

Potential for organ donation in Victoria: an audit of hospital deaths

Helen I Opdam and William Silvester

Australia has one of the highest transplantation success rates but a relatively low organ donation rate compared with other developed countries (Box 1).¹ In 2004, there were 218 deceased donors, from whom 789 people received a transplant. Many of the 1663 people on the transplant waiting list will have died awaiting a transplant.¹

It is unclear why organ donation rates in Victoria and the rest of Australia are relatively low, and whether there is potential to increase these rates. Possible reasons for the low rate include a small donor pool, a low consent rate, and a high incidence of potential organ donors for whom organ donation is not requested.

To understand the causes of the low organ donation rate in Victoria, an audit was undertaken in 12 hospitals by LIFEGift, the Victorian Organ Donation Service. The aims of this study were to quantify the potential for organ donation, to identify missed opportunities for organ donation, and to determine the consent rate.

METHODS

Study design and setting

A prospective audit by medical record review was conducted of all hospital deaths from January 2002 until October 2004. The audit included most metropolitan public teaching hospitals and two regional hospitals in the state of Victoria (Box 2).

Each hospital approved the audit as a quality assurance activity.

Definition of the potential organ donor

Apart from living donation of kidneys and, very rarely, liver, solid organ donation is possible only after death has occurred. In Australia, death may be legally declared when there is irreversible cessation of either circulation of blood or all function of the brain. The latter is termed "brain death", and its certification is a legal requirement if removal of organs for transplantation is to occur while respiration is being maintained artificially. Brain death may be diagnosed by demonstrating absent brain function with clinical brainstem tests (including apnoea) or by demonstrating absent intracranial blood flow using perfusion imaging.⁴

ABSTRACT

Objective: To determine the potential for organ donation in 12 Victorian hospitals.

Design and setting: Prospective audit of all deaths in 12 major public hospitals in the state of Victoria between January 2002 and October 2004.

Main outcome measures: Number of organ donors and potential organ donors (patients with brain death or likely to progress to brain death within 24 hours if supportive treatment continued), requests for organ donation and consents. Unrealised potential donors (organ donation not requested) were categorised by an independent panel of intensivists as category A (brain death formally diagnosed); B (brain death not formally diagnosed but criteria likely to be fulfilled); and C (potential to progress to brain death within 24 hours).

Results: There were 17 230 deaths, 280 potential organ donors and 220 requests for organ donation. The 60 unrealised potential organ donors were classified as category A (3), B (17) and C (40). Consent rate was 53% to 65%, depending on the definition of potential donor (categories A, B and C or category A only). Consent rate was lower when discussions about organ donation were held by trainees or registrars (21%) than when specialists were present (57%) ($P=0.004$). A maximum practically achievable organ donation rate for Victoria was estimated to be 15 to 17 donors per million population (current rate, 9 per million population).

Conclusions: The potential for organ donation in Victoria is limited by a small organ donor pool. There is potential to increase the number of organ donors by increasing the consent rate (lower than expected from public surveys), the identification of potential organ donors (particularly those likely to progress to brain death if supportive treatment is continued), and requests for organ donation.

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For brain death to occur, the patient must have sustained an acute brain injury sufficiently severe to culminate in eventual loss of all blood flow to the brain. Typical injuries include trauma, intracranial haemorrhage, thrombotic stroke and severe hypoxia–ischaemia (eg, resuscitated cardiac arrest).

For the purpose of this audit, potential donors were defined as patients with confirmed brain death, or those who were likely to progress to brain death within 24 hours if supportive treatment continued, and who were medically suitable for organ donation. Medical suitability for organ donation was defined by the guidelines of the Transplantation Society of Australia and New Zealand.⁵

It was not the role of this audit to determine the potential number of non-heart-beating donors (donation after cardiac death), who currently comprise fewer than 2% of cadaveric donors.¹

Data collection

Trained auditors entered all hospital deaths into a database. Patients were excluded as potential donors if they were aged < 1 year

or > 75 years, they were medically unsuitable, or they could not have had a diagnosis of brain death (eg, not comatose before death, or no acute brain injury).

Data collected included age, sex, cause of brain injury, whether brain death was diagnosed, whether organ donation was requested, the outcome of the request and, if treatment was withdrawn, where this occurred and who made this decision. Treating clinicians were interviewed if the information in the medical record was not clear.

Panel review process

The data were reviewed at auditors' meetings, and possible cases of potential donors where organ donation was not raised with the next-of-kin were identified for review by a panel of intensivists. The panel reviewed case summaries (with patient, hospital and staff identity not disclosed) along with de-identified medical records, and decided whether organ donation might have been possible, categorising each patient as follows:

- A: Confirmed brain death through formal

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clinical brain-death testing or a cerebral angiogram or radionuclide brain scan;

- B: Brain death not formally diagnosed, but the patient was likely to have fulfilled criteria for brain death;
- C: Potential to progress to brain death within 24 hours if supportive treatment, such as ventilation, had been continued; or
- D: Low potential to progress to brain death.

Category A, B and C patients were considered to be unrealised potential donors.

Other possible categories included "not medically suitable" (most excluded at auditor review) and "failed physiological support" (cardiac arrest despite provision of adequate resuscitation).

Intensivists were instructed to choose the most appropriate category based on their opinion that it was the most (>50%) likely. The final category was the majority decision of the panel members present.

The average attendance at meetings was seven intensivists. In most cases, the decision was either unanimous or achieved 80% agreement.

Statistical analysis

Consent rates were compared between hospitals and requesting staff using the χ^2 test and Fisher's exact test, respectively. A *P* level <0.05 was considered statistically significant. The characteristics of the above groups were assessed using descriptive statistics.

RESULTS

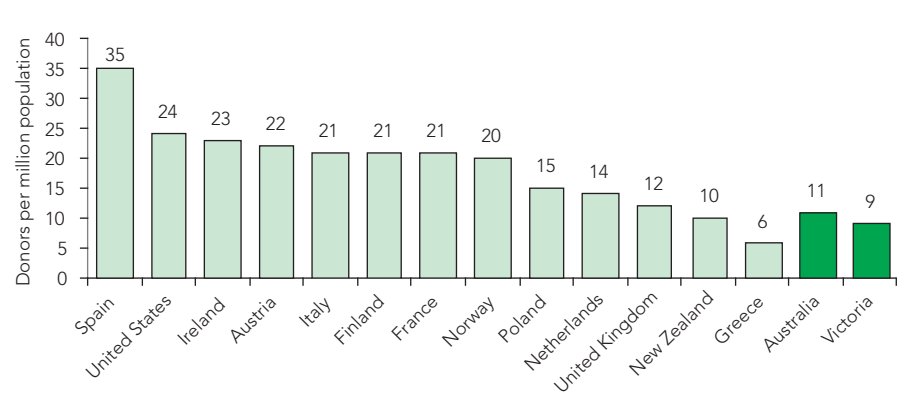
There were 17 230 deaths in the 12 hospitals between January 2002 and October 2004 (Box 3). In Hospital D, data collection was discontinued in mid-2002 after review of 193 deaths, as the hospital denied ongoing access to medical records.

Requests for organ donation and consent rate

The option of organ donation was discussed with the next-of-kin in 220 cases (Box 3).

Consent for organ donation was given for 116 patients: 112 of these either had confirmed brain death or went on to develop brain death. It is not known whether organ donation was discussed with the next-of-kin before or after the diagnosis of brain death. Of these patients, 106 proceeded to organ donation. There was an unavoidable loss of 10 potential donors (9%) because of failed physiological support, lack of suitable recipients or other medical reasons (Box 3).

1 International and Victorian donor statistics for 2004^{1,2}



For 104 patients, the next-of-kin did not consent to organ donation. Sixty-one of these had confirmed brain death. For the remaining 43 patients, organ donation was discussed with the family when the prognosis was dismal but before brain death was diagnosed. When the next-of-kin did not consent to donation, physiological support was withdrawn. Of these 43 patients, 22 were category B (likely to have fulfilled criteria for brain death) and 21 category C (potential to progress to brain death).

Consent rates and other variables

Of the 173 patients in whom brain death was either present or subsequently developed (category A patients) and organ donation was requested, consent was provided in 112 cases (consent rate, 65%). This may overstate the consent rate, as it is the practice of some clinicians not to formally diagnose brain death in patients they suspect to be brain dead unless the next-of-kin have consented to organ donation. Thus a more

realistic consent rate, for category A and B patients combined, was 58%. When all cases where organ donation was discussed are included (categories A, B and C patients), the consent rate was 53%.

The consent rate varied across hospitals. This variation was statistically significant only for the comparison of consent rates that included all cases where organ donation was discussed (category A, B and C patients) (*P*=0.04).

Staff raised the option of organ donation in 85% (187 of 220) of cases. The next-of-kin initiated discussions in the remainder, to indicate their support for (26), or opposition to (7), organ donation.

Discussions with the family about organ donation were managed by intensive care doctors in the vast majority of occasions (208 of 220). Consultants rather than trainees or registrars handled most discussions (196 versus 19). When trainees or registrars held the discussions, as occurred in some hospitals, the consent rate was much lower

2 Characteristics of hospitals participating in the audit (2003–04 statistics)³

Hospital	Number of beds	Intensive care unit	Trauma centre	On-site neurosurgical service
Alfred	433	Yes	Yes	Yes
Austin	511	Yes	No	Yes
Box Hill	355	Yes	No	No
Dandenong	360	Yes	No	Limited
Frankston	365	Yes	No	No
Geelong	414	Yes	No	No
Monash Medical Centre	576	Yes	No	Yes
Northern	255	Yes	No	No
Royal Children's	250	Yes	Yes	Yes
Royal Melbourne	342	Yes	Yes	Yes
St Vincent's	425	Yes	No	Yes
Western	319	Yes	No	Limited

(21%) than when specialists were present (57%) ($P=0.004$).

Organ donation not considered or not requested

Of the 128 patients reviewed at intensivists' meetings, 60 were categorised as unrealised potential donors: three as category A (confirmed brain death); 17 as category B (brain death likely but not formally diagnosed); and 40 as category C (potential to progress to brain death within 24 hours if supportive treatment had continued) (Box 3). These unrealised potential donors occurred across all hospitals, and in both intensive care units (ICUs) and emergency departments (EDs) (Box 4).

The remaining 68 patients were classified as category D (58), not medically suitable (5), failed physiological support (2) and non-consent (3).

Unrealised category A donors

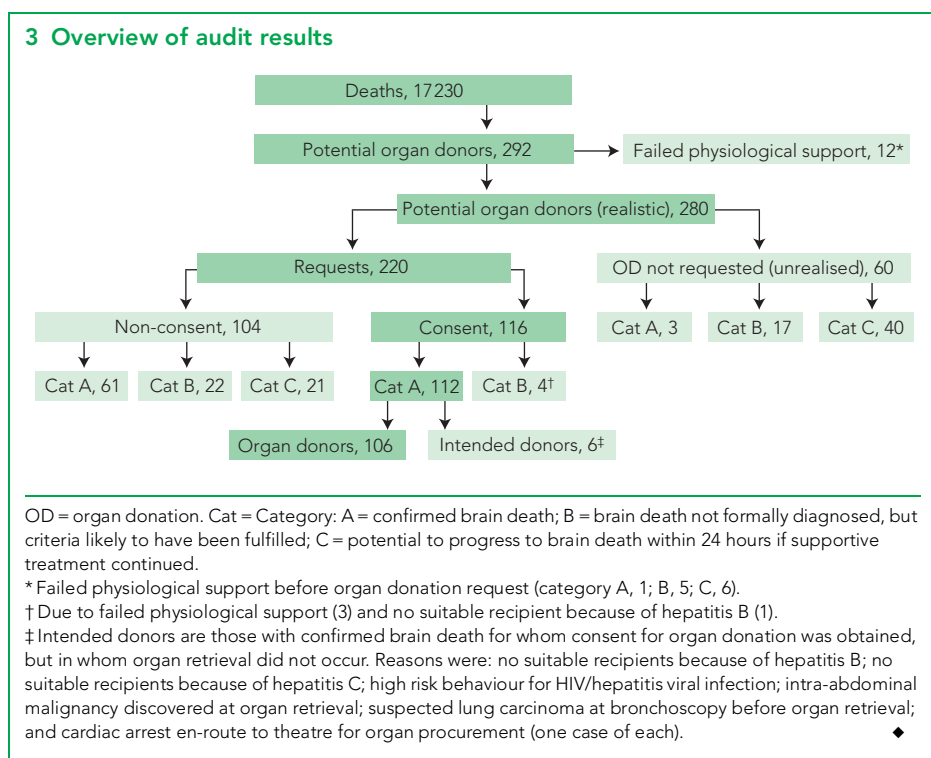
The three unrealised category A potential donors were from different hospitals (Box 4):

- A previously well 57-year-old patient with an intracranial haemorrhage had brain death confirmed in the ED. As no ICU bed was available, and ventilatory support could not be continued in the ED (as it was busy and on bypass, with ambulances being redirected for all but emergencies), the patient was extubated.
- A 71-year-old inpatient developed an intracranial haemorrhage after elective surgery, and treatment was withdrawn after diagnosis of brain death. The next-of-kin consented to corneal donation. When later questioned, the treating clinician said he/she did not think of organ donation at the time.
- A 51-year-old patient developed brain death 10 days after an intracranial haemorrhage. The next-of-kin had been reluctant to withdraw treatment.

Unrealised category B donors

Of the 17 unrealised category B potential donors, six had supportive care withdrawn in the ED (Box 5). They comprised:

- two trauma patients (aged 30 and 58 years) with severe bleeding requiring ongoing resuscitation;
- a 43-year-old with an intracranial haemorrhage who was a renal transplant recipient; liver donation was not considered; and
- three patients (aged 61, 73 and 74 years) with large intracranial haemorrhages and dismal prognoses who had withdrawal of supportive treatment recommended at neurosurgical review; in each case, clinical fea-



tures within 6 hours of presentation were consistent with brain death, including fixed dilated pupils and absence of spontaneous breathing; there were no contraindications to kidney or liver donation.

The 11 patients who had treatment withdrawn in the ICU comprised:

- two children with complex medical histories and prolonged ICU admissions;
- a child who required substantial cardiovascular support;
- a child whose family's religious affiliation was incorrectly believed by the intensivist to preclude organ donation;
- a 20-year-old with a non-survivable head injury who had treatment withdrawn due to futility; the patient's identity was undetermined at the time;
- a 22-year-old who could not undergo clinical brain death testing because of sedative agents and physiological instability; confirmation of brain death by imaging was not pursued;
- two patients (aged 40 and 47 years) with hypoxic-ischaemic brain injuries who had treatment limitations set because of poor prognosis; they subsequently developed features of brain death, and physiological support was not provided;
- a 52-year-old tourist from overseas with no immediate family available in Victoria; and
- two patients aged in their 70s who had

treatment withdrawn after the poor prognosis was conveyed to the families; both may have been suitable liver and kidney donors.

Unrealised category C donors

Of 40 unrealised category C potential donors, supportive treatment was withdrawn in the ED (for 19) and the ICU (for 21) (Box 3).

For all ED patients, supportive treatment appeared to be withdrawn or limited because of poor prognosis, without consideration of the possibility of organ donation. Sixteen of these patients (84%) died from intracranial haemorrhage. Two patients with non-survivable traumatic brain injury were requiring ongoing resuscitation. For one patient, concern was expressed that ongoing treatment might result in the patient surviving in a vegetative state.

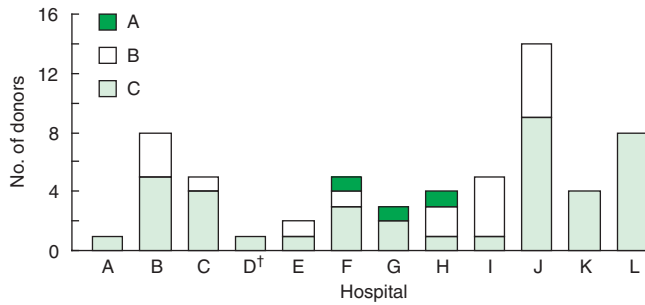
For three of the 21 patients who had treatment withdrawn in the ICU, intensivists stated at follow-up that the family was not coping and that raising the option of organ donation would be too distressing; one of these families was resistant to limiting treatment.

Estimates of potential organ donor rates

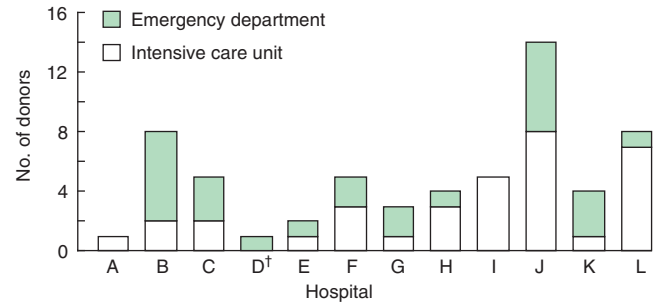
The rates of organ donation that are practically achievable for Victoria can be estimated using the current rate of 9 donors per million population and these audit data. The

4 Unrealised potential donors at each participating hospital

By category of donor*



By site of treatment withdrawal



*Categories: A = confirmed brain death; B = brain death not formally diagnosed, but criteria likely to have been fulfilled; C = potential to progress to brain death within 24 hours if supportive treatment continued. † Hospital D had only 6 months of data.

increase from the current 106 organ donors that would result from increased detection of potential donors and/or an increased rate of consent is shown in Box 6.

The audit detected 280 realistic potential donors and 116 potential donors with next-of-kin consent (consent rate, 53%). There was an unavoidable loss of 10 donors (9%), resulting in 106 organ donors (Box 3).

A maximum practically achievable rate (assuming complete detection and support to brain death of all unrealised potential donors), with a 70% or 80% consent rate, is 15 or 17 donors per million population, respectively (Box 6).

DISCUSSION

This audit suggests that there is limited but real potential to increase the number of organ donors in Victoria. The practically achievable maximum rate of organ donation for Victoria of 15 to 17 donors per million population is similar to that previously reported in Australia,^{6,7} but substantially lower than actual organ donation rates achieved in some countries.¹ This may be due to a smaller organ donor pool in Victoria, as a result of less road and firearm trauma, and differences in the treatment of hypertension and severe brain injury.⁸

Were this practically achievable maximal rate of organ donation to be reached, the current demand for organs for transplantation would largely be satisfied.

An increase in the rate of cadaveric organ donation might be achieved by increasing the consent rate, and increasing the rates of identification of potential donors and request for organ donation.

Increasing the consent rate: The consent rate in this study was 53% to 65%, depending on how broadly the potential organ donor was defined. This is higher than rates reported for the United States (54% for patients with confirmed or suspected brain death)⁹ and the United Kingdom (59% for patients with confirmed brain death),¹⁰ but lower than rates reported in Spain (85%).¹¹

Surveys suggest that public support for organ donation in Australia is as high as 77%.¹² However, the support expressed in surveys may be higher than that felt by newly bereaved individuals facing the reality of making the decision on behalf of a family member. Other factors, such as the way in which the option of organ donation is raised with families, may also influence the likelihood of consent. In our study, non-consent was more likely when junior doctors, rather than specialists, discussed organ donation with the family. It is known that family consent is more likely if the approach is made by individuals who are informed about and support organ donation.^{13,14} Intensive care trainees now receive training on how to identify and care for potential organ donors and how to communicate better with the potential donor's family.¹⁵

Increasing identification of potential donors and requests for organ donation: There were only three patients with confirmed brain death for whom organ donation was not requested. This is fewer than

5 Unrealised potential donors classified as category B or C (n = 57)

	Possibly/probably brain dead (category B)			Brain death likely within 24 hours (category C)		
	ICU*	ED*	Total	ICU*	ED*	Total
Number of patients	11	6	17	21†	19	40
Median age, years (interquartile range)	22 (10–50)	60 (47–70)	43 (20–61)	68 (47–73)	71 (68–72)	70 (61–72)
Intubated (%)	11	6	17 (100%)	21	14	35 (88%)
Cause of brain injury (%)						
Intracranial haemorrhage	3	4	7 (41%)	11	16	27 (68%)
Traumatic brain injury	4	2	6 (35%)	1	2	3 (8%)
Hypoxic–ischaemic injury	4	0	4 (24%)	5	0	5 (13%)
Thrombotic stroke	0	0	0	4	1	5 (13%)
Decisionmakers‡						
Intensivists	11	1	12	21	0	21
Neurosurgeons	3	3	6	5	11	16
ED staff	0	6	6	0	18	18
Neurologists	0	0	0	0	4	4

ICU = intensive care unit. ED = emergency department.

* Location of treatment withdrawal. † One patient had treatment withdrawn in post-theatre recovery (no ICU beds were available).

‡ In some cases, more than one clinician was involved in the decision to discontinue therapy.

6 Estimated number of organ donors that would result from increased identification of potential donors with a range of consent rates

	Potential donors	Requests	Consents	Actual donors	
				Number	Per million population
Current rate of identification of potential donors					
Consent rate, 53%	280	220	116	106	9
Consent rate, 70%	280	220	154	141	12
Consent rate, 80%	280	220	176	161	14
Maximum rate of identification of potential donors					
Consent rate, 53%	280	280	148	136	12
Consent rate, 70%	280	280	196	179	15
Consent rate, 80%	280	280	224	205	17

2% of all patients with confirmed brain death and less than 0.02% of hospital deaths. These rates are very low compared with other published audits.^{9,10,16,17} Avoiding this most obvious type of "missed donor" requires clinicians to ensure that they always discuss the possibility of organ donation with the family.

There were 17 patients with unconfirmed brain death for whom organ donation was not discussed with the next-of-kin. In some of these, circumstances appear to have impeded the process of diagnosing brain death, requesting organ donation and physiologically supporting the potential donor until the time of organ procurement. However, in many cases it appears that brain death was just not recognised and hence not assessed, or, if thought of, was not pursued.

The largest group of unrealised potential donors comprised those with imminent brain death who had supportive treatment withdrawn without organ donation being considered. A change in practice would be needed if the option of organ donation were to be routinely offered for such patients. This would involve discussing the option of organ donation with the next-of-kin before brain death, and providing ongoing supportive treatment to allow time for brain death to occur.

It is vital that the discussion of organ donation not precede the family's understanding and acceptance of a prognosis of death. Recommended practice is that the issue not be raised with the family until after brain death has been diagnosed and explained to them.⁴ However, the audit data demonstrate that, in many instances, organ donation is discussed with the next-of-kin before brain death is diagnosed. Indeed, for

category C patients for whom withdrawal of supportive treatment is being considered, there is no other time to raise the issue. If embarked upon, these discussions should be conducted by skilled staff who are knowledgeable about brain death and organ donation. This would require additional resources in the ICU to provide supportive care for potential donors.

In conclusion, Victoria appears to have a relatively small organ donor pool. There is some potential to raise the organ donation rate through increasing rates of consent, and through optimising the identification and provision of supportive treatment for potential donors, and requests for organ donation.

COMPETING INTERESTS

None identified.

AUTHOR DETAILS

Helen I Opdam, MB BS, FJFICM, Intensive Care Specialist,¹ Medical Consultant²

William Silvester, MB BS, FJFICM, Intensive Care Specialist,¹ Medical Director²

¹ Department of Intensive Care, Austin Health, Melbourne, VIC.

² LIFEGift, Victorian Organ Donation Service, Melbourne, VIC.

Correspondence: helen.opdam@austin.org.au

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