included in the Emergency Department Data Collection. Finally, the difference may also be partially explained by the incomplete coverage of the Emergency Department Data Collection (89% of all NSW emergency department activity).

The lack of text description for the ambulance incident location name does not necessarily mean the call arose from a non-institutional residence, although the name of the building or institution would often be mentioned to the call operator if known. Census mesh block land use category is based on the planned use of the land, and therefore may not reflect the actual land use of the call address.

## Main findings

**A high proportion of patients attended by an ambulance team for 'cardiac or respiratory arrest or death' were already deceased**

- 59% of patients were deceased by the time of examination by the ambulance team.

**Immediate cardiac arrest-related mortality was high, even for patients able to present to an emergency department**

- 61% of patients who presented to an emergency department for cardiac arrest were deceased on arrival or died in the emergency department.

**Most ambulance attendances for 'cardiac or respiratory arrest or death' occurred:**

- in residential areas
- outside of business hours
- among persons aged 65 years and over.

## Acknowledgement

We would like to acknowledge Dr Sandra Muecke, Acting Director of Research, NSW Ambulance Service, for advice on interpretation of the ambulance dispatch data.

**TABLE 1**

Calls to the NSW Ambulance Service assigned the category 'Cardiac, respiratory arrest or death', excluding those that were cancelled and those where no transport occurred for reasons other than the patient being deceased on examination, NSW, 2012.

Category	Count	Per cent
<b>Call disposition</b>		
No transport, deceased on examination	3,851	59
Patient transported	2,613	40
Treated, patient deceased	27	0
Other	34	1
<b>Age</b>		
0–4 years	167	3
5–16 years	64	1
17–34 years	544	8
35–64 years	1,956	30
65–84 years	2,244	34
85 years and over	944	14
Not specified	606	9
<b>Sex</b>		
Male	3,976	61
Female	2,304	35
Not specified	245	4
<b>Day of week</b>		
Monday–Friday	4,582	70
Weekend	1,943	30
<b>Time of day</b>		
12:00–2:59 a.m.	357	5
3:00–5:59 a.m.	337	5
6:00–8:59 a.m.	1,072	16
9:00–11:59 a.m.	1,284	20
12:00–2:59 p.m.	1,008	15
3:00–5:59 p.m.	1,057	16
6:00–8:59 p.m.	801	12
9:00–11:59 p.m.	609	9
<b>Business hours</b>		
Non-working hours	4,422	68
Working hours (Mon–Fri, 9.00 a.m.–5.00 p.m.)	2,103	32
Total	6,525	100

Source: NSW Ambulance Dispatch Database, NSW Ambulance Service, and the NSW Emergency Department and Ambulance Surveillance System, Centre for Epidemiology and Evidence, NSW Ministry of Health.

Notes: Call disposition 'Treated, patient deceased' includes patients that died during treatment or transport to an ED. Call disposition 'Other' includes calls that were transferred to other operations centres, 'Manual operations', 'Other agency assist only', 'Reassigned unit', 'Treated other unit transported', or 'Secondary triage trial'.

**TABLE 2**

Calls to the NSW Ambulance Service assigned the category 'Cardiac, respiratory arrest or death', excluding those that were cancelled and those where no transport occurred for reasons other than the patient being deceased on examination, by call location type manually assigned from location name, NSW, 2012.

Location type	Count	Per cent
<b>No location name recorded</b>	<b>4,946</b>	<b>76</b>
<b>Commercial</b>	<b>428</b>	<b>7</b>
Holiday accommodation	139	2
Commercial, not stated	97	1
Petrol station	6	0
<b>Aged or disabled residential care</b>	<b>400</b>	<b>6</b>
Residential hostel	143	2
Nursing home	129	2
Retirement village	128	2
<b>Residential</b>	<b>281</b>	<b>4</b>
<b>Public or community area</b>	<b>228</b>	<b>3</b>
Road, street, footpath or car park	180	3
Sporting club or facility	76	1
Food, club or pub	65	1
Shopping centre or centre car park	43	1
Church	14	0
Police station	10	0
Public or community building	8	0
<b>Hospital or medical facilities</b>	<b>77</b>	<b>1</b>
<b>Parkland</b>	<b>73</b>	<b>1</b>
<b>Transport</b>	<b>53</b>	<b>0</b>
Train station	35	0
Airport	18	0
<b>Water</b>	<b>19</b>	<b>0</b>
Beach	9	0
River or lake	5	0
Other or not stated	5	0
<b>Education facility</b>	<b>18</b>	<b>0</b>
<b>Correctional facility</b>	<b>16</b>	<b>0</b>
<b>Other</b>	<b>4</b>	<b>0</b>
Total	6,525	100

Source: NSW Ambulance Dispatch Database, NSW Ambulance Service, and the NSW Emergency Department and Ambulance Surveillance System, Centre for Epidemiology and Evidence, NSW Ministry of Health.

Notes: Of the 6,525 calls included in the analyses, there were 1,579 calls (24% of calls analysed) for which a location type could be manually assigned from the information in the 'location name' field. The remaining calls, which either had missing or non-informative location name information, were classified 'No location name recorded' (n = 4,946; 76% of calls analysed).

**TABLE 3**

Calls to the NSW Ambulance Service assigned the category 'Cardiac, respiratory arrest or death', excluding those that were cancelled and those where no transport occurred for reasons other than the patient being deceased on examination, by call location type assigned from land use category of the 2006 census mesh block of the call address, NSW, 2012.

Land use category	Count	Per cent
Residential	5,012	77
Commercial	449	7
Agricultural	447	7
Parkland	361	6
Industrial	110	2
Education	84	1
Hospital or medical facilities	25	0
Transport	21	0
Water	3	0
Not able to be classified	13	0
Total	6,525	100

Source: NSW Ambulance Dispatch Database, NSW Ambulance Service, and the NSW Emergency Department and Ambulance Surveillance System, Centre for Epidemiology and Evidence, NSW Ministry of Health.

Note: A mesh block is currently the smallest geographic unit used by the Australian Bureau of Statistics (ABS). A mesh block consists of 30–60 households. Land use category is an indicator of the planned land use for a particular mesh block. The planned land use of the mesh block, therefore, will not always reflect the actual land use of the call address. For more information, see: [www.abs.gov.au/ausstats/abs@.nsf/mf/1209.0.55.002](http://www.abs.gov.au/ausstats/abs@.nsf/mf/1209.0.55.002).



**TABLE 4**

Calls to the NSW Ambulance Service assigned the category 'Cardiac, respiratory arrest or death', excluding those that were cancelled and those where no transport occurred for reasons other than the patient being deceased on examination, by call location type assigned from either location name where available or alternatively from the land use category of the 2006 census mesh block of the call address, NSW, 2012.

<b>Location type</b>	<b>Count</b>	<b>Per cent</b>
<b>General residential</b>	<b>4,482</b>	<b>69</b>
<b>Commercial or industrial</b>	<b>459</b>	<b>7</b>
Commercial or industrial, not specified	314	5
Holiday accommodation	139	2
Petrol station	6	0
<b>Aged or disabled residential care</b>	<b>400</b>	<b>6</b>
Residential hostel	143	2
Nursing home	129	2
Retirement village	128	2
<b>Public or community area</b>	<b>396</b>	<b>6</b>
Road, street, footpath or car park	180	3
Sporting club or facility	76	1
Food, club or pub	65	1
Shopping centre or centre car park	43	1
Church	14	0
Police station	10	0
Public or community building	8	0
<b>Agricultural</b>	<b>285</b>	<b>4</b>
<b>Parkland</b>	<b>248</b>	<b>4</b>
<b>Hospital or medical facilities</b>	<b>83</b>	<b>1</b>
<b>Education facility</b>	<b>66</b>	<b>1</b>
<b>Transport</b>	<b>59</b>	<b>1</b>
Train station	35	0
Airport	18	0
Other, not specified	6	0
<b>Water</b>	<b>20</b>	<b>0</b>
Beach	9	0
River or lake	5	0
Other or not specified	6	0
<b>Correctional facility</b>	<b>16</b>	<b>0</b>
<b>Other or not able to be classified</b>	<b>11</b>	<b>0</b>
Total	6,525	100

Source: NSW Ambulance Dispatch Database, NSW Ambulance Service, and the NSW Emergency Department and Ambulance Surveillance System, Centre for Epidemiology and Evidence, NSW Ministry of Health.

**TABLE 5**

Calls to the NSW Ambulance Service assigned the category 'Cardiac, respiratory arrest or death', for calls where the patient was classified as deceased by the ambulance team, by residential or non-residential location types, NSW, 2012.

<b>Residential status</b>	<b>Count</b>	<b>Per cent</b>
Residential	3,049	79
Non-residential	796	21
Not stated	6	0
Total	3,851	100

Source: NSW Ambulance Dispatch Database, NSW Ambulance Service, and the NSW Emergency Department and Ambulance Surveillance System, Centre for Epidemiology and Evidence, NSW Ministry of Health.

Note: Residential locations include location type 'Residential' that were assigned using a combination of location name and land use categories of the 2006 census mesh block of the call address (Table 4).

**TABLE 6**

Total numbers of emergency department presentations assigned a provisional diagnosis of cardiac arrest, by patient's age, sex, and day and time of presentation, 89 NSW public hospitals, 2012.

Category	Count	Per cent
<b>Age</b>		
0–4 years	41	3
5–16 years	16	1
17–34 years	72	5
35–64 years	471	36
65–84 years	533	40
85 years and over	183	14
Not specified	1	0
<b>Sex</b>		
Male	858	65
Female	459	35
<b>Day of week</b>		
Monday–Friday	1,128	86
Weekend	189	14
<b>Time of day</b>		
12:00–2:59 a.m.	101	8
3:00–5:59 a.m.	72	5
6:00–8:59 a.m.	150	11
9:00–11:59 a.m.	235	18
12:00–2:59 p.m.	209	16
3:00–5:59 p.m.	207	16
6:00–8:59 p.m.	202	15
9:00–11:59 p.m.	141	11
<b>Business hours</b>		
Non-working hours	907	69
Working hours (Mon–Fri 9.00 a.m.–5.00 p.m.)	410	31
Other or not able to be classified	11	0
Total	1,314	100 %

Source: NSW Emergency Department Data Collection (HOIST and SAPHaRI), Centre for Epidemiology and Evidence, NSW Ministry of Health.

**TABLE 7**

Emergency department presentations assigned a provisional diagnosis of cardiac arrest, by mode of arrival and departure status, 89 NSW public hospitals, 2012.

Category	Count	Per cent
<b>Mode of arrival</b>		
NSW Ambulance Service	1,191	91
Private car	85	6
Other or not stated	38	3
<b>Departure status</b>		
Admitted, died in the ED	769	59
Admitted to a critical care ward	257	20
Admitted, other	190	14
Departed from the ED	35	3
Dead on arrival#	26	2
Other or not stated	37	3
<b>Total</b>	<b>1,314</b>	<b>100</b>

# May be incomplete.

Source: NSW Emergency Department Data Collection (HOIST and SAPHaRI), Centre for Epidemiology and Evidence, NSW Ministry of Health.

Notes: Mode of arrival 'Other or not stated' includes arrival by helicopter, air ambulance and retrieval. Departure status 'Other or not stated' includes transfer to another hospital and patient leaving at own risk.



