

# Cardiac arrest resuscitation policies and practices: a survey of Australian hospitals

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THE MAJOR DETERMINANT of survival from cardiac arrest has been consistently shown to be time from collapse to defibrillation, both in-hospital<sup>1</sup> and out-of-hospital.<sup>2</sup> Within the hospital setting, it is usually a nurse who is the first “on-the-scene” in the event of a cardiac arrest. For this reason, the Australian Resuscitation Council<sup>3</sup> and the American Heart Association<sup>4</sup> have recommended early defibrillation programs for non-physician, in-hospital responders. Such a mandate has been made more feasible by the development of automated external defibrillators (AEDs; also known as semi-automatic or shock-advisory external defibrillators [SAEDs]), with which it is no longer necessary for the operator to be able to recognise cardiac arrhythmias. AEDs are simple to use<sup>5</sup> and relatively inexpensive. Importantly, they have been shown to improve cardiac arrest survival in the out-of-hospital environment, even in the hands of lay people.<sup>6</sup>

Cardiopulmonary resuscitation (CPR) also remains an important component of the resuscitative effort, with considerable evidence that CPR “buys time” by maintaining a degree of cardiac output in the absence of a beating heart. In out-of-hospital cardiac arrest, it has been shown that the likelihood of the first recorded arrest rhythm being ventricular fibrillation is increased when CPR is performed.<sup>2,7</sup> However, CPR skill levels have been shown to degrade within a few months after training — even among healthcare professionals — so regular retraining and practice is commonly recommended.<sup>8</sup>

The aim of this study was to determine the policies and practices within Australian hospitals with respect to

## ABSTRACT

**Objective:** To describe the policy and practice relating to cardiopulmonary resuscitation (CPR) and defibrillation in cardiac arrest in Australian hospitals.

**Design:** Cross-sectional postal survey conducted in December 2001, using a semi-structured, four-page questionnaire.

**Participants:** Australian hospitals with more than 10 beds.

**Main outcome measures:** Type of defibrillator; provision of CPR/defibrillation training for healthcare professionals; hospital policy as to who can use the defibrillator.

**Results:** Of the 878 hospitals surveyed, 665 (76%) responded. All but one hospital indicated that CPR training was provided for nursing staff, with 12-monthly or more frequent updates; only 55% of hospitals (366) indicated that CPR training was provided for doctors. 21 of the 665 responding hospitals (3.2%) indicated that they did not have a defibrillator. 43% of hospitals had one or more defibrillators with shock advisory capacity (ie, automated external defibrillators [AEDs]). Of the 644 hospitals with defibrillators, 16% (101) indicated that registered nurses were not permitted to defibrillate; this included 9% of hospitals with AEDs.

**Conclusions:** The importance of CPR in cardiac arrest has been accepted by Australian hospitals, but the overwhelming evidence that “time to defibrillation” is the single most important determinant of cardiac arrest outcome seems less accepted. All Australian hospitals should review their resuscitation policies and practices to reflect this fact, with defibrillation by nurses, who are usually first on the scene, providing the best opportunity to minimise time to defibrillation.

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CPR and defibrillation. More specifically, we aimed to ascertain for Australian hospitals (i) the type of defibrillators (manual or AED) on-site, (ii) CPR and defibrillation training provided, (iii) who is permitted to use the defibrillators, (iv) whether routine data on cardiac arrest occurrence and outcomes are collected, and (v) issues encountered in relation to resuscitation policy/practice.

## METHODS

In December 2001, the Department of Public Health’s Survey Research Centre

at the University of Western Australia sent a semi-structured, four-page, reply-paid postal questionnaire to the “Director of Nursing” of rural and metropolitan hospitals throughout Australia. Hospitals’ postal addresses were obtained from the 2001 *Australian hospitals directory*,<sup>9</sup> which lists all Australian hospitals with more than 10 beds. A follow-up letter was sent 4 weeks later if no reply had been received.

The survey consisted of 12 questions relating to the hospitals’ resuscitation equipment, training, practices and policies. Most questions required a “yes” or “no” or “tick box” response to several pre-defined answers, but there was also provision for additional comments to be included. The questionnaire was piloted by nursing and medical staff at one teaching hospital in Perth.

On advice from the University of Western Australia Human Research Ethics Committee, the study did not

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### 1: Summary of responding hospital characteristics, percentage of hospitals with one or more automated external defibrillators, and percentage of hospitals where nurses are permitted to defibrillate

State	No. (%) of hospitals responding*	% Of surveyed hospitals located in major cities†	Bed numbers‡ (median [IQR])	% With automated external defibrillator§	% Of hospitals where nurses are permitted to defibrillate¶	% Of hospitals in major cities† where nurses are permitted to defibrillate¶
Australian Capital Territory	6/6 (100%)	100%	95 (25–232)	83%	100%	100%
New South Wales	209/293 (71%)	41%	55 (32–109)	31%	84%	71%
Northern Territory	3/6 (50%)	0	60 (na)	100%	100%	na
Queensland	121/168 (71%)	23%	55 (22–132)	47%	82%	71%
South Australia	81/101 (80%)	33%	41 (20–96)	49%	90%	85%
Tasmania	14/18 (78%)	0	97 (35–136)	15%	85%	na
Victoria	144/191 (75%)	48%	76 (40–168)	42%	78%	70%
Western Australia	86/95 (90%)	31%	47 (21–107)	69%	92%	87%
Total	664*	36%	59 (28–128)	44%	84%	75%

IQR = interquartile range. na = not applicable. The Australian Bureau of Statistics classifies both Hobart and Darwin as “Inner Regional Australia” rather than major cities.

\* State not known for one record. † As per Australian Bureau of Statistics remoteness classification. ‡ Bed numbers not known for 49 hospitals. § Percentage of the 643 hospitals with any defibrillator that have at least one automated external defibrillator. ¶ Percentage of the 643 hospitals with any defibrillator that permit nurses to defibrillate.

require ethics approval, as completing the questionnaires was voluntary and anonymous, and individual hospitals would not be identified.

#### Statistical analysis

Results are presented as both crude numbers and percentages of relevant subsets of the total number of hospitals that responded. Denominators vary if one or more values are missing for the variable(s) under consideration. SPSS version 11.0<sup>10</sup> was used to examine the univariate relationship between the two dependent variables (one or more AEDs, and nurses permitted to defibrillate), with independent categorical variables, such as Australian Bureau of Statistics remoteness category and state, using the Pearson  $\chi^2$  test, and with hospital bed numbers using the Mann–Whitney non-parametric test. Statistical significance was accepted at  $P < 0.05$ .

#### Qualitative data

Comments on the questionnaire were categorised into one of five groups: training issues, practice issues, equipment issues, ethical issues, or other issues. All comments were transcribed into a separate database and initially examined line by line to identify units of information. These were then grouped

together into categories with similar content. This is achieved through continuous comparison of the possible categories for each successive unit of information and, where necessary, developing a new category or collapsing others.

## RESULTS

Surveys were sent to 878 hospitals; 665 (76%) responded. Some of the “hospitals” listed in the directory were actually community health centres or administrative centres for regional health services, and it is not surprising that these did not respond. Responses received from institutions that were not hospitals were excluded from the analysis. The number of surveys posted and the response rate for each state and territory are shown in Box 1.

#### Hospital characteristics

Geographical location of hospitals was classified according to the Australian Bureau of Statistics (ABS) five categories of remoteness derived from the Accessibility/Remoteness Index of Australia (ARIA), and based on the post-code of the hospital.<sup>11</sup> The ABS categories are Major Cities of Australia, Inner Regional Australia, Outer

Regional Australia, Remote Australia, and Very Remote Australia.<sup>12</sup> As shown in Box 1, only 36% of the responding hospitals were located within “major cities” (as classified by the ABS). Hospital size in terms of number of beds was available for 94% of the hospitals surveyed, and ranged from 10 or fewer beds to 863. The mean number of beds was 104 (SD, 131) and nearly half (47%) had fewer than 50 beds. There was no statistically significant difference in response rate based on hospital size; 73% of hospitals with fewer than 100 beds responded, compared with 76% of hospitals with 100 or more beds ( $P = 0.36$ ).

#### CPR training

With the exception of one psychiatric hospital, all 665 responding hospitals provided CPR training for their nursing staff, with updates every 12 months or less. By contrast, only 55% of hospitals (366) indicated that CPR training was provided for medical officers. Several respondents commented that CPR training for medical staff was “offered, but refused”. Over 67% of hospitals provided CPR training for allied health staff, 60% for housekeeping staff, and 58% for clerical staff. CPR training for non-clinical staff in hospitals was more common outside the major cities.

## Defibrillation

Only 3.2% of hospitals (21) indicated that they did not have a defibrillator; these were mostly classified as rehabilitation, psychiatric or geriatric hospitals, although several also had “medical beds”. Forty-three per cent of hospitals indicated that they had one or more defibrillators with shock advisory capacity (ie, AEDs), while 50% had manual-only defibrillators. In 4% of cases the type of defibrillator was not stated. A statistically significant difference was found between the percentage of hospitals with AEDs across different Australian states or territories ( $\chi^2 = 48.3$ ; df, 7;  $P < 0.001$ ; see Box 1). No significant relationship was found between number of hospital beds or ABS remoteness category and the percentage of hospitals with AEDs.

## Nurses and defibrillation

Of the 644 hospitals with defibrillators, 16% (101) indicated that nurses were not permitted to defibrillate. Just over half (57%) of these 101 hospitals were located in major cities. There was some variation across different states or territories in the percentage of hospitals allowing nurses to defibrillate (see Box 1), but this difference did not reach statistical significance ( $\chi^2 = 12.4$ ; df, 7;  $P = 0.09$ ). A statistically significant difference was found in the percentage of nurses permitted to defibrillate in each of the ABS remoteness categories ( $\chi^2 = 23.6$ ; df, 4;  $P < 0.001$ ); thus Major City (75%), Inner Regional (89%), Outer Regional (91%), Remote (87%), Very Remote (87%). Nearly half of the hospitals where nurses were not permitted to defibrillate had fewer than 50 beds, making it unlikely that a medical officer would be on-site 24 hours a day. Within major city hospitals, the likelihood of nurses being able to defibrillate increased with the increasing number of beds (Mann-Whitney *U* test, 2892.5;  $P < 0.001$ ).

Of the 360 hospitals that had only manual defibrillators, 21% did not permit nurses to defibrillate. Of the 284 hospitals that indicated that they had an AED, 26 (9%) did not allow registered nurses to defibrillate. Of the 26 hospitals not allowing nurses to perform defibrillation, 50% were located in major

## 2: Summary of categories and additional comments on survey forms

### Training and skill retention (140 hospitals)

- Need for accessible and suitable ALS courses
- Problems with high staff turnover
- Problems with maintaining competency

### Resuscitation practice (158 hospitals)

- Confusion about differences between the guidelines of the Australian Resuscitation Council, the American Heart Association and the European Resuscitation Council
  - Nurses not permitted to defibrillate
  - AED use requiring ALS competency
  - Minimal staff numbers on duty
- ### Equipment issues (23 hospitals)
- Cost of AEDs prohibitive
  - Confusion about monophasic v biphasic defibrillators
  - Confusion about joules to use (differences in recommendations by different AED manufacturers)

### Ethics issues (13 hospitals)

- Not-for-resuscitation orders

### Policy and/or practice under review (49 hospitals)

- AED in process of being introduced in the hospital
- Resuscitation Coordinator being appointed
- MET being introduced

ALS = advanced life support; AED = automatic external defibrillator; MET = medical emergency team.

cities, 23% in inner regional centres, and 27% in outer regional/remote areas. Only 22% of hospitals with AEDs indicated that enrolled nurses were permitted to use the device.

Among hospitals that reported permitting nurses to defibrillate using AEDs, comments were included on survey forms that indicated that the concept of first-responder defibrillation was not being fully embraced. For example, a major teaching hospital stated that “Nurses can only use AEDs if trained with manual defibrillators... and not in general ward areas”. A comment from a rural hospital indicated that registered and enrolled nurses were permitted to defibrillate “only under GP supervision”. Notwithstanding the considerable number of comments about limitations on nurses’ “permission” to defibrillate, one rural hospital did com-

ment about “RNs [registered nurses] refusing to be trained to defibrillate”.

## Resuscitation guidelines

Most hospitals (88%) stated that they follow the Australian Resuscitation Council guidelines. However, there were several comments expressing confusion about the differences between the various resuscitation organisations’ policies.

## Data collection

About half of all hospitals routinely collect data on cardiac arrest occurrences and outcomes, although the likelihood of this increased with increasing hospital size — only 24% of hospitals with fewer than 25 beds stated that they routinely collected cardiac arrest data, while more than 80% of hospitals with 250 or more beds indicated that they did so. We recognise that such data are often incomplete, and do not include cardiac arrests in special units of hospitals, such as emergency departments, the operating rooms or coronary care units.

## Comments

Respondents were asked to specify any particular issues that had arisen at their hospital in relation to implementing resuscitation policies and practices, and were also given the opportunity to add further comments. Forty-four per cent of respondents (291) included one or more comments on their survey forms, which were classified as shown in Box 2.

Nearly half (48%) of all comments included mention of resuscitation training issues, and 54% raised issues relating to resuscitation practice. The logistical difficulties of conducting annual updates and recertification in resuscitative procedures, compounded by high staff turnover, were clearly articulated. Some hospitals, particularly in rural and remote locations, expressed difficulty in keeping up to date with frequently changing resuscitation guidelines, or, in any case, confusion about policy differences among the various resuscitation organisations.

A number of hospitals (23) identified issues relating to resuscitation equipment (see Box 2). In addition, there

were concerns about lack of access to training equipment such as mannequins and simulators. The legal and ethical implications of “not-for-resuscitation” orders were also identified as issues by 13 hospitals.

Overall, 7% of hospitals (49) indicated that their resuscitation policy and/or practice was currently being reviewed. Changes under consideration included introducing AEDs to the hospital, introducing a Resuscitation Coordinator position, introducing a Medical Emergency Team (MET) program,<sup>13</sup> permitting enrolled nurses to use AEDs, and introducing strategies to encourage medical officers to attend resuscitation-skills update sessions.

## DISCUSSION

This study is the first national survey describing resuscitation policies and practices in Australian hospitals.

All but one of the Australian hospitals surveyed indicated that CPR training is provided for nursing staff, with annual updates being usual practice. Only half of the hospitals provide CPR training for medical staff. However, this may reflect a lack of knowledge of the survey respondents (directors of nursing) of alternative sources of CPR training available to medical staff.

Most hospitals in Australia have at least one defibrillator, with fewer than 50% having AEDs. The notion that the cost of AEDs is prohibitive needs to be brought into perspective by comparing costs with those of other cardiovascular interventions, such as thrombolysis and revascularisation.

Over 100 hospitals with a defibrillator still do not allow nurses to defibrillate, including hospitals where there is no medical officer on-site and hospitals with AEDs. This is contrary to the recommendations of all international resuscitation bodies, including the Australian Resuscitation Council.<sup>3</sup> To delay defibrillation is clearly not best practice, and hospitals need to be cognisant of the overwhelming evidence that any delay in time to defibrillation is likely to reduce the chance of survival for cardiac arrest patients.

Other issues we identified include the need for the Australian Resuscitation

Council to better promote its role and function to health professionals and to make its policy statements more accessible, perhaps through free access on the Internet. In addition, differences in AED protocols and accessories are causing confusion among healthcare professionals.

Data on cardiac arrest are being routinely collected by hundreds of hospitals around Australia, yet the number of publications about cardiac arrest outcomes in Australian hospitals is dismally low. Perhaps it is time that an Australian national in-hospital cardiac arrest database be established, similar to the United States National Registry of CardioPulmonary Resuscitation (NRCPR),<sup>14</sup> which is sponsored by the American Heart Association.

From a methodological perspective, there were some limitations with the survey instrument, which were identified *post hoc*. However, these were most unlikely to substantially bias the results in the light of the high response rate.

One additional question that should have been included was “Is there someone on duty at all times who can defibrillate?”. For instance, it became evident that within some hospitals there were nurses who had been “specially trained” and deemed competent to perform defibrillation, but, from the comments included, this did not necessarily extend to 24-hour, 7-day-a-week cover.

Our survey has shown that the importance of minimising “time to defibrillation” and the ease of use of shock advisory defibrillators require additional emphasis. Hospital policies and procedures need to be reviewed immediately to reduce the crucial interval between cardiac arrest and defibrillation. In most instances this can best be reduced by nurses at the scene being expected (not just permitted) to defibrillate.<sup>15-18</sup> As of 2002, the Australian Resuscitation Council has listed defibrillation using an AED as a “basic life support skill”,<sup>19</sup> and, since 1997, the ARC has recommended early defibrillation by the first responder in the hospital setting.<sup>3</sup> It is paradoxical that, in the out-of-hospital setting, the concept of non-medical personnel (flight attendants,<sup>20</sup> security guards,<sup>21</sup> and police officers<sup>22</sup>) performing defibrillation is well established and accepted, yet there are still hospitals in

Australia where the ability of registered nurses to perform the same role is questioned. In an era of evidence-based practice, it is no longer possible for hospitals to defend resuscitation policies and practices that do not encompass the concept of “early defibrillation”.

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## COMPETING INTERESTS

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