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Safety of anaesthesia: A review of anaesthesia-related mortality reporting in Australia and New Zealand

2015-2017

Australian and New Zealand College of Anaesthetists,
Mortality Sub-Committee

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Editor

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Foreword

Anaesthesia for Australians and New Zealanders remains extremely safe, with mortality from anaesthesia-related causes very rare. Anaesthetists continue to show their professionalism and commitment to the safe care of their patients through specialist training, research work and quality improvement activities such as mortality reporting and monitoring that has contributed to this publication.

Safety of anaesthesia: A review of anaesthesia-related mortality reporting in Australia and New Zealand 2015-2017 is the 11th triennial report produced by the Australian and New Zealand College of Anaesthetists looking into anaesthesia-related mortality.

This document contains data from all Australian states and territories, covering an estimated 13.6 million procedures, combined with a stand-alone report from New Zealand. The Australian data equates to anaesthesia-related mortality of one in 57,125 procedures, consistent with previous reports. In New Zealand, perioperative mortality data is collected rather than specific anaesthesia-related mortality. Between 2011 and 2016, the cumulative 30-day mortality rate, where a death has occurred within 30 days after an anaesthesia procedure, was 542 out of 100,000 deaths, or 0.54 per cent.[1]

As previous reports have shown, there is an increasing proportion of cases in which patients' pre-existing medical conditions may have contributed to the outcome. Similarly, older patients and those with higher American Society of Anesthesiologists physical status classification scores make up a larger proportion of the reports than previously. With overall mortality numbers essentially unchanged from previous triennia, this report reflects an overall improvement in the quality of anaesthesia being delivered.

This new-look report includes several case studies in order to highlight the issues of anaphylaxis, aspiration and perioperative medical care. The case studies are not necessarily from within this triennium, but aim to represent scenarios that have led to these outcomes.

Anaphylaxis and aspiration remain the most common contributors to anaesthesia-related mortality in the Australian data, while perioperative medicine is emerging as another important part in the overall care of those patients at higher risk from their procedures.

Our thanks to anaesthetists across Australia and New Zealand who have contributed to this publication through incident reporting, involvement in regional mortality committees, and assisting with the ANZCA Mortality Committee as well as the hard-working ANZCA staff who have helped with writing and editing this publication.

Dr Vanessa Beavis
President

Reference:

1 POMRC. 2018. Perioperative Mortality in New Zealand: Seventh report of the Perioperative Mortality Review Committee. Wellington: Health Quality & Safety Commission.

ANZCA Mortality Sub-Committee

The Mortality Sub-Committee members who produced this report include the president of the Australian and New Zealand College of Anaesthetists (ANZCA), the chairs or co-ordinators of functioning state mortality committees, and other interested parties as listed:

ANZCA President

Dr Vanessa Beavis

Chairs or co-ordinators of functioning (2021) Australian state/territory and New Zealand anaesthesia mortality committees

Chairs/co-ordinators	Representing
Dr Simon Jenkins	South Australia
Dr Jennifer Bruce	Western Australia
Dr Andrea Kattula	Victoria
Dr Carl D'Souza	New South Wales
Dr Margaret Walker	Tasmania
Dr James Troup	Queensland
Dr Carmel McInerney	Australian Capital Territory
Dr Philip Blum	Northern Territory
Dr Kerry Gunn	New Zealand

Other interested parties	Representing
Professor David Story	Chair, ANZCA Safety and Quality Committee
Dr Peter Roessler	ANZCA Director of Professional Affairs, Policy
Mr Anthony Luca	ANZCA Policy Officer

Details on each jurisdiction, including (where available) terms of reference, legislative protection and information regarding coronial legislation, can be found in the "State, territory and national information" section, starting on page 40.

Executive summary

This is the 11th triennial report of anaesthesia-related mortality produced by ANZCA, incorporating data from Australia and New Zealand (the first being for the triennium 1985-87). The format is similar to previous reports and, for the first time, now contains data from every state and territory of Australia, as well as a report from New Zealand. The ANZCA Mortality Sub-Committee has supported these regions in their collection of data and encouraged reporting from its fellows in both countries.

Although this report contains reports from both New Zealand and Australia, the two countries have different approaches to reporting and investigating mortality in the perioperative period. The result of this is that combining the data from both nations was not considered for this report. Instead, the New Zealand Perioperative Mortality Review Committee (POMRC), a multidisciplinary committee established in 2010 that has access to broader data, has again provided very useful information on all-cause 30-day perioperative mortality.

Within Australia, the state and territory mortality data arise from quite different and individual committees where reporting may be mandatory or voluntary, they use different formats for reporting, and some work hand in hand with their regional Surgical Audit of Perioperative Mortality while others remain largely separate. As reporting and identifying anaesthesia-related deaths is different between regions, it must be recognised that some anaesthesia-related deaths may be missed despite the efforts made at individual, state and national levels. It should also be noted that cases reported to the regional Audits of Perioperative Mortality will be those under the direct care of a surgeon; cases considered here will include those where anaesthesia has been provided for patients having procedures performed by specialists other than surgeons.

While regional committees and reporting is not standardised, all regions have applied the same classification system to improve consistency in the allocation of cases into the various categories. However, it should be appreciated that classification of anaesthesia-related deaths relies on expert opinion or consensus, and therefore remains subjective to some extent. It is also possible that some committees may vary in their interpretation of the categorisation of anaesthesia-related deaths.

During the triennium, 239 anaesthesia-related deaths (categories one, two and three) were reported within Australia. However, only 35 cases (14.6 per cent) were classified as category one (where it was considered "reasonably certain" that death was caused by anaesthesia factors alone. In 29 cases there was "some doubt" (category two), and in the remaining 175 cases, "medical, surgical and anaesthesia factors were implicated" (category three). The percentage of category one deaths appears to have stabilised over the last four triennial reports. In 2006-8, category one cases were 15 per cent of the total anaesthesia-related deaths, 14 per cent in 2009-11, 12 per cent in 2012-14 and now 15 per cent in 2015-17.

During the triennium, the combined population for Australia was 24.4 million (Australian population statistics). Using this figure, the anaesthesia-related mortality rate was 3.29 per million population per annum. The anaesthesia-related mortality rate per million population is very similar in all triennial reports since 1997-99.

During the triennium, there were about 13.65 million anaesthetic procedures performed across Australia. This figure was obtained from the Australian Institute of Health and Welfare (AIHW), with data obtained from coders at all public and private hospitals. Using this denominator, the anaesthesia-related mortality rate was 1:57,125 in Australia. This remains very similar to previous triennial reports since 2000-02.

Only a very small proportion of the deaths (7.5 per cent) occurred in patients considered low risk (ASA-P 1-2), with 92.5 per cent occurring in higher risk patients (ASA-P 3-5). This number has plateaued over the last three triennial reports, falling from 26 per cent in 1991-93 to 7 per cent in 2009-11 and 2012-14.

In comparison to the previous triennium, the average number of causal or contributary factors per anaesthesia-related death was lower at 0.83 (compared to 1.01). This trend of a reducing number of identifiable anaesthetic causal or contributary factors has continued over the past two decades. This was 2.42 in 2000-02, 1.30 in 2006-08 and 1.03 in 2012-14. Over the same period there has been an increase in the percentage of cases in which the patient's chronic medical condition (H) contributed to the patient's death (85 per cent in 2015-17) and the number of deaths in which no correctable factor could be identified (G) (61 per cent in 2015-17). As noted in the 2012-14 triennial report, "These data are consistent with the likelihood that there has been a progressive reduction in preventable anaesthesia-related mortality over this period, and that the most important factor is the severity of the patient's underlying medical condition" and "this indicates that a larger percentage of anaesthetic-related deaths occurred despite optimal anaesthetic management within our current knowledge".

The majority of anaesthesia-related deaths occurred in older patients. Seventeen per cent were in patients over 90 years, 57 per cent were in patients over 80 years, 79 per cent were in patients over 70 years and 89 per cent were in patients over 60 years of age.

Emergency surgery remains a major risk factor for anaesthesia-related deaths, with 72 per cent occurring in procedures or a procedure considered urgent or emergent (compared with 70 per cent in 2009-11 and 73 per cent in 2012-14).

The majority of deaths (81 per cent) occurred in metropolitan teaching hospitals or regional centres and is consistent with previous reports. This is not surprising as these hospitals would generally manage more emergency cases and older patients with more comorbidities than private or day surgery hospitals.

The majority of deaths (90 per cent) involved specialist anaesthetists. It is encouraging that higher risk procedures would preferentially be managed by specialist anaesthetists either directly or by in person supervision of trainees.

The types of surgery most frequently associated with anaesthesia-related death were orthopaedics (51 per cent), endoscopic procedures (8.6 per cent), vascular surgery (8.3 per cent), abdominal surgery (7.9 per cent) and cardiothoracic surgery (7.5 per cent). The rate for endoscopic procedures has increased significantly from the previous triennial report (9.6 per cent, compared with 6.5 per cent in 2013-15), consistent with the increasing trend of anaesthesia-related mortality in non-surgical procedures noted in the 2012-14 triennial report.

This report includes a brief clinical summary of 18 of the 35 deaths classified as category one (where it is "reasonably certain" death was caused by anaesthesia or other factors under the control of the anaesthetist). Unfortunately, 17 category one deaths were unable to be reviewed in more detail. However, of the 18 cases reviewed in detail, there were eight deaths due to anaphylaxis, seven cases involving pulmonary aspiration, one cardiac arrest, one hypoxic arrest due to difficult airway management and one case where the cause of death remains unclear.

Dr Simon Jenkins
Chair, Mortality Sub-Committee

About this report

History of triennial reports

The *Safety of anaesthesia* report is a triennial report co-ordinated and published by the Australian and New Zealand College of Anaesthetists (ANZCA). The 2015-2017 triennial report is the 11th report published by ANZCA since the college assumed responsibility for the report in 1990. Prior to 1990, a national Working Party on Anaesthetic Mortality, constituted by the National Health and Medical Research Council (NHMRC), coordinated the first two reports during the 1985-87 and 1988-90 trienniums.[2]

Since the inception of the report, individual states and jurisdictions have worked towards developing an appropriately uniform system for collecting, interpreting, and reporting data associated with deaths and anaesthesia. We are pleased that this 2015-17 triennial report is the first to include data reported from every Australian state and territory.

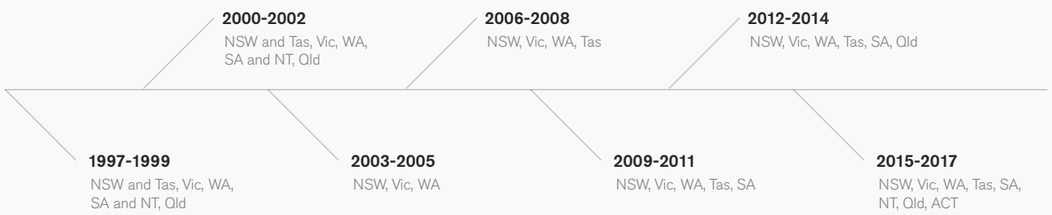
Why is this report important?

Functionally, the *Safety of anaesthesia* triennial report aims to provide an account and understanding of anaesthesia-related mortality in Australia over the related three-year period. In doing so, it serves an educational purpose by highlighting emerging themes and common factors identified in association with perioperative mortality where anaesthesia may have been a factor. For anaesthetists contributing to mortality reporting, it provides an opportunity to reflect on practice outcomes and identify areas for improvement.

The report also represents another important aspect of anaesthesia practice, that is, the profession's ongoing commitment to transparency and accountability. There is no legal obligation which requires the *Safety of anaesthesia* report to be published. However, specialist anaesthetists are committed to strive for better outcomes for their patients and are willing to commit resources through the college and their own time and effort to achieve this.

Finally, the *Safety of anaesthesia* report presents an opportunity for jurisdictions to share insights about anaesthesia-related mortality and compare analyses, enabling them to learn from each other in identifying opportunities to improve practice outcomes. This function is enhanced by an ongoing commitment to improve uniformity in reporting parameters, which is reflected in this triennial report as the first where data has been contributed from each state and territory.

History of reporting jurisdictions by triennial report



Reference:

2 Australian and New Zealand College of Anaesthetists: Anaesthesia Related Mortality in Australia 1991 – 1993. Editor: B F Horan.

Key findings and Recommendations

Key findings

Notwithstanding the effect of jurisdictional differences in methodology for case reporting and classification, this report indicates that anaesthesia-related death rates in modern Australia are low, whether assessed by the number of anaesthesia-related deaths per million population per annum (3.23) or by the number of anaesthesia-related deaths per number of procedures per annum (1:57,125). The emerging pattern is that anaesthesia risk remains extremely low in patients who are fit and well (ASA-P 1-2).

Most anaesthesia-related deaths occur in older, sicker patients having non-elective surgery. Further reductions in mortality may be achieved by reviewing the timing of surgery to allow better optimisation of such patients. There may have been some cases in which the decision to operate was inappropriate or futile. There appears to be an increasing willingness to engage with patient and carers in conjunction with surgeons, anaesthetists and other specialists, in detailed discussions about their condition, treatment options and their wishes, particularly around end-of-life decisions.

The fact that drug anaphylaxis and pulmonary aspiration persist as leading causes of anaesthesia-related death reinforces the need for research into reducing their occurrence and training in crisis management to maximise the benefit of resuscitation when they do occur. In very low frequency events such as these, simulation-based training should be used.

The high and increasing frequency of underlying chronic health conditions contributing to anaesthesia-related mortality (85 per cent in the 2015-17 triennium) would suggest that improving perioperative management of these conditions may reduce perioperative deaths. ANZCA is working to improve the knowledge and skills of its specialist anaesthetists through an increasing emphasis on perioperative medicine in its curriculum and continuing professional development.

Noting also that 61 per cent of cases of anaesthesia-related mortality were deemed to have occurred despite what was believed to be optimal management, improving how we identify these circumstances prior to embarking on the surgery may further reduce the number of perioperative deaths. Further research and education of clinicians in perioperative management and operative risk, along with engagement with patients and their families in decision-making around high risk procedures would also be of benefit.

Recommendations

The ANZCA Mortality Sub-Committee makes the following recommendations:

- Healthcare authorities should recognise that anaesthesia mortality is higher in older, sicker patients having urgent surgery. If the decision is made to proceed, appropriate perioperative resources should be provided, including appropriate levels of specialist anaesthetist care and supervision, and availability of high dependency facilities for postoperative care.
- ANZCA should continue to emphasise perioperative medicine in its training curriculum and continuing professional development, with specialist anaesthetists uniquely positioned to fill the role of the perioperative physician. Anaesthetists should work collaboratively with other specialists to optimise perioperative management of patients at high risk.
- Clinicians and healthcare authorities must engage with elderly patients and their families and carers in collaborative discussion about the likely outcomes from emergency anaesthesia and surgery. This should include consideration of any existing advanced care directives and end-of-life care plans, and should aim to reduce the risk of inappropriate interventions.
- The ANZCA Mortality Sub-Committee and the anaesthesia mortality committees in Australia and New Zealand should continue to work collaboratively to establish and maintain robust methodologies to obtain accurate anaesthesia-related mortality data.
- Patients, healthcare authorities, anaesthetists, other medical specialists and healthcare workers should recognise the role of current anaesthesia training, research, accreditation, continuing professional development and education in achieving and maintaining the highest standards of safety and quality in the practice of anaesthesia in Australia and New Zealand.
- The broader community should be informed that modern anaesthesia care is very safe as indicated by the very low anaesthesia-related mortality rates in Australia and the ongoing aim to avoid all anaesthesia-related deaths.

Commentary – emerging perioperative theme

Comorbidities, perioperative risk, and shared decision making

Increasing prevalence of comorbidities and chronic conditions

Patients with complex comorbidities presenting for both elective and non-elective surgical or interventional procedures are an increasingly common scenario. This is not surprising – In the 2017-18 National Health Survey by the Australian Bureau of Statistics "just under half" (47 per cent) of Australians and 80 per cent of those aged 65 and above, had one or more chronic conditions (ABS, 2018). The rising prevalence of obesity is discussed further below.

Chronic conditions and complex comorbidities present significant challenges across the perioperative period, for both patients (and their families) and the broad range of clinicians involved in their care. In the *Safety of anaesthesia* report, this impact is often reflected in deaths classified as category 3 (medical/surgical and anaesthesia factors identified) and category 5 (inevitable deaths), and those category 1-3 cases ascribed the subcategories G (no correctable factor identified) and/or H (medical condition of the patient). It is also reflected in the proportion of anaesthesia-related deaths in ASA 3 and 4 patients.

The types of issues seen in relation to comorbidities and chronic conditions are wide ranging and vary from those directly leading to the patient's death to those contributing to a prolonged and complicated postoperative course.

Major cardiovascular events, including perioperative stroke and myocardial infarction, form a significant group. Of note, while most perioperative strokes occur post-operatively, an estimated 5-15 per cent occur intraoperatively or become apparent in the immediate postoperative (PACU) period (Vilisides & Mashour, 2016). This highlights the importance of neurological assessment in patients who are slow to awaken in the PACU to facilitate timely diagnosis and escalation of care. Perioperative myocardial infarction is associated with a high mortality rate, even with percutaneous coronary intervention (PCI) (Parashar, et al., 2016). Previous coronary stent implantation within a year of non-cardiac surgery (NCS) has been identified as an independent risk factor for major adverse cardiac and cerebrovascular events and bleeding (Mahmoud, et al, 2016). Management of antiplatelet therapy (APT)/dual antiplatelet therapy (DAPT) in patients with stents undergoing NCS can be complex. A 2017 review (Banerjee, et al, 2017) noted "the need to carefully consider the risk of ischemic complications, consequences of delayed surgery, and perioperative bleeding in post-PCI patients on DAPT undergoing NCS, and to individualize treatment decisions" (p.1868) noting the importance of "an astute clinician, a highly individualized and collaborative approach to patient care, and team-based decision making" (p.1869).

The role of multidisciplinary preoperative shared decision making

The impact of complex comorbidities and chronic conditions highlights the important role multidisciplinary teams can play in preoperative shared decision making and co-ordination of perioperative care from initial surgical assessment and preoperative optimisation through to postoperative follow up, including ongoing specialist and primary care.

Effective co-ordination of perioperative care is dependent on clear and regular communication of all involved clinical care teams with each other and with the patient (and their family or carer).

Shared decision making is the key starting point for this whole process. It is a concept with three core elements (Légaré & Witteman, 2013).

1. A shared recognition of the need for a significant decision (by both clinician and patient).
2. A shared understanding of the "best available evidence" regarding the risks and benefits of different treatment options.
3. A decision encompassing both the clinicians' advice/guidance and the patient's values, preferences and priorities. For patients with complex comorbidities this may include a multidisciplinary team approach.

Although widely accepted as an important patient-centred initiative, there are significant ongoing challenges in effectively implementing shared decision making including provision of clinician training (particularly for junior staff) (Légaré & Witteman, 2013) and a need for more evidence as to what specific interventions drive more successful SDM (Légaré, et al, 2018). These represent important ongoing opportunities for improving patient-centred perioperative care.

Obesity

The 2017-18 ABS National Health Survey noted a rising prevalence of obesity in Australia with 67 per cent of Australians considered overweight or obese, and an increase in those categorised as obese from 27.9 per cent in 2014-15, to 31.3 per cent in 2017-18 (ABS, 2018). The rising prevalence of severe obesity (body mass index 35kg/m^2 or above) is particularly relevant, having almost doubled between 1995 and 2014-15 (from 5 per cent to 9 per cent) (AIHW, 2017).

This is concerning due to the association of obesity with chronic conditions that may lead to surgical intervention (for example, cardiovascular disease and some cancers), potential technical difficulties in providing anaesthetic care, and increased perioperative risk due to associated chronic conditions (for example, hypertension, cardiovascular disease, type 2 diabetes) with their long-term health consequences. Technical difficulties can be significant, and often relate to airway management, vascular access, drug dosing and positioning (Nightingale et al, 2015).

Clinical lessons

The rising prevalence of chronic health conditions and obesity in the general population has implications for both anaesthesia-related mortality and morbidity, and broader perioperative outcomes. It is a strong imperative to continue working towards a more multidisciplinary approach to perioperative care to reduce risks and optimise outcomes.

Patients with complex medical problems benefit from experienced multidisciplinary perioperative care planning. Preoperative assessment by senior clinicians can help inform discussions with the patient (and their families/carers) about perioperative risks, treatment options and patient goals of care, helping optimise individual care plans and outcomes, and avoiding futile interventions.

It is important that goals of care discussions are appropriately documented, updated and communicated to clinicians involved in the patient's care. Clinical decision making is more difficult in the intraoperative and early postoperative period when such conversations have not occurred or been clearly documented, and a patient's condition rapidly deteriorates.

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Methods

Confidentiality

Confidentiality of information, an absolute requirement for all committees, was ensured by no primary data being examined in the compiling of the report. All information is de-identified prior to receipt and some data points were suppressed to prevent identification, upon request of individual states.

Data collection

1. **State-specific data provided by state, and territory, mortality committees and audit bodies.**

   Information relating to the terms of reference for each state-based mortality committee and audit body, as well as information pertaining to relevant state coroners' acts and jurisdictional public health legislation, can be found on page 40.

2. **The Australian Institute of Health and Welfare (AIHW).**

   Data pertaining to anaesthesia procedures was sourced from the AIHW using the Australian coding standards of the National Centre for Classification in Health. More information on coding classification of anaesthesia procedures can be found on page 26.

3. **The Australia Bureau of Statistics (ABS).**

   Population statistics were derived from the available ABS national, state and territory data during the 2015-17 period.[3]

Uniformity

To uphold uniformity between the states and territories, in analysing reports, the chairs of the state-based mortality committees have continued to use the agreed "Glossary of terms – case classification" form wherever possible. Due to varying legislative responsibilities, there were some instances where this was not appropriate and, as such, is duly noted within this report. The use of this classification system was developed in March 2000 and has been in use in all states, and territories, since 2006. See Appendix B to view the form in its entirety.

System of classification

The system of classification and the term "death attributable to anaesthesia" is defined in Table 1 and the report focuses on deaths in which anaesthesia played a part, that is, categories one, two and three. For the most part, the term "anaesthesia-attributable" has been replaced with "anaesthesia-related" in this and other reports.

Constraints

Mortality reporting requirements differ on a state-by-state basis, thus presenting a uniform framework for data reporting may not provide the most thorough indication of national anaesthesia-related mortality statistics. Due to this differentiation, some state-specific data points were excluded to preserve analytical legitimacy, which will be appropriately flagged throughout this report.

Reference:

3 Australian Bureau of Statistics, 2019, National, state and territory population, cat. no. 3101.0.

Table 1: Systems of classification by state-based anaesthesia mortality committees

Death attributable to anaesthesia	
Category 1	Where it is reasonably certain that death was caused by the anaesthesia or other factors under the control of the anaesthetist.
Category 2	Where there is some doubt whether death was entirely attributable to the anaesthesia or other factors under the control of the anaesthetist.
Category 3	Where it is reasonably certain death was caused by both medical/surgical and anaesthesia factors.

Explanatory notes:

- The intention of the classification is not to apportion blame in individual cases but to establish the contribution of the anaesthesia factors to the death.
- The above classification is applied regardless of the patient's condition before the procedure. However, if it is considered that the medical condition makes a substantial contribution to the anaesthesia-related death, subcategory H should also be applied.
- If no factor under the control of the anaesthetist is identified which could or should have been done better, subcategory G should also be applied.

Death in which anaesthesia played no part	
Category 4	Death where the administration of the anaesthesia is not contributory and surgical or other factors are implicated.
Category 5	Inevitable death, which would have occurred irrespective of anaesthesia or surgical procedures.
Category 6	Incidental death, which could not reasonably be expected to have been foreseen by those looking after the patient, was not related to the indication for surgery and was not due to factors under the control of the anaesthetist or surgeon.
Unassessable death	
Category 7	Those that cannot be assessed despite considerable data, but where the information is conflicting or key data are missing.
Category 8	Cases that cannot be assessed because of inadequate data.

Clinical aspects

Clinical aspects of category one anaesthesia-related deaths

Each triennium jurisdictions are asked to provide summaries of the clinical aspects of category one anaesthesia-related deaths where appropriate. These are considered deaths *where it is reasonably certain that death was caused by the anaesthesia or other factors under the control of the anaesthetist*. It should also be noted that providing summaries of each category one anaesthesia-related death may not be possible due to jurisdictional restrictions and confidentiality concerns.

In the 2015-17 triennium, we have detailed data for the category one cases from Victoria, South Australia, Western Australia and Queensland. Unfortunately, detailed summaries from NSW were not available. Out of the 18 cases reviewed, two recurring issues were highlighted among the category one summaries received: anaphylaxis (eight) and pulmonary aspiration (seven). These issues were similarly reported in the previous 2012-14 *Safety of anaesthesia* triennial report. However, cardiac arrest (one), stroke (zero) and airway related (one) deaths were lower in this triennium than in 2012-14.

Anaphylaxis

Anaphylaxis (type 1 hypersensitivity) is a life-threatening allergic event, characterised by cardiovascular and respiratory effects, skin changes and/or a range of other signs and symptoms. Although the public is perhaps most familiar with severe allergies to bee stings or peanuts, anaphylaxis in anaesthesia is typically related to any number of a range of drugs or other agents used intraoperatively.

Although patients are frequently asked about allergies in their perioperative journey, the first episode of type 1 hypersensitivity is highly unpredictable and usually follows previous "safe" (uneventful) administration of the agent concerned. Additionally, the highly variable presentation of the clinical signs of anaphylaxis, particularly while the patient is anaesthetised, can make a clear diagnosis difficult to ascertain. Further complicating this, resuscitation of a patient who has other comorbid disease while simultaneously managing their surgery and anaesthetic, can often be more difficult still.

In this triennium we reviewed eight cases of anaphylaxis where the precipitating agent either remains unknown (five cases) or was only suggested by post-mortem testing (three cases – all suggestive of allergy to suxamethonium). Seven sustained cardiovascular collapse and cardiac arrest as the predominant effect leading to death, with one patient being initially resuscitated from cardiovascular collapse but ultimately passing away postoperatively from the neurological insult due to prolonged hypotension in the case. Four had additional comorbidities including severe ischaemic heart disease and obesity that made resuscitation more difficult.

Pulmonary aspiration

Aspiration refers to the regurgitation of gastric contents and subsequent inhalation into the lungs, resulting in physical blockage of airways and inflammation leading to hypoxia and potentially death. It primarily occurs in unfasted patients or those who have delayed gastric emptying, who are unable to protect their own airway due to general anaesthesia.

Anaesthetists usually manage this risk by using strict fasting protocols in elective or semi-urgent surgery (that is, "low risk" of aspiration) or by using alternative techniques, such as regional anaesthesia or rapid sequence induction (RSI), where fasting is not feasible or gastric emptying may be delayed (that is, "high risk").

There are seven cases discussed in this triennium where patients have suffered pulmonary aspiration in both high-risk and low-risk scenarios. All were in elderly patients with additional medical conditions of concern. Six of the seven were in emergency cases, but only two were deemed insufficiently fasted for theatre, both with bowel obstruction. Pulmonary aspiration occurred at induction in three cases where intubation occurred (including rapid sequence induction), and during the case when patients were either sedated without an airway device in situ (three cases) or anaesthetised with a supraglottic airway device (one case). The procedures being undertaken included endoscopy, colonoscopy, hip arthroplasty (two cases), abdominal surgery or other procedures (two cases).

Additional cases

There were three other category one cases reported in this triennium. In one case an elderly patient with severe medical comorbidities suffered a cardiac arrest after induction of anaesthesia, a second case involved a hypoxic arrest associated with difficult airway management, while the cause of death was unclear in the third patient.

Overview

Section A

Number of deaths classified

The total number of deaths reviewed by the states and territories for the triennium was 2909, of which 239 (8.2 per cent) were considered to be wholly or partly related to anaesthesia factors (categories one, two and three [Table 3]). Of the 2909 reviewed, 49 were classified "unable to assess" due to inadequate or conflicting data (categories seven or eight [Table 3]).

Table 2 – Total deaths reviewed

	NSW	Vic	WA	Tas	SA	Qld	NT	ACT	Total
2015	286	10	78	17	11	414	0	2	818
2016	279	24	76	6	15	544	5	2	951
2017	388	147	57	14	10	506	18	0	1140
Total	953	181	211	37	36	1464	23	4	2909

There is considerable variation in the nature of jurisdictional mortality committees from which this data is collected. Their terms of reference (TOR) may differ with mandatory/voluntary reporting and reporting of anaesthesia-only cases versus all perioperative mortality. This will directly affect the total number of cases reviewed, which may explain why similar-sized states (for example, Western Australia and Southern Australia, or Victoria and Queensland) can have such large differences in the numbers of cases reviewed.

Other factors may affect total numbers of cases reviewed, such as the engagement from those providing reports to the committees. This will be affected by local factors, such as differing levels of engagement from specialist versus non-specialist anaesthesia providers, differences in reporting from different sites (for example, major metropolitan hospitals, rural sites, private hospitals or office-based sites). Direct comparisons of number of reports received in Table 2 should not be used to infer differences in perioperative or anaesthesia-related mortality between regions.

Committee members who sit on the regional committees suggest that the majority of anaesthetic-related deaths occurring in these regions are being reported and considered as category one, two and three cases (see Table 2), though there is potential for some under estimation in those regions with voluntary reporting.

As noted above, individual regions are completely independent and have different terms of reference. However, the subset of cases of anaesthesia-related mortality is common to all of these committees. Cases considered by these committees use standard definitions to reduce bias in determining the contribution of anaesthesia practice to individual cases (see Table 1).

Table 3 – Number of deaths classified by each committee

	NSW	Vic	WA	Tas	SA	Qld	NT	ACT	Total
Category 1	17	12	2	0	3	1	0	0	35
Category 2	13	2	4	1	2	6	1	0	29
Category 3	121	44	2	1	3	3	1	0	175
Total	151	58	8	2	8	10	2	0	239
Category 4	68	35	11	14	5	366	5	4	508
Category 5	673	82	175	20	18	986	15	0	1969
Category 6	29	6	16	1	0	91	1	0	144
Category 7	4	0	1	0	0	4	0	0	9
Category 8	28	0	0	0	5	7	0	0	40

The number of deaths in which anaesthesia was not considered to be a contributing factor (categories four, five and six) was 2621, or 90 per cent of all reports considered. The 49 cases that were deemed unable to be assessed, representing a small minority of the total.

The disparity in total cases classified reflects both population differences and different requirements and methodology for reporting in different states (see state, territory and national information on page 40). The jurisdictional differences in relation to the relative weighting of these categories may represent some subjectivity in classification. There is less subjectivity, however, in relation to category one cases.

Overview

Section A

Case study 1 – Anaphylaxis

A consultant anaesthetist in a busy tertiary referral hospital was asked, at short notice, to cover a morning maxillo-facial list. The registrar rostered to the list had reviewed the charts the previous night and provided a brief presentation of the cases on the list to the consultant. The first patient was a medically complex 46-year-old having multiple dental extractions. The consultant performed a preoperative assessment and noted that the patient had end-stage renal failure on home haemodialysis. He was obese at 130kg, but with a reasonable exercise tolerance. He had treated hypertension, obstructive sleep apnoea on CPAP and controlled GORD.

There were no reported problems with previous anaesthetics. The patient gave a history of penicillin allergy. Previous anaesthetic records indicated that he had received cephazolin on two previous occasions without problems.

The pre-induction NIBP was 140/60mmHg and HR was 65bpm. A thorough anaesthetic plan was made. A peripheral cannula was sited, and the patient was induced with fentanyl, propofol and cisatracurium. The registrar had one failed attempt at intubation and the consultant then successfully intubated the patient.

The patient was ventilated with Sevoflurane. Peak airway pressures after intubation were approximately 26cmH_2O. A timeout was completed. The history of penicillin allergy was noted. Following confirmation of the safe use of cephazolin on two previous occasions a dose of 2 grams of cephazolin was administered while the patient was being prepped and draped.

Shortly after the administration of cephazolin the ventilator began to alarm due to high airway pressures. The NIBP was 160/60mmHg and the HR was 50 bpm. Troubleshooting was undertaken by the anaesthesia consultant and a second consultant who was nearby. One hundred per cent oxygen was commenced. The lungs were stiff to manual ventilation and silent to auscultation. The tube position was confirmed with laryngoscopy. A provisional diagnosis of primary bronchospasm was made, salbutamol was administered via the endotracheal tube and magnesium sulfate was administered IV. Further auscultation revealed bilateral polyphonic wheeze. The oxygen saturation fell to 83 per cent and chest compliance remained poor. The NIBP failed to record a blood pressure. HR was 45 bpm.

On removal of the drapes the patient was mottled but without rash. The NIBP returned a reading of 100/53mmHg. On palpation the peripheral pulse felt thready and weak. The surgeon was asked to commence cardiac compressions and an emergency buzzer was activated. Among the staff that attended there were several consultant anaesthetists, some with extra skills in cardiac anaesthesia and resuscitation. After a round of CPR and 1mg of IV Adrenaline the patient's rhythm was determined to be pulseless electrical activity (PEA). The working diagnosis was now anaphylaxis and treatment proceeded according to the ALS algorithm for PEA.

Leg elevation was undertaken. Fluid resuscitation was commenced but was limited by small-bore IV access. An adrenaline infusion was commenced. Circulatory collapse was profound and multiple attempts at further IV access and ABG collection were unsuccessful. An ultrasound-guided brachial arterial line and internal jugular central venous line were placed. Chest compressions were shown to be effective with arterial pressure increasing during compressions.

ALS proceeded through multiple cycles. The patient remained in PEA at rhythm check points. Adrenaline boluses were increased in frequency to one a minute as the diagnosis of anaphylaxis became more certain. Various measures were undertaken to correct abnormalities seen on arterial blood gases, including administration of 8.4 per cent sodium bicarbonate (300mL), calcium chloride (6g), and 10 units of Actrapid insulin in 50 per cent dextrose. Multiple differentials of cardiac arrest were considered at different time points and excluded. Two brief episodes of returns of spontaneous circulation occurred during resuscitation but both rapidly deteriorated into PEA within 1-2 minutes. Resuscitation was ceased after one hour, and the patient was declared dead. In total 31mg of Adrenaline and 3 litres of IV crystalloid were administered. The post-mortem analysis and autopsy were consistent with anaphylaxis. Tryptase was elevated at > 200 ug/L. Allergen specific IgE to cephazolin was positive.

Clinical lessons

Anaphylaxis remains a major cause of category one anaesthesia deaths in Australia and New Zealand. As this case illustrates the management of anaphylaxis can be complex, labour intensive and prolonged. Yet despite the best efforts of all those involved, death may still ensue. In an effort to improve treatment and communication during an episode of anaphylaxis the Australian and New Zealand Anaesthetic Allergy Group (ANZAAG) has developed a series of anaphylaxis management cards to use as a cognitive aid. These cards outline treatment in the acute and refractory phases of anaphylaxis as well as providing a list of differential diagnoses.

The mainstays of treatment remain adrenaline, oxygen and IV fluids with the use of additional vasoactive substances in the presence of persistent hypotension and additional bronchodilators in the presence of persistent bronchospasm. Aggressive fluid resuscitation as outlined in the ANZAAG Anaphylaxis Management Cards in the presence of persistent hypotension remains a key component of the treatment of anaphylaxis. In the most severe cases extravasation can be so profound that in excess of 10L of fluids may be required. Echocardiography is a useful tool in this situation.

Previous anaesthesia records should be reviewed for unexplained perioperative events. Unfortunately, a history of previous safe exposure to a drug does not preclude anaphylaxis on re-exposure. Antibody-mediated hypersensitivity can potentially result from any prior exposure.

Rash is not necessarily a ubiquitous feature of anaphylaxis in the intraoperative (perioperative) setting and therefore absence of rash cannot be used to exclude a diagnosis of anaphylaxis. When present it is frequently masked, either physically by surgical drapes or physiologically by hypotension where blood flow to the skin is attenuated and rash does not develop until cutaneous perfusion is restored.

Although bronchospasm is a less common presenting feature of anaesthetic (perioperative) anaphylaxis, anaphylaxis must remain a key differential diagnosis in any patient who develops marked bronchospasm. Bronchospasm that occurs as part of perioperative anaphylaxis is typically severe, refractory, and poorly responsive to first-line measures for treating primary bronchospasm.

Overview

Section B

Number of anaesthesia-related deaths in relation to population

Grouping together the total number of anaesthesia-related deaths from all jurisdictions in the triennium, the overall rate of anaesthesia-related mortality for Australia is 3.29 per annum per million population. This is comparable to the same metric observed in the past four triennial reports; 2.73 (2003-05), 2.79 (2006-08), 3.01 (2009-11) and 2.96 (2012-14).

Despite a slight increase depicted compared to previous reports, the overall rate for this triennium may be a more reliable indicator of anaesthesia safety when contrasted with previous reports. This is a result of key variables such as the significant increase in number of anaesthesia procedures performed compared to previous trienniums (Table 8), as well as the completeness of population statistics provided by reporting jurisdictions. Unlike the 2015-17 triennium, previous reports have not considered all Australian states and territories (Table 5). As a result, identifying the potential for subsequent reporting bias remained a crucial consideration, particularly when data from large states is not available. Similarly, regions with voluntary reporting may subsequently under-report the total number of deaths as described earlier.

Other factors may also contribute to the differences seen, such as the number of surgeries performed, an aging population and increasing frequency of comorbid disease. These will be considered below.

Table 4: Number of anaesthesia-related deaths during the 2015-2017 triennium, in relation to the population of all Australian states and territories

Number of deaths considered anaesthesia-related	239
Population of NSW, Vic, WA, Tas, SA, Qld, NT and ACT*	(24.40 million)
Number of anaesthesia-related deaths per million population, 2015-2017	9.87
Number of anaesthesia-related deaths per million population per annum	3.29

*Average national population estimate, calculated from annual June recordings of state-by-state population published by Australian Bureau of Statistics (ABS) data (3101.0 Australian Demographic Statistics)

Breakdown of state population statistics derived from ABS 3101.0 data; NSW 7.74, Vic 6.17, WA 2.56, Tas 0.52, SA 1.71, Qld 4.85, NT 0.25, ACT 0.40 (x million).

Table 5: Number of anaesthesia-related deaths in comparison with previous reports

	1997-99	2000-02	2003-05	2006-08	2009-11	2012-14	2015-17
NSW	-	-	53	92	125	156	151
NSW and Tas	56	67	-	-	-	-	-
Vic	32	39	40	21	18	28	58
WA	11	16	19	7	11	2	8
Tas	-	-	-	4	0	3	2
SA and NT	11	2	-	-	-	-	-
SA	-	-	-	-	2	4	8
NT	-	-	-	-	-	-	2
Qld	20	12	-	-	-	7	10
ACT	-	-	-	-	-	-	0
Total	130	136*	112	124	156	200	239

As noted in section C, comparing the rate of anaesthesia-related mortality has been constrained by data availability in previous reports. In addition, differences in reporting requirements and interpretations of mortality classifications makes contrast between trienniums less than ideal. Nonetheless, there is value in demonstrating anaesthesia-related mortality in relation to previous reports, particularly through more reliable comparators such as average number of anaesthesia procedures per death (Table 8), as it demonstrates the trending improvement of anaesthesia safety throughout the trienniums.

*An error was made in the 2000-02 triennial report which stated the total number of anaesthesia-related deaths was 137, the correct figure was 136.

Table 6: Number of anaesthesia-related deaths in relation to population in comparison to previous reports

	1997-99	2000-02	2003-05	2006-08	2009-11	2012-14	2015-17
Population (x million)	13.40	13.75	13.68	14.80	17.30	22.52	24.40
Number of anaesthesia-related deaths	130	137	112	124	156	200	239
Anaesthesia-related death rate per million population per triennium	9.70	9.96	8.19	8.37	9.02	8.88	9.87
Anaesthesia-related death rate per million population per annum	3.23	3.32	2.73	2.79	3.01	2.96	3.29

The 2015-17 triennium is the first to include data from each of Australia's states and territories and thus can be measured against the country's total population. New South Wales, Victoria and Western Australia have all consistently recorded and reported data since 1997, while other jurisdictions have contributed intermittently. This is the first *Safety of anaesthesia* triennial report where the population considered for analysis represents the estimated population of all Australian states and territories combined, rather than only the regions contributing to the dataset in previous triennial reports.

Overview

Section B

Number of anaesthetics administered

As in the previous reports, the total number of "episodes of anaesthesia care" (denominator) was obtained from the Australian Institute of Health and Welfare. The AIHW receives coding (ICD-10) on all medical procedures, including anaesthesia procedures, from coders at all public and private hospitals in Australia. As there is often more than one anaesthesia item and code for any single episode of anaesthesia care, AIHW applied a hierarchy to ensure that only one code was counted for each episode. The total number of episodes of care between 1 January 2015 and 31 December 2017 inclusive was obtained. This information is presented in Table 7.

Hierarchy used by "coders"

This hierarchy follows the Australian Coding Standards (0031) used by the National Centre for Classification in Health.

Australian Coding Standard 0031 (ACS 0031)

Classification consideration

If more than one anaesthetic from block [1910] cerebral anaesthesia and/or block [1909] conduction anaesthesia is administered in a "visit to theatre" (including different anaesthetics for different procedures), assign only one code from each block using the following hierarchies (listed from highest priority to lowest):

[1910] Cerebral anaesthesia

I. General anaesthesia (92514-XX)
II. Sedation (92515-XX)

[1909] Conduction anaesthesia

I. Neuraxial block (92508-XX)
II. Regional blocks (92509-XX, 92510-XX, 92511-XX and 92512-XX)
III. Intravenous regional anaesthesia (92519-XX)

[1333] Analgesia and anaesthesia during labour and caesarean section

I. Neuraxial block during labour (92506-XX)
II. Neuraxial block during labour and delivery procedure (92507-XX)

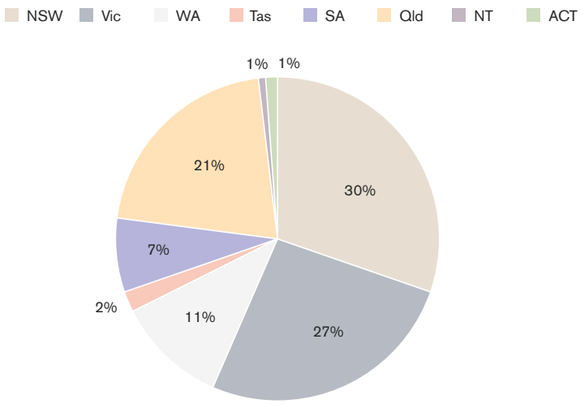
For the purposes of this report "episodes of anaesthesia care" applied only when anaesthesia was being provided for a surgical, diagnostic, or other interventional procedure. It excludes isolated nerve blocks because it is likely that the majority of nerve blocks identified outside the hierarchy used would have been performed for analgesia alone. It is possible that this methodology misses nerve blocks that were used to provide the sole anaesthesia for a small proportion of surgical procedures. However, it is likely that the number of such cases would be small in relation to the total number of cases, and would have little effect on the overall anaesthesia mortality rate. This approach was the same taken in previous iterations of this report.

Along with the growth in population in Australia, the number of episodes of anaesthesia has also grown. Figure 1 describes the relationship between the number of anaesthesia episodes of care and the number of anaesthesia-related deaths for the 2015-17 triennium. There remains considerable variation between regions despite correcting for the number of procedures performed.

Table 7: Estimated number of anaesthetics administered in all Australian states, and territories, and the estimated anaesthesia-related mortality rate per number of procedures

	NSW	Vic	WA	Tas	SA	Qld	NT	ACT	Total
Number of anaesthetics 1 January 2015 – 31 December 2017	4,138,345	3,594,249	1,495,634	310,238	993,692	2,846,532	99,326	174,822	13,652,911

Figure 1: Estimated number of anaesthetics administered in all Australian states, and territories, and the estimated anaesthesia-related mortality rate per number of procedures



Number of deaths considered anaesthesia-related	239
Estimated total number of anaesthesia procedures	13,652,911
Estimated mortality rate in relation to anaesthesia procedures	1:57,125

*The total number of anaesthetic procedures is calculated using the national dataset provided by the Australian Institute of Health and Welfare, and is subject to some minor state-specific data suppression requirements in certain circumstances.

Incidence of death related to anaesthesia

Numerator (number of anaesthesia-related deaths)

To obtain an accurate numerator it is necessary to identify all anaesthesia-related deaths and classify them correctly. As in previous iterations of this report, all participating states and territories had comprehensive procedures in place to assess and record anaesthesia-related mortality. Nevertheless, there is no way of ascertaining whether all anaesthesia-related deaths were reported or classified correctly. Therefore, the numerator must be considered a best estimate. On the other hand, it was felt by all state committees that it was unlikely a large number of cases were missed or classified incorrectly.

Denominator (total number of anaesthesia episodes of care)

The method used to obtain data on the total number of anaesthesia episodes of care was similar to the previous triennium. This method uses ICD-10 codes identified at individual hospital levels and reported to the AIHW. While this method is considered to be the most accurate available in Australia at present, the possibility of a small proportion of incorrect or incomplete coding must be considered. Therefore, the denominator is also a best estimate.

Anaesthesia-related mortality rate

The estimated anaesthesia-related mortality for the eight states and territories was 1:57,125 procedures. This is very similar to the estimated anaesthesia-related mortality rate outlined in the previous five triennial reports (Table 8).

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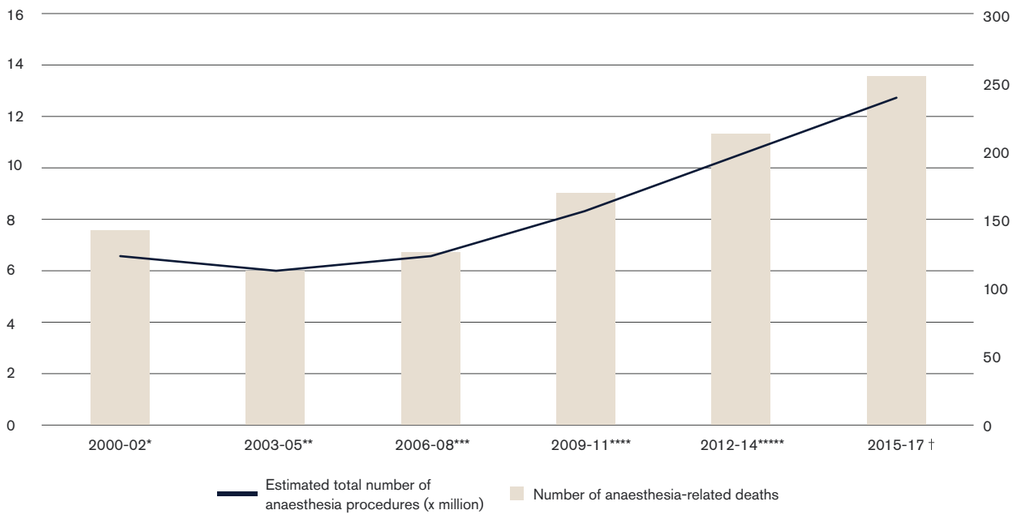
Table 8: Estimated anaesthesia-related mortality in relation to number of procedures compared to previous reports

	2000-02*	2003-05**	2006-08***	2009-11****	2012-14*****	2015-17 †
Estimated total number of anaesthesia procedures (x million)	7.65	5.98	6.88	9.05	11.40	13.65
Number of anaesthesia-related deaths	122	112	124	156	200	239
Anaesthesia-related death rate	1:56,000	1:53,426	1:55,490	1:58,039	1:57,023	1:57,125

Figure 2 shows the relationship between the recorded number of anaesthesia-related deaths and total anaesthesia procedures among the contributing jurisdictions to the reports since the 2000-02 triennium. The frequency of category 1-3 deaths for Australia at 1 per 57,125 procedures performed in this triennium closely matches previous reports.

Figure 2: Estimated anaesthesia-related mortality in relation to number of procedures compared to previous reports



* All Australian states
** NSW, Vic, WA
*** NSW, Vic, WA and Tas
**** NSW, Vic, WA, Tas and SA
***** NSW, Vic, WA, Tas, SA and Qld
† All Australian states and territories

Case study 2 – Pulmonary aspiration

An elderly man was admitted to hospital with a history of several months' weight loss, increasing abdominal discomfort and vomiting over several days. CTs performed had revealed a gastric mass and liver and lung infiltrates consistent with advanced gastric carcinoma.

He had previously suffered from hypertension, high cholesterol and ischaemic heart disease, with very occasional angina occurring on exertion. He was admitted to a metropolitan hospital under a general surgical team, who referred him to gastroenterology for endoscopy and biopsy of the tumour. The team also placed a nasogastric tube on free drainage and administered analgesics and replacement IV fluids. He was seen by an anaesthesia trainee the following morning immediately prior to the procedure, who noted the comorbidities, fluid administration and that no gastric fluid had drained overnight. They discussed the anaesthetic with the patient and consent was given. Limitations of treatment were discussed, and the patient expressed a wish not to be resuscitated or managed on a ventilator for a prolonged period. The patient was listed as ASA4E and sedation was planned. An anaesthesia consultant was present for the case. The nasogastric tube was removed prior to the procedure. Upon administration of the propofol sedation, passive regurgitation of thick gastric contents occurred, soiling the airway and interfering with the patient breathing. The anaesthetist administered suxamethonium and intubated the patient. Saturations remained low at 91 per cent on 100 per cent oxygen. The trachea was examined by fiberoptic bronchoscope and gastric contents removed by suction. The patient was transferred to ICU.

While in ICU, the patient's condition continued to deteriorate, with saturations falling despite ventilatory support. In consultation with the patient's family and in keeping with his previously expressed wishes, treatment options were not advanced further. The patient died later that day.

Clinical lessons

It is not uncommon to anaesthetise patients for diagnostic purposes, rather than specific surgical treatment. It is also not uncommon to be asked to make a patient comfortable for a procedure, noting that the patient may set limits on their care that may influence the provision of anaesthesia. In this case, the patient and operative team had discussed treatment options and made plans for both the procedure and subsequent care should it be required.

The choice to provide mild sedation and not to protect the airway with an endotracheal tube from the outset may have been influenced by the patient's wish to avoid ventilation or concerns about the lung infiltrates and the ability to extubate the patient after the procedure. Unfortunately, the risk of aspiration due to incomplete gastric emptying was also very high in this case, and the result was that lung function was compromised even further.

Aspiration of gastric contents continues to be a significant contributor to anaesthesia-related mortality in Australia. Risk of aspiration is reduced by recognising the circumstances where delayed gastric emptying is a risk, delaying emergency procedures to allow gastric emptying, aspiration of gastric contents via endogastric tubes, using non-particulate antacid medication and protecting the airway with a cuffed endotracheal tube. Rapid sequence induction is debated in the literature along with the use of cricoid pressure and the value of different choices in muscle relaxants.

Overview

Section B

Level of risk

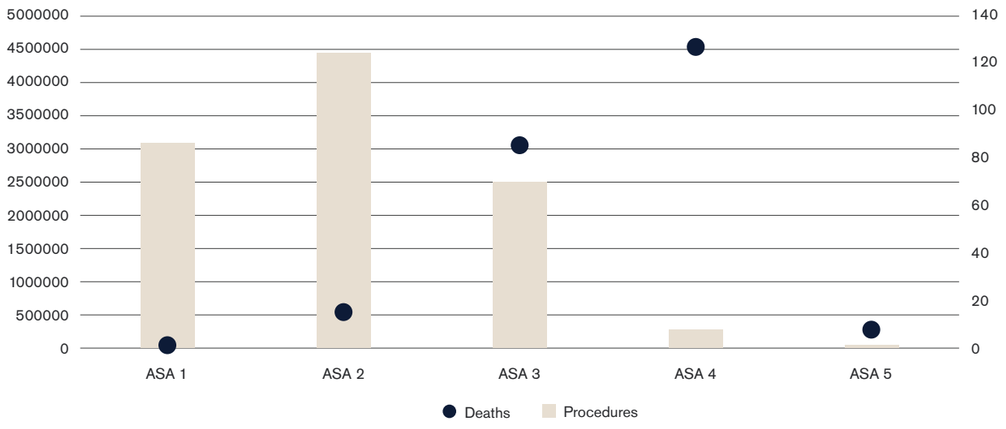
The American Society of Anesthesiologists' classification of Physical Health (ASA Score) has been used to determine anaesthesia risk since 1963. Patients are classified from I to V, with a higher score representing increasing levels of comorbid disease. Emergency surgery is an additional risk factor, denoted by the letter E.

Table 9: Level of risk of patients by ASA physical status

ASA physical status	NSW	Vic	WA	Tas	SA	Qld	NT	ACT	Total
1	0	2	0	0	0	0	0	0	2
2	7	7	0	0	2	0	0	0	16
3	52	19	5	1	2	6	1	0	86
4	87	29	3	1	4	3	0	0	127
5	5	1	0	0	0	1	1	0	8
Total	151	58	8	2	8	10	2	0	239

The majority of deaths reported where anaesthesia may have contributed occurred in ASA 3 and 4 cases. However, the majority of procedures performed over this period were undertaken on ASA 1 and 2 patients. The risk of patients dying from anaesthesia-related causes increases with their ASA score (see Figure 3). This is clearly evident with increasing numbers of anaesthesia-related deaths in ASA 3 and 4 patients, despite fewer procedures being performed in these categories. Very few procedures are performed upon patients deemed to be ASA 5 (that is, unlikely to survive more than 24 hours, despite surgery), so the number of deaths is unreliable.

Figure 3: Number of procedures in relation to ASA status of recorded deaths within the 2015-2017 triennium



Anaesthesia is very safe in low complexity patients undergoing elective procedures, with risk increasing in ASA 3 and 4 patients.

By ASA status, the total number of procedures were; ASA 1 3.08 million; ASA 2 4.46 million, ASA 3 2.49 million, ASA 4 308,883 and ASA 5 7,731. In addition, there was 160 procedures relating to ASA 6 and 3.30 million procedures where the ASA status was not documented.

Incidence of death in patients considered to be good or fair risk

Table 10: Incidence of death in patients considered to be good or fair risk compared to previous reports

Triennium	Number of ASA P1-2 patients	Total number of category 1-3 deaths	Percentage of deaths considered at good or fair risk
1991-93	30	116	26%
1994-96	13	135	10%
1997-99	19	130	15%
2000-02	26	137	19%
2003-05	18	112	16%
2006-08	17	124	14%
2009-11	11	156	7%
2012-14	14	200	7%
2015-17	18	239	7.5%

Patients at low risk (ASA 1 or 2) make up a small number of the overall anaesthesia-related deaths. At 7.5 per cent in this triennium, this proportion has been stable across three reports, having fallen from a high of 26 per cent in 1991-93. This is consistent with the trend towards higher anaesthesia-related mortality in older, sicker patients.

Causal or contributory factors in anaesthesia-related deaths

The classifications by the state committees of the most likely causal or contributory factors in the anaesthesia-related deaths are summarised in Table 11.

Table 11: Causal or contributory factors in anaesthesia-related deaths

	Total
Preoperative	
I. Assessment	28
II. Management	10
Total	38
Anaesthesia technique	
I. Choice or application	15
II. Airway maintenance	26
III. Ventilation	4

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IV. Circulatory support	7
Total	52
Anaesthesia drugs	
I. Selection	7
II. Dosage	17
III. Adverse event	16
IV. Incomplete reversal	1
V. Inadequate recovery	0
Total	41
Anaesthesia management	
I. Crisis management	6
II. Inadequate monitoring	16
III. Equipment failure	0
IV. Inadequate resuscitation	6
V. Hypothermia	0
Total	28
Postoperative	
I. Management	5
II. Supervision	5
III. Inadequate resuscitation	7
Total	17
Organisational	
I. Inadequate supervision or assistance	4
II. Poor organisation	3
III. Poor planning	20
Total	27
Total contributory factors	203
A. No correctable factor	146
B. Medical condition of the patient a significant factor	213

The average number of causal or contributary factors per anaesthesia-related death for this triennium was 0.85. This has been trending downward over the past two decades, with the average being 2.42 in 2000-02, 1.58 in 2003-05, 1.30 in 2006-08, 1.01 in 2009-11 and 1.03 in 2012-14. Over the same period, there has been a progressive increase in the percentage of deaths in which the medical condition of the patient has been deemed a significant factor contributing to their death. This was 28 per cent in 2000-02, 58 per cent in 2003-05, 72 per cent in 2006-08, 81 per cent in 2009-11, 86 per cent in 2012-14 and now 89 per cent in 2015-17. This data would be consistent with a progressive reduction in preventable anaesthesia-related mortality over this period, and that the most important factor is the severity of the patient's underlying medical condition.

Over the same period of time, the number of deaths in which no correctable factor could be identified has been trending upward, from 20 per cent in 2000-02, 33 per cent in 2003-05, 49 per cent in 2006-08, 58 per cent in 2009-11, 57 per cent in 2012-14 and now 61 per cent in 2015-17. This finding suggests that an increasingly large number of anaesthesia-related deaths occurred despite what has been considered to be optimal anaesthesia management by today's standards. As in previous reports these numbers have been heavily influenced by a large number of cases from NSW categorised by 3GH. This classification is used to describe extremely high risk cases in which the stress of surgery and anaesthesia has most likely contributed to or hastened death, but in which the death was considered non-preventable, other than by withholding the surgery.

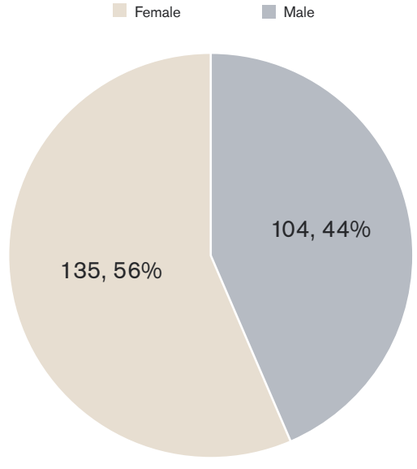
Sex

Table 12: Sex distribution in anaesthesia-related deaths

Sex	Total
Male	104
Female	135
Total	239

Of the reports received, females made up 56 per cent of the anaesthesia-related deaths reported in the triennium, while males made up 44 per cent.

Figure 4: Sex

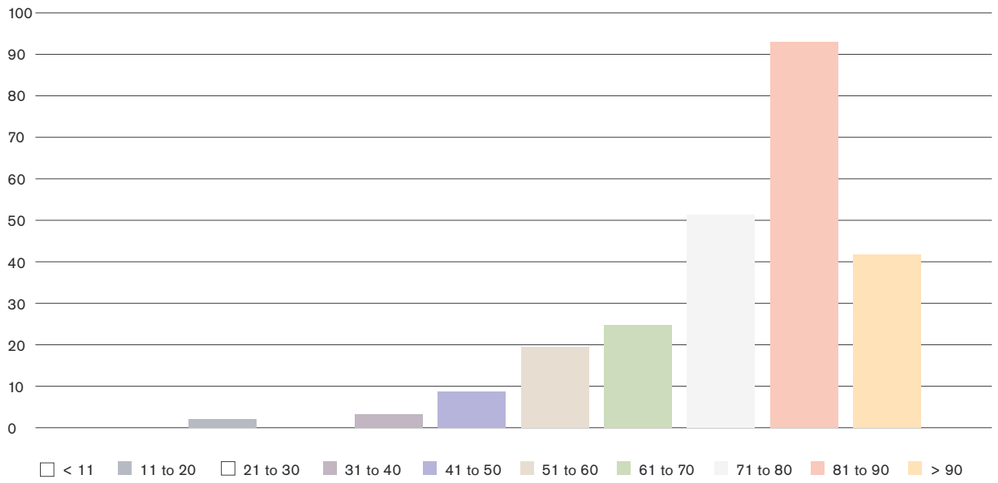


Overview

Section B

Age

Figure 5: Age distribution in anaesthesia-related deaths



Fewer than 5 per cent of the total reports received in the triennium were for patients 50 years of age or younger. Seventeen per cent were in patients over 90 years, 57 per cent were in patients over 80 years, 79 per cent were in patients over 70 years and 89 per cent were in patients over 60 years of age. Increasing age appears to increase the risk of anaesthesia-related death.

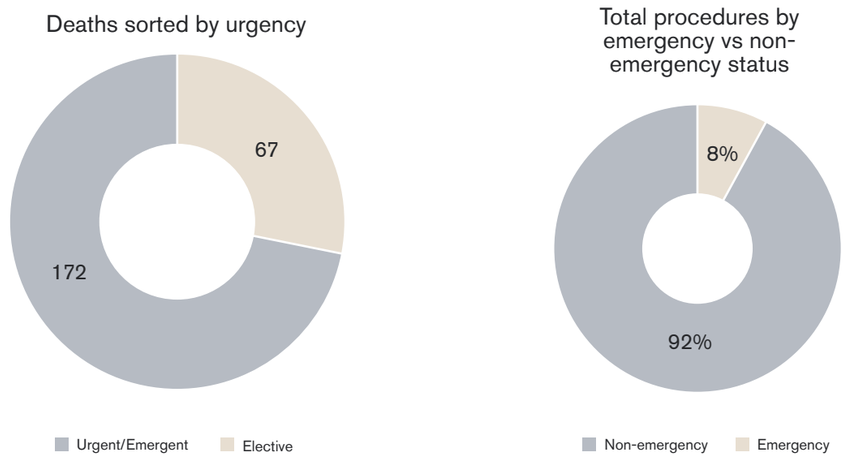
Table 13: Age distribution in anaesthesia-related deaths

Age (years)	Total
<11	0
11 to 20	1
21 to 30	0
31 to 40	2
41 to 50	8
51 to 60	19
61 to 70	24
71 to 80	51
81 to 90	93
>91	41
Total	239

Degree of urgency (based on admission status)

Figure 6: Recorded anaesthesia-related deaths based on procedural urgency status

Emergency procedures make up the minority of procedures performed in Australia, whereas urgent and emergent patients make up the majority of mortality reports reviewed.



A key theme emerging from this dataset is the disproportionate representation of emergency procedures as the common procedure type among 172 (of 239) reported deaths this triennium, accounting for approximately 72 per cent of reported deaths, despite only accounting for roughly 8 per cent of total procedures performed in all the jurisdictions during the triennium. This number is similar to recent triennial reports, with 73 per cent in 2012-14 and 70 per cent in 2009-11. Emergency surgery remains a likely risk factor for anaesthesia-related deaths.

Elective surgery allows patient and medical staff to carefully consider and plan their procedure, having weighed up the risks and come to a decision together. Conditions requiring emergency surgery, by their very nature, allow limited opportunity to plan and tend to balance the risk of performing the procedure with the risk of delaying it. As was stated in the previous report, anaesthetists must continue to be involved in the full discussion of risk with the patients, family and carers to account for properly informed consent and end of life planning. Many patients will have existing advanced care directives which should be considered and discussed in this setting. Such conversations should be held with the input of surgeons, anaesthetists and other specialists as needed to satisfy full understanding of the risks to the patient.

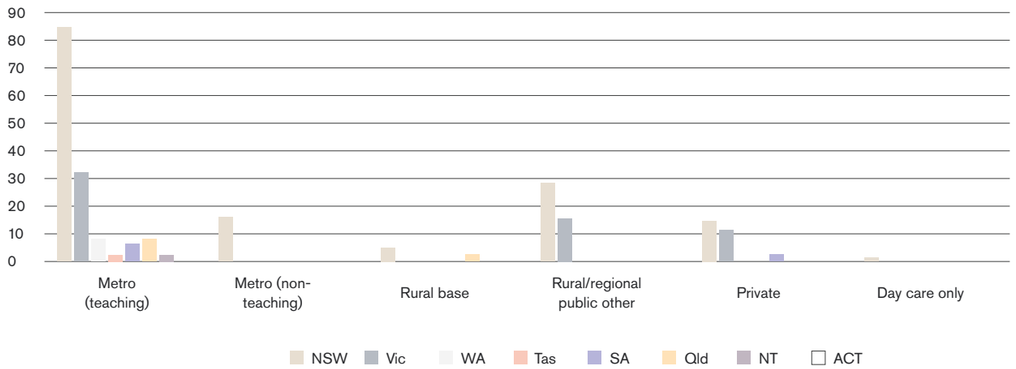
Overview

Section B

Type of hospital

Although the classification of hospitals differs between regions, the majority of deaths occurred in metropolitan teaching hospitals or rural/regional hospitals (81 per cent overall). The majority of emergency operations occur in teaching hospitals or rural centres, and the metropolitan teaching hospitals are usually the referral centres for higher risk surgical patients to undergo their procedures.

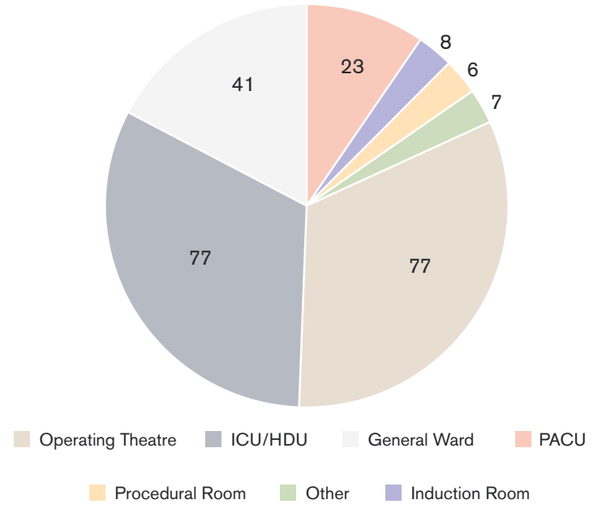
Figure 7: Type of hospital



Location of event leading to death

The location of the event leading to death, as documented in the triennial reports, is not necessarily in the operating theatre or induction room. Almost 50 per cent occur in HDU/ICU or ward settings. This is markedly different to the previous triennial report in which 94 per cent occurred in the induction room, procedure room, theatre or PACU. This appears to be related to a large number of incidents occurring in ICU/HDU or general wards in NSW and Victoria, whose committees are multidisciplinary and look at the broader perioperative journey of the patient. Considering the large number of cases classified as 3GH from NSW, it is conceivable that this aberration is due to cases being classified as such where it is the decision to operate that is being labelled as the “event” leading to their death.

Figure 8: Location of event leading to death



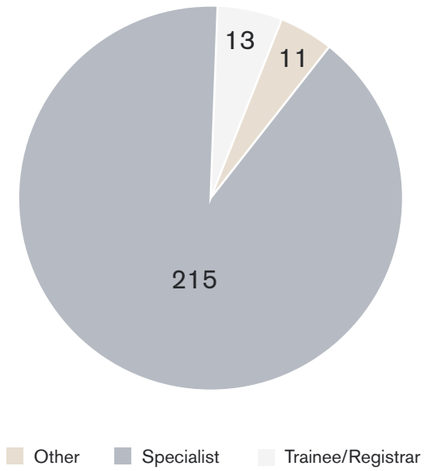
Overview

Section B

Grade of anaesthetist

Ninety per cent of cases reported had specialist anaesthetists involved in their care (89 per cent in 2012-14), while only 5 per cent were managed by trainee anaesthetists or registrars without direct supervision (6 per cent in 2012-14). This suggests that trainees are being supervised by specialists for the higher risk and emergency cases.

Figure 9: Grade of anaesthetist



Type of surgery or procedures

Table 14: Type of surgery or procedures

	Total
Surgical categories	
Abdominal	19
Cardiothoracic	18
ENT and Head/Neck	4
General (non-abdominal)	5
Gynaecological	1
Maxillofacial	0
Neurosurgery	3
Obstetrics	0
Ophthalmological	2
Orthopaedic	121
Renal	2
Urological	10
Vascular	20
Procedural categories	
Cardiology	0
Endoscopy	23
Radiology	2
Miscellaneous	
Electroconvulsive therapy	0
Invasive monitoring	0
Pain management	0
Resuscitation	1
Other	8

Orthopaedic procedures were the most likely to be associated with anaesthesia-related mortality (51 per cent of the total for this triennium). This is consistent with the 2012-14 triennium where orthopaedic procedures accounted for 55 per cent of the total deaths. Endoscopic procedures made up a further 9.6 per cent (increased from 6.5 per cent in 2012-14), then vascular surgery (8.3 per cent), abdominal surgery (7.9 per cent) and cardiothoracic surgery (7.5 per cent).

The increase in anaesthesia-related mortality associated with endoscopic procedures may reflect a general increase in the number of these procedures being performed, that more emergency procedures are being performed or that these procedures are being performed on older patients with more comorbidities.

The type of procedure should not affect anaesthesia-related mortality per se, but the surgical subspecialties listed are more likely than others to present patients with life-threatening emergencies (particularly vascular, cardiothoracic and abdominal surgery) or high-risk patients for urgent surgery (orthopaedic patients with hip fractures). The high numbers of orthopaedic cases listed from NSW is consistent with previous reports.

Overview

The New Zealand Perioperative Mortality Review Committee was established in 2010 under the NZ Public Health and Disability Act 2000 and reports to the Health Quality and Safety Commission (HQSC) alongside the already established mortality review committees; that is the Perinatal and Maternal, the Family Violence, the Child Mortality Review Committees and recently the time-limited Suicide Mortality Review Committee. The committee of mortality review chairs is working to co-ordinate and, where appropriate, integrate the activities of the respective committees and align the work of the committees with the aims of the Health Quality and Safety Commission.

Committee composition (2012-14)

The committee will have a maximum of eight members, including a public member, which will include the following expertise:

1. Substantial clinical experience and national credibility in one or more of the following: anaesthesia; surgery; obstetrics and gynaecology; intensive care; surgical nursing; and procedural internal medicine (for example, cardiology).
2. Knowledge of and experience in clinical epidemiology.
3. Knowledge of quality and risk management, in particular quality improvement in the health sector.
4. Knowledge of data and information gathering systems and analysis.
5. Senior level health service provision and management, both public and private sectors.
6. Knowledge of Māori health.
7. Knowledge of health inequities.

Deaths to be reported

1. Deaths that occurred during or after an operative procedure:
   a. Within 90 days.
   b. After 90 days of an operative procedure but before discharge home or to a rehabilitation facility.
2. A death that occurred while under the care of a surgeon in hospital even though an operation was not undertaken.
3. A death that occurred during or after an anaesthetic (general, regional or local) or sedation
4. For removal of doubt, gastroscopies, colonoscopies, and cardiac or vascular angiographies (diagnostic or therapeutic) carried out in a designated endoscopy or radiology room would be included in this definition.

In analysing NZ data therefore, strict comparisons with Australian state and territory anaesthesia mortality committes yeilds complimentary but differering results. While all deaths are captured in those who underwent anaesthesia care, the patient group was not restricted to that, and deaths are not specifically ascribed to anaesthesia events.

Confidentiality

The provisions relating to confidentiality are contained in schedule 5 of the NZ Public Health and Disability Act 2000, and place strict limits on disclosure of information. Anyone who discloses information illegally faces a fine of up to $10,000 and if a registered health practitioner, disciplinary action.

Coroners Act 2006 (relevant sections) Section 14 http://www.legislation.govt.nz/act/public/2006/0038/latest/whole.html#DLM377533

(1) The purpose of this act is to help to prevent deaths and to promote justice through:

a. Investigations, and the identification of the causes and circumstances, of sudden or unexplained deaths, or deaths in special circumstances.
b. The making of specified recommendations or comments (as defined in section 9) that, if drawn to public attention, may reduce the chances of the occurrence of other deaths in circumstances similar to those in which those deaths occurred.

(13) Deaths that must be reported under section 14(2)

(1) This section applies to the following deaths if, and only if, they are deaths to which subsection (2) applies:

During medical, surgical, or dental operation, treatment, etc

c. Every death –
   i. That occurred while the person concerned was undergoing a medical, surgical, dental, or similar operation or procedure.
   ii. That appears to have been the result of an operation or procedure of that kind.
   iii. That appears to have been the result of medical, surgical, dental, or similar treatment received by that person.
   iv. That occurred while that person was affected by an anaesthetic.
   v. That appears to have been the result of the administration to that person of an anaesthetic or a medicine (as defined in section 3 of the Medicines Act 1981).
d. Any death that occurred while the woman concerned was giving birth, or that appears to have been a result of that woman being pregnant or giving birth.

Terms of reference

The committee is required to:

1. Review and report to the HQSC on deaths that are within the committee's scope, with a view to reducing these deaths and to continuous quality improvement through the promotion of ongoing quality assurance programs.
2. Advise on any other matters related to mortality.
3. Develop strategic plans and methodologies that are designed to reduce morbidity and mortality and are relevant to the committee's functions.

The committee must:

4. Monitor the number, categories and demographics of deaths relevant to its functions and to identify patterns and trends over time.
5. Undertake or co-ordinate reviews locally as local quality improvement initiatives, for system and practice improvements to reduce avoidable perioperative mortality and as data collection systems for national review.
6. Analyse and use data collected to develop effective recommendations that are useful for policy development at a national level.

Publications

POMRC has now released eight reports:

- 2012 - Perioperative Mortallity in New Zealand
- 2013 - Second report of the Perioperative Mortality Review Committee
- 2014 - Third report of the Perioperative Mortality Review Committee
- 2015 - Fourth report of the Perioperative Mortality Review Committee
- 2016 - Fifth report of the Perioperative Mortality Review Committee
- 2017 - Sixth report of the Perioperative Mortality Review Committee
- 2018 - Seventh report of the Perioperative Mortality Review Committee
- 2019 - Eighth report of the Perioperative Mortality Review Committee

Data collection

For the epidemiological analysis, POMRC uses data from the National Minimum Dataset (NMDS), which receives coded information about all discharges from public and some discharges from private facilities, and the National Mortality Collection (NMC), which receives information from multiple sources including death certificates, police and coroner. Using these data sources allows deaths in institutions the patient was transferred to and after discharge to be identified. These reports have focussed on the epidemiology of all-cause perioperative deaths related to specific procedures (general anaesthesia, total hip and knee replacements, colorectal resection, cataract extraction, cholecystectomy), a higher expected mortality group (age 80+), a lower expected mortality group (ASA-P 1-2 elective admissions), post-operative complications (pulmonary embolus) and recent concerns in other countries (day of week of procedure). Each specific group of deaths is analysed with respect to admission status (elective, acute-arranged, acute), gender, ASA status, ethnicity and socio-economic status (NZDEP scale). As with the reports from the Australian state and territory mortality committees, the main risk factors are the specific procedure, age, admission status and ASA status.

While cause of death is noted in the national mortality collection, it is the underlying cause of death, not the proximate cause of death. Specific classes of deaths are tracked over time so that trends can become apparent.

This data can describe who died, but not why they died or if some of those deaths could have been prevented. This is the focus of the second stream of work, peer review of selected cases of interest. To do this, the committee needs to receive reports describing the care delivered in more detail.

Current developments

The reports in 2018, 2019 and 2020 have specifically investigated areas of high perioperative risk, and sought indicators of areas of change and improvement.

The 2018 topic was related to hip fracture patients. Key findings of the report were:

- Surgery was undertaken in 90.7 per cent of patients admitted with hip fractures. The remaining 9.3 per cent were given non-surgical treatment, which typically involves bed rest for about six weeks.
- Delays between admission and surgery increase the mortality rate. The mortality rate following surgery within one day of admission was 6.4 per cent, rising to 8.2 per cent after four days.
- Age and gender have an effect on outcomes. Males have a higher overall mortality rate than females. Males over 80 years old had the highest mortality rate.
- Having other health conditions, poor health and complications were also associated with higher mortality rates following hip fractures.

The 2019 report focussed on acute laparotomy. In particular, it investigated the differences in outcome between mortalities in Māori and Pakeha (European) subgroups. The key differences identifies were:

- Māori are dying at a higher rate and much earlier than non-Māori following emergency laparotomy.
- Māori are over-represented and dying at much higher rates in the highest socioeconomic deprived areas.
- Māori are dying at higher rates with a higher prevalence of comorbidities.
- The average age of Māori having emergency laparotomies is 10 years younger than non-Māori.
- Approximately one in 20 deaths in New Zealand fall within the POMRC's scope. In 2015, there were 31,608 deaths, and 4.3 per cent of these (1354) occurred within 30 days of surgery. Some of these perioperative deaths were 'expected', for example, surgery as a last resort in a life-or-death situation. Others may have been avoidable with earlier intervention or better medical and surgical care.

At a regional meeting of the Lancet Commission on Global Surgery in 2015, New Zealand was credited with having the best perioperative mortality data in the world. The POMRC is further developing New Zealand's perioperative mortality data by introducing a local system for reviewing perioperative deaths. This system is being trialled in pilot sites across five district health boards. This national web-based system will allow the POMRC to collate the review findings at a national level, and to share with others the important quality improvement themes and lessons learned from the reviews.

Using the inclusion criteria New Zealand data of perioperative mortality can be tabulated into the following subgroups

Table 54: WHO metrics and perioperative mortality by year, New Zealand 2011–2016

Year	Admissions with at least one general/neuraxial anaesthetic	Deaths on the same day as surgery	Day-of-surgery mortality rate per 100,000 (% of all admissions)	In-hospital deaths following general and/or neuraxial anaesthetic	In-hospital mortality rate per 100,000 (% of all admissions)
2011	269,559	93	34.50 (0.03%)	1,052	390.27 (0.39%)
2012	270,925	102	37.65 (0.04%)	964	355.82 (0.36%)
2013	277,616	112	40.34 (0.04%)	987	355.53 (0.36%)
2014	285,130	124	43.49 (0.04%)	1,002	351.42 (0.35%)
2015	278,650	99	35.53 (0.04%)	944	338.78 (0.34%)
2016*	265,458	124	46.71 (0.05%)	927	349.21 (0.35%)
2011-2016	1,647,338	654	8	2	356.68 (0.33%)

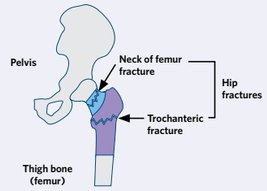
Numerator: NMC: Deaths occurring after a general anaesthetic or neuraxial block.

Denominator: NMDS: Hospital admissions with at least one general anaesthetic or neuraxial block.

* Provisional data.

Dr Kerry Gunn FANZCA
POMRC

Hip fractures



POMRC
Perioperative Mortality Review Committee

Hip fractures are common

Falls are the leading cause of injury to older people, with over 3,000 people falling and fracturing their hip every year.

One in three older people has a fall each year, and the likelihood of falling increases as people get older and more frail.

Consequences of hip fracture are serious

- 8% of people who sustain a hip fracture will die within 30 days
- 10% don't return to their own home
- 50% will still experience a mobility-related disability 12 months after injury
- 25% will die within one year

Improvements to care

Having surgery within 48 hours of admission leads to better outcomes and a lower mortality rate. Operate within 48 hours, unless there is a good reason not to

Delays between admission and surgery increase the mortality rate

Comorbidities, health status and complications are associated with poorer outcomes

Postoperative complications have a significant impact on morbidity and mortality

People undergoing surgery should receive proactive perioperative care from a multidisciplinary team, to enable the early detection and management of comorbidities and complications

- All older people in the community should be routinely screened for osteoporosis and risk of falling.
- All health care facilities should conduct a falls risk assessment for patients over 70 years of age.

Take measures to reduce your risk of falling

- Keep active
- Have your medicines reviewed
- Have your eyes checked and update your glasses
- Remove trip hazards

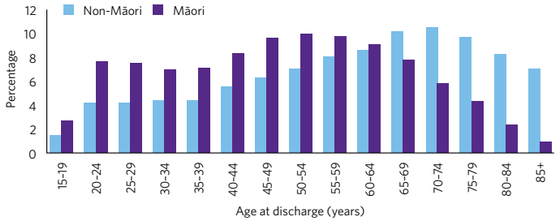
Develop an advance care plan

Have a conversation about what to do if you fall. Making plans in case of an injury or illness gives people confidence that their thoughts and wishes are known and can be respected. Talk about and write an advance care plan.

Emergency laparotomy outcomes for Māori | Ngā putanga hahae puku ohotata mō Ngāi Māori

Differences in patient health and perioperative mortality between Māori and non-Māori show the current system creates and maintains health inequity.

Distribution of patients undergoing emergency laparotomy by age



The average age of Māori having emergency laparotomies is 10 years younger than non-Māori.

Māori are dying at higher rates and at much younger ages than non-Māori **following emergency laparotomy.**

Māori are over-represented and dying at much higher rates in the **highest socioeconomic deprived areas.**

Māori are dying at higher rates with a **higher burden of comorbidities, including diabetes.**

Māori have a **higher burden of disease**, which correlates to higher mortality.

Even at younger ages, Māori have a higher mortality rate, demonstrating a higher burden of disease at younger ages in Māori.

Multivariate analysis shows the percentage increased mortality from each factor:
15% socioeconomic deprivation, 18% comorbidities, 9% complications and **11% racial disparities.**

Recommendations from the POMRC include:

Improvements to Māori surgical outcomes

All surgical departments to commit to achieving equitable outcomes for Māori, and honouring Te Tiriti o Waitangi.

All surgical departments to review Māori mortality and morbidity outcomes and, where inequities exist, consider all aspects of the surgical pathway that may contribute to these inequities.

All surgical staff to undertake training on Te Tiriti o Waitangi, cultural safety and competency.

Improvements to surgical care

Emergency laparotomy patients and their whānau should be given the opportunity to discuss appropriate goals of care.

New South Wales

SCIDUA

Overview

The NSW Special Committee Investigating Deaths Under Anaesthesia (SCIDUA) is an expert committee established under section 20 of the Health Administration Act 1982.

Established in 1960, SCIDUA is the longest serving committee of its kind in the world, and has contributed to the impressive reduction in mortality attributable to anaesthesia in Australia.

The terms of reference for SCIDUA are to subject all deaths occurring while under, as a result of, or within 24 hours after the administration of anaesthesia or sedation, to peer review so as to identify any areas of clinical management where other methods may have led to a more favourable result.

The committee also began examining sedation related deaths in NSW from 1 September 2012.

Committee composition

The members of SCIDUA are appointed by the secretary, NSW Health, under delegation by the minister for health. Committee members are appointed for a fixed term of five years, at the end of which the committee advises the secretary, NSW Health whether their re-appointment is appropriate. The committee elects its own chairperson, who must be a practicing anaesthetist. The chief executive, clinical excellence commission serves as an ex-officio member.

The committee tries to ensure that anaesthetists from a broad range of clinical specialties and professional organisations are represented. Nominations for membership come to the committee from the Australian and New Zealand College of Anaesthetists (ANZCA), the Australian Society of Anaesthetists (ASA), and academic departments of anaesthesia.

Purpose and function

The NSW Public Health Act 2010 requires the health practitioner who is responsible for the administration of the anaesthetic or sedative drug, where the patient died while under, or as a result of, or within 24 hours after the administration of an anaesthetic or sedative drug, for a medical, surgical or dental operation or procedure, to report the death to the secretary, NSW Health. Reports are submitted to SCIDUA, the regulatory body responsible for investigating these deaths.

Terms of reference

SCIDUA undertakes:

- To register, investigate and classify deaths occurring during or within 24 hours of a procedure performed under anaesthesia or sedation.
- To examine information acquired and identify any issues of management which were instrumental in the patient's death.
- To report the committee's findings confidentially to the medical practitioner/s involved in the patient's care.
- To report annually to the minister for health, drawing attention to any matters which require action to improve the safety of anaesthesia and sedation in NSW.
- To acquaint the medical profession in general, and anaesthetists in particular, with any matters to which special attention needs to be paid to ensure the safety of anaesthesia and sedation.
- To make available the expertise of its members to the Clinical Excellence Commission in pursuit of systemic improvements to patient care in the fields of anaesthesia and sedation.

New South Wales

Continued

Reporting and review of anaesthesia-related deaths

Notification of deaths meeting the SCIDUA criteria are reported by public and private hospitals across NSW. They are also self-reported to SCIDUA by the medical practitioner administering the anaesthesia or sedation.

All reported deaths are individually reviewed by the two-member triage sub-committee, which will classify the death as *due to factors not falling under the control of the health practitioner* or request the reporting health practitioner to provide further information by completing the standard SCIDUA questionnaire, available online.

Once the deaths are triaged, the chair reviews the cases. They are then discussed at the next SCIDUA committee meeting and classified using the nationally recognised Anaesthetic Mortality Classification system. A confidential reply by the chair is then emailed to the health practitioner explaining the committee's decision.

The committee reports annually to the minister on the results of its deliberations. The committee also provides aggregate data to the National Committee on Anaesthetic Mortality, on a triennial basis.

Legislative protection

All of the committee's proceedings, documents and correspondence are considered as specially privileged information and protected under section 23 of the Health Administration Act 1982.

All communications between the reporting medical practitioner and the committee are strictly confidential.

Annual report

The SCIDUA 2018 Report has been released and can be found online.

It is the first-time real cases have been included in the report ensuring readers have a clinical framework from which to learn from.

SCIDUA is working on its 2019 annual report which will include diagnostic reports to further enhance the quality of its learnings.

Joint forum

The Clinical Excellence Commission recently facilitated the inaugural joint forum of the Collaborating Hospitals' Audit of Surgical Mortality (CHASM) Committee and the Special Committee Investigating Deaths Under Anaesthesia (SCIDUA). This new initiative was designed to review a case which progressed through both mortality programs and identify relative clinical learnings.

The outcomes paper from the joint forum and the de-identified case are available online. Together, these documents demonstrate the complexities that clinicians encounter, along with the challenges of clinical management.

Dr Carl D'Souza FANZCA
Chair, SCIDUA

Victoria

VPCC (formerly VCCAMM)

Overview

The Victorian Consultative Council on Anaesthetic Mortality and Morbidity (VCCAMM or the council) was originally established in 1976 under section 13 of the *Health Act 1958* to inquire into the circumstances of deaths and illnesses occurring during or as a result of anaesthesia, with the "sole object of making recommendations which would lead to their prevention" (Letter accompanying the first report, 1983). The council has subsequently operated pursuant to sections 33-43 of the *Public Health and Wellbeing Act 2008* (the act).

Key developments

Final term of the VCCAMM and establishment of a new Victorian Perioperative Consultative Council (VPCC)

For more than 40 years, Victorian anaesthetists have generously provided information about possible anaesthesia-related mortality and morbidity to help improve overall safety and quality of anaesthesia care in Victoria. The inclusion of morbidity reporting has always been an important and unique focus in the Victorian model. Over time, this has become increasingly relevant as anaesthesia-related mortality has become less common.

Cases reported in the 2015-2017 triennium reflected the growth in non-operating room anaesthesia and included an increasing number of reports around broader perioperative issues, particularly in older patients with complex medical problems. This trend highlighted the changing context in which anaesthesia is delivered and the multifactorial nature of perioperative outcomes.

In 2018, the council participated in a Safer Care Victoria review of the VCCAMM and the Victorian Surgical Consultative Council (VSCC). This was a significant and welcomed opportunity to review past achievements, revisit objectives in a changing healthcare context and consider opportunities to strengthen perioperative outcome review in Victoria. The resulting Victorian Perioperative Consultative Council (VPCC) report is available here.

In this spirit, the VCCAMM completed its final term on 30 June 2019, with Safer Care Victoria establishing the new VPCC in 2019 to take perioperative outcome review forward with a new direction and focus more consistent with Victoria's evolving health context.

The VPCC was established to combine and strengthen the functions of the VCCAMM and the VSCC. It oversees, reviews and monitors perioperative care in Victoria to improve outcomes for patients before, during and after surgery. The VPCC is chaired by Professor David Watters. The functions of the new VPCC are described in more detail in the "Current developments" section page 49.

VCCAMM in the 2015-2017 triennium

Purpose and functions

The role of the VCCAMM during 2015-2017 was to provide advice to the Victorian minister for health and the Department of Health and Human Services (DHHS) on avoidable causes of morbidity and mortality relating to anaesthesia. In addition, the VCCAMM aimed to identify systemic issues that may challenge the quality of care and outcomes for anaesthesia and identify opportunities for system wide improvement to support the work of the department.

The work of the VCCAMM (and other consultative councils) was managed and supported by the DHHS and subsequently Safer Care Victoria.

During this time, the functions of the council as outlined in section 38 of the act were to:

a. Monitor, analyse and report on matters specified for that prescribed consultative council (which for this council relates to potentially preventable anaesthesia mortality and morbidity within the Victorian hospital system);
b. Consider, investigate and report on any matter specified by the minister or the secretary in a direction to the prescribed consultative council under section 37(2);
c. Liaise with any other consultative council on any matter relevant to the functions of the prescribed consultative council;
d. Improve public health and wellbeing by publishing and disseminating relevant information and practical strategies identified by the prescribed consultative council in the course of performing its functions;
e. Publish an annual report on the activities of the prescribed consultative council;
f. Perform any function specified in the Order which established that prescribed consultative council;
g. Perform any other prescribed function;
h. Collect information for the purpose of performing the functions specified in this subsection.

Key events in the 2015-2017 triennium

The 2015-2017 triennium saw a number of changes in the VCCAMM structure and processes, including:

- Appointment of a new council in December 2015 (with revised terms of reference and functions) and establishment of a Case Review Sub-Committee.
- Enhanced multidisciplinary representation, including much-valued consumer representation on both the council and Case Review Sub-Committee. This greatly broadened the council's focus regarding opportunities for improving anaesthesia and perioperative care.
- Collaboration with the Victorian Audit of Surgical Mortality (VASM) in 2016, enhancing the council's ability to identify possible anaesthesia-related mortality.
- Introduction of an online reporting form, facilitating more timely and complete referral submissions.

Acknowledgements

We are deeply appreciative of the VCCAMM and Case Review Sub-Committee members for their contributions over the 2015-2017 triennium. Their knowledge, experience and multidisciplinary expertise was invaluable. We would also like to acknowledge the members who retired during the triennium, many of whom generously contributed their time and expertise to the VCCAMM over a great number of years. In particular, we wish to acknowledge the contribution of Associate Professor Larry McNicol AM, who chaired the council from 2004 to 2017 with tireless effort, dedication and commitment to improving the safety of anaesthesia care in Victoria.

Council composition (2015-2017)

Under the act, council members (not more than 15) were appointed by the minister for health:

- One member appointed as the chairperson (an expert clinician or health service executive with expertise in anaesthesia).
- One member appointed as the deputy chairperson.
- The majority of members must be persons with special knowledge which the minister considers is relevant for the functions of the council.

The last VCCAMM council was appointed in December 2015. It comprised the existing chairperson, and 14 other members, including six specialist anaesthetists, a medical leader in clinical practice improvement with an anaesthesia background, a pathologist, a private sector hospital executive, a public hospital director of safety and quality, a perioperative nursing representative, a department representative and two consumer representatives. The council met approximately quarterly.

In 2016, the council appointed a Case Review Sub-Committee (CRSC) under section 36 of the act. The inaugural sub-committee included seven VCCAMM members and three external appointees (two anaesthetists and one surgeon). The sub-committee was established to carry out expert clinical case reviews to allow the council to focus on outcomes and provide strategic advice for system-wide improvement. The sub-committee reported to the council. Project and secretarial support to the council and sub-committee was provided by the DHHS and subsequently Safer Care Victoria.

Reporting and review of anaesthesia-related deaths (2015-2017)

During the 2015-2017 triennium, VCCAMM continued to operate pursuant to sections 33-43 of the act.

Under section 39 of the act, the council chair may issue a notice requesting general or specific information on any anaesthesia-related mortality or morbidity case from a Victorian health service provider or pathology service that the council chair considers is necessary to enable the council to perform its functions. Under section 40 of the act, the health service provider must provide such requested information. However, activation of these provisions has depended on initial notification of potential anaesthesia-related mortality and morbidity to the VCCAMM.

Sections 42 and 43 of the act describe the confidentiality obligations that apply to the council; section 41 of the act outlines the circumstances in which information can be disclosed by a council. Accuracy of the data regarding the number of anaesthesia-related deaths has been dependent on the council's ability to obtain information on all potential anaesthesia-related deaths in Victoria.

Anaesthesia is a broad concept that includes general anaesthesia, major regional blocks, intravenous sedation and local anaesthesia. As such, anaesthesia is not always administered in an operating theatre or by an anaesthetist. Anaesthesia is increasingly being provided in non-traditional locations for a growing range of non-surgical disciplines and procedures, and by a range of providers. During the 2015-2017 triennium, the council had limited ability to capture anaesthesia-related mortality and morbidity occurring in this expanding, broader context.

Under existing arrangements, cases directly referred to the council were voluntarily reported in the 2015-2017 triennium. The council greatly appreciated efforts by individual anaesthetists, anaesthesia departments, the Coroners Court of Victoria and, more recently the VASM to inform the VCCAMM of potential and/or significant cases of anaesthesia-related mortality and morbidity. Notifications from the VASM, which began in 2016, importantly improved the council's ability to identify anaesthesia-related events that may have unfolded or first become apparent in the postoperative period. Under arrangements with the Coroners Court of Victoria, the council chair has had access to medical depositions submitted to the coroner for cases in which anaesthetic administration(s) had occurred.

During the 2015-17 triennium, the VCCAMM reviewed 238 cases, including 110 cases classified as anaesthesia-related mortality and morbidity. The classification of mortality and morbidity events as anaesthesia-related remained a subjective judgement based on council consensus opinion.

Current developments (2020)

Role of the new Victorian Perioperative Consultative Council (VPCC)

The VPCC was established in October 2019 to oversee, review and monitor perioperative care and to improve processes and outcomes for patients before, during and after surgery. The VPCC combines and strengthens the functions of the previous VCCAMM and VSCC. Like the VCCAMM and VSCC, the VPCC is protected under Victoria's *Public Health and Wellbeing Act 2008* and reports to the minister for health. The VPCC will continue to review and monitor anaesthesia-related mortality and morbidity in Victoria and provide Victorian data for the ANZCA *Safety of Anaesthesia* report.

Surgery in Victoria is safe, with a 0.3 per cent interventional mortality rate reported in 2017-18. This is comparable to international OECD standards and attests to the safety and quality of perioperative care in Victorian hospitals. The majority of surgical deaths occur in elderly patients with multiple comorbidities undergoing emergency surgery (VASM Report, 2018). Two of the major causes of perioperative death are fractured neck of femur or acute abdominal pathology. These conditions also cause significant morbidity and loss of function for many patients who survive their surgery and anaesthesia. The VPCC will encourage health services to participate in the Australia and New Zealand Hip Fracture Registry and Emergency Laparotomy audit. These quality improvement registries address process of delivery and patient-related outcomes of care, with key performance indicators.
The VPCC also has an interest in learning from unplanned returns to theatre (URTT). URTT is one of the Australian Commission on Safety and Quality in Health Care's hospital acquired complications and occurs in 15 per cent of perioperative mortalities, though the vast majority (95 per cent) of patients who require an unplanned return to theatre survive. URTT is not necessarily a negative event; rather it can be an essential contribution to a patient's survival, representing timely decision making in response to deterioration during the postoperative period. Opportunities to learn from URTTs will include transferred patients who undergo a return to theatre.

Perioperative cardiovascular events also cause considerable morbidity and some mortality. They may occur across any stage of the perioperative period, often after discharge from hospital, and include stroke, myocardial infarction and pulmonary embolism. The VPCC will be working with health services, clinicians, VASM and other organisations to identify opportunities to raise awareness, improve care and reduce the incidence of these events. These broader activities in the perioperative space represent important opportunities for the new VPCC to have a significant impact on improving perioperative care and outcomes in Victoria.

We look forward to the work ahead. For more information visit the Safer Care Victoria website.

Dr Andrea Kattula FANZCA
Chair, VCCAMM (2017-2019)
Deputy Chair, VPCC (2019-)

Professor David Watters
Chair, VPCC (2019-)

Western Australia

Western Australia Council on Anaesthetic Mortality and Morbidity

Overview

The Anaesthetic Mortality Committee (AMC) of Western Australia was established in 1978 by proclamation of the Health Act Amendment Act 1978. The Public Health Act under which the functions of the AMC and the investigators are governed was updated in 2017 and is now the Health (Miscellaneous Provisions) Act 1911.

The committee consists of 12 members appointed by the minister of health with deputy members appointed as needed. In addition to the committee, the minister appoints specialist anaesthetists as the investigator and deputy investigator. For any particular meeting, a quorum consists of six of the committee members including the chair.

Committee composition

The members consist of six practicing specialist anaesthetists nominated by, and representing the following bodies:

- The Australian and New Zealand College of Anaesthetists – the chair of the committee.
- The Australian Society of Anaesthetists.
- The Australian Medical Association.
- The Department of Health, Chief Health Officer.
- A professor of anaesthesia at UWA.
- A professor of clinical pharmacology at UWA.

And six non-anaesthesia representatives:

- A specialist surgeon nominated by the state branch of the Royal Australasian College of Surgeons.
- A specialist obstetrician and gynaecologist nominated by the state branch of the Australian council of the Royal Australian and New Zealand College of Obstetricians and Gynaecologists.
- Two general practitioners with a special interest in anaesthesia, nominated by the state branch of the Royal Australian College of General Practitioners.
- A dental practitioner nominated by the state branch of the Australian Dental Association.
- A registered midwife nominated by the state branch of the Royal Australian Nursing Federation.

The minister may appoint persons as deputies to act in the respective places of the chairperson and other members of the committee when not able or available to act.

The minister also appoints an investigator and their deputy who are to be medical practitioners who specialise in anaesthesia.

Purpose and functions

- Assessments of cases reportable under Health (Miscellaneous Provisions) Act 1911: Where a person died within the period of 48 hours following the administration of an anaesthetic agent or as the result of any complications arising from the administration of an anaesthetic. These are referred by the chief health officer (CHO) to the investigator for assessment, cases which the investigators considers may be in categories 1-3 or if they are unable to make a definitive assessment are reviewed by the AMC.
- The AMC must determine whether in the opinion of the committee the death might have been avoided, and may add to its determination any constructive comments the committee considers advisable for the future assistance and guidance of medical practitioners, dental practitioners, nurses and midwives.
- Provide the CHO with a yearly summary of the cases and assessments.
- Provide information, education and instruction in anaesthesia theory and practice as it may deem necessary or advisable from time to time for the assistance and guidance in avoiding and preventing anaesthesia morbidity or mortality.

Reporting and review of anaesthesia-related deaths

Requirements for reporting: Death of persons under the anaesthetic must be reported to the chief health officer:

All deaths occurring within 48 hours of commencement of an anaesthetic or deaths where the anaesthetic is thought to have been a contributing factor or as the result of any complications arising from the administration of an anaesthetic must be reported to the CHO. The timing is considered to be from the commencement/induction of the anaesthetic.

The process for assessment:

- The report written to the CHO regarding the death is referred to the investigator(s) who review the case and enquire into the circumstances of the death. The investigator may request further information if needed. This is usually in the form of the hospital file and the autopsy report. The investigator may also interview the anaesthetist or any other persons likely to assist in the investigation.
- If a case is identified to the WA AMC, by a third party the anaesthetist involved in the patient management will be asked to send a report.
- If the investigator clearly considers the case not to be classified in categories 1-3 (not likely to have been due, in whole or part, to anaesthetic factors), the reporting anaesthetist is notified of this in writing and the finding will be reported to the CHO.
- If the investigator is of the opinion that the death is likely to have been due in some measure to anaesthetic or surgical factors, they prepare a case report for the chair of the committee.
- In all cases which the investigator considers may be in categories 1-3 or if they are unable to come to a definite conclusion, the de-identified documents related to the case are considered by the AMC and a consensus opinion is reached regarding the cause of death and whether the conduct of the anaesthetic or surgery played any part.
- The chair of the committee will then write to the anaesthetist involved regarding the assessment of the case.

Legislative protection

The Health (Miscellaneous Provisions) Act 1911, subsection Child health and preventive medicine Part XIII, 2017 update, governs the functions of the AMC and the investigators. With the following protections regarding confidentiality and liability protection:

- (6) For the purposes of this section all information, records of interviews, reports, statements, memoranda or other particulars … shall be confidential and shall not be communicated or divulged, either in whole or in part, to any person other than the chair of the Anaesthetic Mortality Committee, or by the chair or any other member of the committee, except for the purposes and in accordance with the provisions of Part XIIIC.
- Information, records of interviews, reports, statements, memoranda and other particulars referred to in subsection (6) are not admissible in any court or before any tribunal, board or person in any action, cause or inquiry of any kind whatsoever.
- No person, corporate body, association, or institution shall be liable in any action for damages or other relief by reason of the furnishing to the investigator, or to the Anaesthetic Mortality Committee, of any information, record, report, statement, memorandum or particulars referred to in subsection (6).
- Nothing in this section shall prejudice or otherwise affect any of the provisions of the Coroners Act 1996, or of any other act so far as the same relates to prosecutions for indictable and other offences and the obtaining and adducing of evidence relative thereto, but this section shall be read and construed as separate and distinct from the provisions of those acts.
- The report of the investigator to the chair is in the form of a medical report with identification of persons and places removed. The chair knows the name of the anaesthetist as he or she has to write to the anaesthetist after the meeting. When the committee has completed its deliberations, the material must be returned to the executive director of Public Health for safe custody.
- The reports of the investigator and the determinations of the committee may be disseminated for educational purposes, provided that persons involved are not identifiable.

Terms of reference

- The AMC must determine whether in the opinion of the committee the death might have been avoided, and may add to its determination any constructive comments the committee considers advisable for the future assistance and guidance of medical practitioners, dental practitioners, nurses and midwives.
- The determination of the committee must be notified in writing by the chair to the medical practitioner or dental practitioner (if any), or nurse or midwife (if any), who was attending the deceased at the time of the occurrence of the death or who attended the deceased before the occurrence of the death if the committee considers that person should be informed of that determination.
- The chair must forward to the CHO a summary of the cases investigated by the investigator and considered by the committee during each year.
- The committee may publish, or cause to be published… or may make available to any educational institution … any investigator's report considered by the committee and its determination relating thereto and any comments made by it, but all reasonable steps shall be taken to preclude disclosure or identification of the person or persons concerning whom the investigation and resultant report was made.
- The committee may impart, or cause to be imparted to medical practitioners, dental practitioners, nurses, midwives and students of any educational institution such education and instruction in anaesthesia theory and practice as it may deem necessary or advisable from time to time so to do for their assistance and guidance in avoiding and preventing anaesthesia morbidity or mortality.

Update on recent regional committee developments:

- The Public Health Act under which governs the functions of the AMC was updated in 2017 and is now the Health (Miscellaneous Provisions) Act 1911.
- Meeting requirements by the WA government for equal gender representation all boards and committees has resulted in changes to the membership of the committee.
- Dr John Martyr has taken over from Dr Simon Maclaurin as the deputy investigator.
- Improvement of communication regarding the reporting requirements; functioning of the WA AMC and yearly reports with the WA anaesthesia community with updates to the WA DOH website, the ASA website and the WA ANZCA website (recently embedded in the general ANZCA website), and communication with private hospital bodies via the WA AMA.
- Development of an online reporting system for anaesthesia mortality in WA. This is in the initial stages of development with the WA DOH.
- We have commenced collaboration with Western Australian Audit of Surgical Mortality (WAASM) to identify cases meeting reporting criteria. Cases identified by the reporting surgeon as having anaesthesia contribution to the mortality are reported to the WA AMC who will then ask for a report by the anaesthetist involved in the case, if a report has not already been received. WAASM is notified when the assessment has been completed; however, no details are released to WAASM.

Dr Jennifer Bruce FANZCA
Chair, Western Australian Anaesthetic Mortality Committee

Tasmania

Tasmanian Audit of Anaesthesia Mortality

Overview

During the 2015-17 triennium in Tasmania, mortality data was collected and reviewed by the Tasmanian Audit of Anaesthesia Mortality (TAAM). The audit is run under the auspices of the Management Committee of the Tasmanian Audit of Surgical Mortality (TASM), for several reasons including:

- Sharing of resources including staff, office space, consumables, and software.
- Funding approval from the state government was easier to secure for a joint audit, as funding was already in place for the surgical audit, and additional funding for the anaesthesia audit was small in comparison (the initial establishment costs for the surgical audit having been met by the Royal Australasian College of Surgeons).
- Ease of identifying cases – surgical audit office is notified of all deaths occurring in Tasmania within 30 days of a surgical procedure, so capture rate for post-surgical deaths is high.

Committee composition

The TASM and TAAM audit is co-ordinated by a management committee consisting of representatives from the Tasmanian Department of Health, Tasmanian Health Service regions (north-west, north, and south), the Australian and New Zealand College of Anaesthetists, the Royal Australian and New Zealand College of Obstetricians and Gynaecologists and the Royal Australasian College of Surgeons (RACS).

Purpose and function

As a fellowship-based organisation RACS conducts the TASM and TAAM under its commitment to ensuring the highest standard of safe and comprehensive surgical care through excellence in surgical education, training, professional development, and support.

The committee was established to support the peer review process undertaken for mortality review of surgical cases identified in Tasmanian hospitals. The committee's work will encompass public and private hospitals in Tasmania where surgical work is undertaken.

Reporting and review of anaesthesia-related deaths

Participation in a mortality audit is a requirement of the state government for all medical practitioners employed in the public sector and in most private hospitals. All anaesthetists in Tasmania are now aware of and participating in the audit. The review process is based on a first-line assessment of the initial de-identified reporting proforma by a volunteer assessor. If case note review is requested by the first-line assessor, it will be performed by a second-line assessor. This system allows us to engage more fellows in the audit process, encourage wider participation and awareness of the audit, ensures anonymity is maintained, allows fellows to gain continuing professional development points for the case reviews, and facilitates more timely feedback than having a small committee reviewing all cases at intervals during the year. This system works particularly well in a small population.

Legislative protection

The information collected by TASM is protected by Commonwealth Privilege under part VC of the *Health Insurance Act 1973* (Cth) and may only be used for quality assurance purposes. It is also protected from disclosure to any person outside the Management Committee by Tasmanian Government qualified privilege under section four of the *Health Act* 1997 (Tas).

Under the Coroner's *Act 1995* (Tas), a reportable death is defined as a death that occurs during a medical procedure, or after a medical procedure where the death may be causally related to that procedure, and a medical practitioner would not, immediately before the procedure was undertaken, have reasonably expected the death.

Terms of reference

Key objectives of TASM terms of reference (Approved September 2016) are to:

- Determine a response to any serious issues identified relating to inappropriate or inadequate practice, or to indications of major system issues.
- Analyse adverse event information from surgical care with the objective of recommending quality improvement initiatives.
- Assist in formulating action areas to prevent or reduce the likelihood of severity of future adverse events in surgical and anaesthesia care.
- Promote systemic improvements in the safety and quality of healthcare in the Tasmanian health system both in hospitals and other health care settings.
- Review recommendations and actions taken to respond to relevant safety and quality issues as identified and disseminate recommendations to health services state-wide.
- Support and promote the need for a peer review process of surgical mortality cases.

To support these key objectives TAAM will

- Provide leadership and strategic direction for the development and implementation of the Tasmanian Audit of Surgical Mortality (TASM).
- Participate in a cross-jurisdictional/national perioperative mortality audit process to establish standardised reporting protocols and analytical methodology for comparison of surgical and anaesthesia mortality among the states and territories in Australia.
- Promote the use of the independent audit of surgical and anaesthesia mortality among all Tasmanian surgeons and anaesthetists.
- Compare surgical and anaesthesia mortality outcomes in Tasmania with other Australian states and territories, and with international standards.
- Collaborate with the cross-jurisdictional/national project, to develop best practice standards and guidelines for surgical and anaesthesia practice in hospitals based on scientific knowledge of clinical efficacy.
- Assist in the wide dissemination of best practice standards and guidelines for surgical and anaesthesia practice in hospitals, as provided by the cross-jurisdictional/national body.
- Provide direction and support for first level evaluations of perioperative mortality reported on a voluntary basis by participating surgeons and anaesthetists.
- Co-ordinate the transfer of de-identified information (case notes) to the cross-jurisdictional/national body for surgical and anaesthesia mortality data evaluated as warranting second level audit.
- Analyse and review data obtained in relation to the safety and quality of services with the objective of recommending quality improvement initiatives for surgical and anaesthesia care.
- Promote systemic improvements in the safety and quality of healthcare in the Tasmanian health system both in hospitals and other healthcare settings.
- Publish journal articles, educate surgeons and anaesthetists, and/or provide information to the general public deemed appropriate by the committee, in each case using de-identified data.
- Communicate as may be necessary or appropriate with any other committee declared by the minister under section 4(1) of the Health Act, 1997, to be a quality assurance committee for the purposes of that act in relation to any matter, which falls within the functions of either committee.
- Report in accordance with these terms of reference

Current developments

There have been no relevant amendment of legislation or material change in the operation of the audit since 2012-14.

Dr Margaret Walker FANZCA
Tasmanian Audit of Anaesthesia Mortality

South Australia

South Australian Anaesthetic Mortality Committee

Overview

The South Australian Anaesthetic Mortality Committee (SAAMC) was re-established in 2010 after several years' hiatus in the mid-2000s. Its role is to review anaesthesia-related patient mortality from health services in SA with the intention of improving the quality of care provided by anaesthesia. It receives voluntary reports primarily from anaesthetists, but also from those performing the procedures.

Engagement with the anaesthesia community in SA has been improving since 2010, with reporting gradually increasing. The committee reviewed a total of 36 cases, a small increase over each of the previous periods.

Committee composition (2015-17)

In 2015, membership of the South Australian Anaesthetic Mortality Committee consisted of the following:

Three nominations each from:

- Australian and New Zealand College of Anaesthetists.
- Australian Society of Anaesthetists.

One nomination each from:

- South Australian Department of Health and Ageing.
- College of Intensive Care Medicine.
- Royal Australasian College of Surgeons.
- Australian College of Operating Room Nurses.
- Royal Australian and New Zealand College of Obstetricians and Gynaecologists.
- Australian College of Rural and Remote Medicine.

Reporting and review of anaesthesia-related deaths

Reports to the South Australian Anaesthetic Mortality Committee are voluntary. The vast majority of reports are received from the anaesthetist involved with the case, with a few reports received from the surgeon or proceduralist. SAAMC encourages reporting of deaths within 48 hours of an anaesthetic, or perioperative deaths in which complications related to the anaesthesia may have contributed.

Cases are de-identified and reviewed by the committee based upon information provided in the confidential reports and classified according to the standard. Feedback is provided to the individual reporting the case through a confidential letter from the chair.

We do not have a method to verify whether all anaesthesia-related deaths are reported to the committee but are confident that a representative sample of the cases within SA is contained in the data. We are confident that other reporting sources, such as the South Australian Audit of Surgical Mortality, are also reviewing similar perioperative mortality, such that major cases are not overlooked.

Legislative protection

The South Australian Anaesthetic Mortality Committee has qualified privilege under part 7 of the Health Care Act 2008.

Current developments (2020):

Voluntary reporting to the South Australian Anaesthetic Mortality Committee continues to improve over time and it is felt that faster turn-around of cases with timelier feedback provided back to anaesthetists will continue to improve case numbers. The relationship between SAAMC and South Australian Audit of Surgical Mortality continues to grow, with the chairs of each committee having representation on the other.

Dr Simon Jenkins FANZCA
Chair, South Australian Anaesthetic Mortality Committee

Queensland

Queensland Perioperative and Periprocedural Anaesthetic Mortality Review Committee

Overview

The Queensland Perioperative and Periprocedural Anaesthetic Mortality Review Committee (QPPAMRC) was established as a Quality Assurance Committee on 21 May 2012 following a request from the Statewide Anaesthesia and Perioperative Care Clinical Network (SWAPNET). The QPPAMRC is sponsored by the Clinical Excellence Division, Department of Health.

Committee composition

The QPPAMRC is a Quality Assurance Committee (QAC) established under Part 6, Division 1 of the *Hospital and Health Boards Act 2011* (the Act). The purpose of this division is to improve the safety and quality of health services by providing protections for quality assurance committees established under the act.

The QPPAMRC was established to:

- Collect and analyse clinical information regarding perioperative and periprocedural anaesthesia mortality in Queensland to identify statewide specific trends.
- Make recommendations to the minister for health on standards and quality indicators for perioperative and periprocedural anaesthesia clinical care to enable health providers in Queensland to improve safety and quality.
- Assist with the adoption of such standards in both public and private sectors.

Legislative protection and privacy

The QPPAMRC privacy policy guides QPPAMRC activity and ensures:

- The QPPAMRC operates in accordance with sections 81-92 of the act.
- All information held by the QPPAMRC is managed in accordance with the act and where relevant, the Information Privacy Act 2009.
- QPPAMRC members and relevant personnel are aware of their responsibilities in relation to privacy and confidentiality.

Developments

The first meeting of the QPPAMRC was convened on 1 August 2012. Subsequent meetings were convened bimonthly or as required.

Reporting deaths to the QPPAMRC is voluntary. Since the first report was logged on the QPPAMRC Anaesthetic Death Register (online database) on 20 August 2012, over 2900 deaths have been reported.

Following on from the publication of QPPAMRC Mortality Review Report, Volume 1 in June 2016 and noted in the last triennial report, Volume 2 based on a further 1200 reported deaths is nearing completion and includes seven case studies as learning opportunities for anaesthetists.

The QPPAMRC Anaesthetic Death Register continues to be enhanced and refined. A solution to enable private hospitals to report deaths to the QPPAMRC continues to be progressed.

Dr James Troup FANZCA
Chair, Queensland Perioperative and Periprocedural Anaesthetic Mortality Review Committee

Position	Nominated by
Senior specialist anaesthetist (Chair)	Queensland Health
Specialist anaesthetist	Australian and New Zealand College of Anaesthetists (State Branch)
Specialist anaesthetist	Australian Society of Anaesthetists
Specialist anaesthetist	Australian Medical Association
Specialist anaesthetist	Private Hospitals Association
Chair or nominated delegate	Statewide Anaesthesia and Perioperative Care Clinical Network
GP rural generalist/specialist anaesthetist	Statewide Anaesthesia and Perioperative Care Clinical Network (SWAPNET)
Specialist surgeon	Royal Australasian College of Surgeons (State Branch)
Trauma surgeon	Faculty of Medicine, University of Queensland
Anaesthesia assistant (technician or nurse)	Statewide Anaesthesia and Perioperative Care Clinical Network
Forensic pathologist	Royal College of Pathologists of Australasia

Northern Territory

Northern Territory Northern Territory Audit of Anaesthesia Mortality

Overview

Anaesthesia mortality data review began in July 2016. This is the first time the Northern Territory (NT) is in a position to contribute data for the *Safety of Anaesthesia* report.

Committee composition

The audit is conducted alongside the NT Audit of Surgical Mortality (NTASM). The Royal Australasian College of Surgeons and NT Health Service jointly fund a NTASM surgical audit officer and a perioperative clinical audit and quality manager.

Reporting and review of anaesthesia-related deaths

Participation in NTASM is mandatory for surgeons. Involvement by anaesthetists is voluntary – although the majority of anaesthetists at the five hospitals in the NT have signed the participation form. These hospitals are the Royal Darwin Hospital, Darwin Private Hospital, Alice Springs Hospital, Gove District Hospital and Katherine District Hospital. There are 35 anaesthetists in the NT who participated in the audit for a total population of 245,000.

All deaths related to a surgical procedure, or if a death occurred within 48 hours of the procedure, are reported to the NTASM project manager. Surgeons, or their registrar delegates, complete the surgical case form wherein the surgeon may indicate if there are anaesthesia considerations to be addressed. Anaesthetists may also self-report and it is anticipated that in this way other areas where anaesthesia services are provided will be included. As the NT is a small jurisdiction it was thought that to maintain impartiality all first-line assessment of the de-identified anaesthesia case form was passed via the NTASM project officer to the Tasmanian Audit of Surgical Mortality (TASM). TASM would then task a local fellow who has volunteered to be an assessor. NT anaesthetists have volunteered to be first line assessors for TASM. Second-line assessment of the patient notes will occur by assessors from Tasmania with reciprocal assessment by NT fellows as requested. TASM has stated that they are happy to collate our NT de-identified data for the ANZCA triennium reports.

Legislative protection

Information collected by NTASM is protected by Commonwealth privilege under part VC of the Health Insurance Act 1973 and may only be used for quality assurance purposes.

Dr Phil Blum FANZCA
Co-ordinator NT Audit of Anaesthesia Mortality

Australian Capital Territory

Australian Capital Territory Audit of Anaesthesia Mortality

Overview

Australian Capital Territory Audit of Anaesthesia Mortality data review began in February 2014. This is the first "complete" contribution from the ACT to the triennial report.

Committee composition (2015-17)

The audit is conducted alongside the ACT Audit of Surgical Mortality (ACTASM) which began in October 2010 and now involves most surgical craft groups. The Royal Australasian College of Surgeons and ACT Health jointly fund the ACTASM Project Manager position. For various reasons, this role was not adequately filled for some time and momentum was lost as the workload was incompatible with the hours allocated. More recently, the position has become more conventional in terms of hours, and relationships with the people in the various medical records departments and hospitals are being re-established.

Reporting and review of anaesthesia-related deaths

Participation in ACTASM is mandatory for surgeons. Involvement by anaesthetists is voluntary; despite several approaches (all of which have to be made through ANZCA), the number of anaesthetists who have agreed to participate remains at about 50 per cent. All deaths within 30 days of a surgical procedure are reported to the ACTASM project manager. Surgeons, or their registrar delegates, complete the surgical case form wherein the surgeon may indicate if there are anaesthesia considerations to be addressed. Anaesthetists may also self-report. First-line assessment of the de-identified anaesthesia case form occurs by the anaesthesia representative on the ACTASM Committee or other local fellow who has volunteered to be an assessor. Second-line assessment of the patient notes will occur by assessors from other states with reciprocal assessment by ACT fellows as requested. If there is concern about local first-line assessment, then it is proposed that the anaesthesia representative on ACTASM and the chairs (or their nominee) of the regional committees of ANZCA and ASA will decide on whether external review is appropriate.

Sixteen cases were identified and four progressed to first-line review and were designated category 4. Two cases were coroner's cases (one from 2015) and the anaesthetists declined to participate until the coronial process was concluded. In four cases, anaesthesia case forms were sent, reminders were sent, and no forms were received. Five cases were not commenced, having occurred during the period of abbreviated project manager hours.

Legislative protection

Information collected by ACTASM is protected by Commonwealth privilege under part VC of the Health Insurance Act 1973 and may only be used for quality assurance purposes.

Dr Carmel McInerney FANZCA
Co-ordinator ACT Audit of Anaesthesia Mortality

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Acknowledgements

The ANZCA Mortality Sub-Committee wishes to thank the members of all regional mortality committees that have provided data and information for this report. The sub-committee would also like to thank those involved in other groups or committees that have also contributed. These thanks extend to the support staff of these committees.

Thanks goes to Anthony Luca, Policy Officer with ANZCA, for his exceptional assistance in taking this project through to completion.

The template of this report is based upon a template originally used in 2003-05. Thanks also goes to the ANZCA design team for their considerable work in enhancing and reworking the report design, particularly to Elizabeth Short, Digital Designer with ANZCA.

Appendices

Appendix A — Tables

Table 1: Systems of classification by state-based anaesthesia mortality committees

Death attributable to anaesthesia	
Category 1	Where it is reasonably certain that death was caused by the anaesthesia or other factors under the control of the anaesthetist.
Category 2	Where there is some doubt whether death was entirely attributable to the anaesthesia or other factors under the control of the anaesthetist.
Category 3	Where it is reasonably certain death was caused by both medical/surgical and anaesthesia factors.

Explanatory notes:

- The intention of the classification is not to apportion blame in individual cases but to establish the contribution of the anaesthesia factors to the death.
- The above classification is applied regardless of the patient's condition before the procedure. However, if it is considered that the medical condition makes a substantial contribution to the anaesthesia-related death, subcategory H should also be applied.
- If no factor under the control of the anaesthetist is identified which could or should have been done better, subcategory G should also be applied.

Death in which anaesthesia played no part	
Category 4	Death where the administration of the anaesthesia is not contributory and surgical or other factors are implicated.
Category 5	Inevitable death, which would have occurred irrespective of anaesthesia or surgical procedures.
Category 6	Incidental death, which could not reasonably be expected to have been foreseen by those looking after the patient, was not related to the indication for surgery and was not due to factors under the control of the anaesthetist or surgeon.
Unassessable death	
Category 7	Those that cannot be assessed despite considerable data, but where the information is conflicting or key data are missing.
Category 8	Cases that cannot be assessed because of inadequate data.

Table 2 – Total deaths reviewed

	NSW	Vic	WA	Tas	SA	Qld	NT	ACT	Total
2015	286	10	78	17	11	414	0	2	818
2016	279	24	76	6	15	544	5	2	951
2017	388	147	57	14	10	506	18	0	1140
Total	953	181	211	37	36	1464	23	4	2909

Table 3 – Number of deaths classified by each committee

	NSW	Vic	WA	Tas	SA	Qld	NT	ACT	Total
Category 1	17	12	2	0	3	1	0	0	35
Category 2	13	2	4	1	2	6	1	0	29
Category 3	121	44	2	1	3	3	1	0	175
Total	151	58	8	2	8	10	2	0	239
Category 4	68	35	11	14	5	366	5	4	508
Category 5	673	82	175	20	18	986	15	0	1969
Category 6	29	6	16	1	0	91	1	0	144
Category 7	4	0	1	0	0	4	0	0	9
Category 8	28	0	0	0	5	7	0	0	40

Table 4: Number of anaesthesia-related deaths during the 2015-2017 triennium, in relation to the population of all Australian states and territories

Number of deaths considered anaesthesia-related	239
Population of NSW, Vic, WA, Tas, SA, Qld, NT and ACT*	(24.40 million)
Number of anaesthesia-related deaths per million population, 2015-2017	9.87
Number of anaesthesia-related deaths per million population per annum	3.29

Table 5: Number of anaesthesia-related deaths in comparison with previous reports

	1997-99	2000-02	2003-05	2006-08	2009-11	2012-14	2015-17
NSW	-	-	53	92	125	156	151
NSW and Tas	56	67	-	-	-	-	-
Vic	32	39	40	21	18	28	58
WA	11	16	19	7	11	2	8
Tas	-	-	-	4	0	3	2
SA and NT	11	2	-	-	-	-	-
SA	-	-	-	-	2	4	8
NT	-	-	-	-	-	-	2
Qld	20	12	-	-	-	7	10
ACT	-	-	-	-	-	-	0
Total	130	136*	112	124	156	200	239

Table 6: Number of anaesthesia-related deaths in relation to population in comparison to previous reports

	1997-99	2000-02	2003-05	2006-08	2009-11	2012-14	2015-17
Population (x million)	13.40	13.75	13.68	14.80	17.30	22.52	24.40
Number of anaesthesia-related deaths	130	137	112	124	156	200	239
Anaesthesia-related death rate per million population per triennium	9.70	9.96	8.19	8.37	9.02	8.88	9.87
Anaesthesia-related death rate per million population per annum	3.23	3.32	2.73	2.79	3.01	2.96	3.29

Table 7: Estimated number of anaesthetics administered in all Australian states, and territories, and the estimated anaesthesia-related mortality rate per number of procedures

	NSW	Vic	WA	Tas	SA	Qld	NT	ACT	Total
Number of anaesthetics 1 January 2015 – 31 December 2017	4,138,345	3,594,249	1,495,634	310,238	993,692	2,846,532	99,326	174,822	13,652,911

Number of deaths considered anaesthesia-related	239
Estimated total number of anaesthetic procedures	13,652,911
Estimated mortality rate in relation to anaesthetic procedures	1:57,125

Table 8: Estimated anaesthesia-related mortality in relation to number of procedures compared to previous reports

	2000-02*	2003-05**	2006-08***	2009-11****	2012-14*****	2015-17 †
Estimated total number of anaesthesia procedures (x million)	7.65	5.98	6.88	9.05	11.40	13.65
Number of anaesthesia-related deaths	122	112	124	156	200	239
Anaesthesia-related death rate	1:56,000	1:53,426	1:55,490	1:58,039	1:57,023	1:57,125

Table 9: Level of risk of patients by ASA physical status

ASA physical status	NSW	Vic	WA	Tas	SA	Qld	NT	ACT	Total
1	0	2	0	0	0	0	0	0	2
2	7	7	0	0	2	0	0	0	16
3	52	19	5	1	2	6	1	0	86
4	87	29	3	1	4	3	0	0	127
5	5	1	0	0	0	1	1	0	8
Total	151	58	8	2	8	10	2	0	239

Table 10: Incidence of death in patients considered to be good or fair risk compared to previous reports

Triennium	Number of ASA P1-2 patients	Total number of category 1-3 deaths	Percentage of deaths considered at good or fair risk
1991-93	30	116	26%
1994-96	13	135	10%
1997-99	19	130	15%
2000-02	26	137	19%
2003-05	18	112	16%
2006-08	17	124	14%
2009-11	11	156	7%
2012-14	14	200	7%
2015-17	18	239	7.5%

Table 11: Causal or contributory factors in anaesthesia-related deaths

	NSW	Vic	WA	Tas	SA	Qld	NT	ACT	Total
Preoperative									
I. Assessment	15	2	1	0	3	5	2	0	28
II. Management	3	1	0	0	1	4	1	0	10
Total	18	3	1	0	4	9	3	0	38
Anaesthesia technique									
I. Choice or application	5	1	1	1	2	5	0	0	15
II. Airway maintenance	16	5	1	0	1	3	0	0	26
III. Ventilation	3	0	0	0	0	1	0	0	4
IV. Circulatory support	2	0	0	0	0	4	1	0	7
Total	26	6	2	1	3	13	1	0	52
Anaesthesia drugs									
I. Selection	4	0	1	0	0	2	0	0	7
II. Dosage	12	1	0	0	2	2	0	0	17
III. Adverse event	6	7	1	0	2	0	0	0	16
IV. Incomplete reversal	1	0	0	0	0	0	0	0	1
V. Inadequate recovery	0	0	0	0	0	0	0	0	0
Total	23	8	2	0	4	4	0	0	41
Anaesthesia management									
I. Crisis management	1	3	1	0	0	1	0	0	6
II. Inadequate monitoring	9	2	1	0	1	3	0	0	16
III. Equipment failure	0	0	0	0	0	0	0	0	0
IV. Inadequate resuscitation	3	0	0	0	0	2	1	0	6
V. Hypothermia	0	0	0	0	0	0	0	0	0
Total	13	5	2	0	1	6	1	0	28
Postoperative									
I. Management	4	0	0	0	0	1	0	0	5
II. Supervision	5	0	0	0	0	0	0	0	5
III. Inadequate resuscitation	4	2	0	0	0	1	0	0	7
Total	13	2	0	0	0	2	0	0	17
Organisational									
I. Inadequate supervision or assistance	2	1	0	0	0	1	0	0	4
II. Poor organisation	2	0	0	0	0	1	0	0	3
III. Poor planning	13	3	0	0	1	2	1	0	20
Total	17	4	0	0	1	4	1	0	27
Total contributory factors	110	28	7	1	13	38	6	0	203
A. No correctable factor	105	30	3	1	4	2	1	0	146
B. Medical condition of the patient a significant factor	138	49	8	2	5	9	2	0	213

Table 12: Sex distribution in anaesthesia-related deaths

Sex	NSW	Vic	WA	Tas	SA	Qld	NT	ACT	Total
Male	62	28	4	1	4	5	0	0	104
Female	89	30	4	1	4	5	2	0	135
Total	151	58	8	2	8	10	2	0	239

Table 13: Age distribution in anaesthesia-related deaths

Age (years)	NSW	Vic	WA	Tas	SA	Qld	NT	ACT	Total
<11	0	0	0	0	0	0	0	0	0
11 to 20	1	0	0	0	0	0	0	0	1
21 to 30	0	0	0	0	0	0	0	0	0
31 to 40	1	1	0	0	0	0	0	0	2
41 to 50	2	5	0	0	0	1	0	0	8
51 to 60	9	5	2	0	1	2	0	0	19
61 to 70	17	6	1	0	0	0	0	0	24
71 to 80	35	11	1	1	2	1	0	0	51
81 to 90	61	20	1	1	3	5	2	0	93
>91	25	10	3	0	2	1	0	0	41
Total	151	58	8	2	8	10	2	0	239

Figure 6: Degree of urgency of the procedure with anaesthesia-related deaths

Urgency	NSW	Vic	WA	Tas	SA	Qld	NT	ACT	Total
Elective	37	22	2	0	3	3	0	0	67
Urgent/Emergent	114	36	6	2	5	7	2	0	172
Total	151	58	8	2	8	10	2	0	239

Figure 7: Type of hospital

Hospital	NSW	Vic	WA	Tas	SA	Qld	NT	ACT	Total
Metro (teaching)	85	32	8	2	6	8	2	0	143
Metro (non-teaching)	16	0	0	0	0	0	0	0	16
Rural base	5	0	0	0	0	2	0	0	7
Rural/regional public other	29	15	0	0	0	0	0	0	44
Private	15	11	0	0	2	0	0	0	28
Day care only	1	0	0	0	0	0	0	0	1
Total	151	58	8	2	8	10	2	0	239

Figure 8: Location of event leading to death

Location of event leading to death	NSW	Vic	WA	Tas	SA	Qld	NT	ACT	Total
Induction room	0	7	0	0	0	1	0	0	8
Operating theatre	41	17	6	1	7	5	0	0	77
PACU	15	7	0	0	1	0	0	0	23
Procedural room	1	0	2	0	0	3	0	0	6
ICU/HDU	63	10	0	1	0	1	2	0	77
General ward	30	11	0	0	0	0	0	0	41
Other	1	6	0	0	0	0	0	0	7
Total	151	58	8	2	8	10	2	0	239

Figure 9: Grade of anaesthetist

Grade of anaesthetist	NSW	Vic	WA	Tas	SA	Qld	NT	ACT	Total
Specialist	142	44	8	2	7	10	2	0	215
GP/Non-specialist	0	0	0	0	0	0	0	0	0
Trainee/Registrar	8	4	0	0	1	0	0	0	13
Other	1	10	0	0	0	0	0	0	11
Total	151	58	8	2	8	10	2	0	239

Table 14: Type of surgery or procedures

	NSW	Vic	WA	Tas	SA	Qld	NT	ACT	Total
Surgical categories									
Abdominal	8	6	0	0	3	2	0	0	19
Cardiothoracic	12	2	0	1	2	1	0	0	18
ENT and Head/Neck	3	1	0	0	0	0	0	0	4
General (non-abdominal)	2	2	0	0	0	1	0	0	5
Gynaecological	0	1	0	0	0	0	0	0	1
Maxillofacial	0	0	0	0	0	0	0	0	0
Neurosurgery	2	0	0	0	0	0	1	0	3
Obstetrics	0	0	0	0	0	0	0	0	0
Ophthalmological	0	1	1	0	0	0	0	0	2
Orthopaedic	85	25	4	0	2	4	1	0	121
Renal	0	0	1	0	0	1	0	0	2
Urological	4	5	0	0	1	0	0	0	10
Vascular	16	3	0	1	0	0	0	0	20
Procedural categories									
Cardiology	0	0	0	0	0	0	0	0	0
Endoscopy	15	6	2	0	0	0	0	0	23
Radiology	2	0	0	0	0	0	0	0	2
Miscellaneous									
Electroconvulsive therapy	0	0	0	0	0	0	0	0	0
Invasive monitoring	0	0	0	0	0	0	0	0	0
Pain management	0	0	0	0	0	0	0	0	0
Resuscitation	0	1	0	0	0	0	0	0	1
Other	2	5	0	0	0	1	0	0	8
Total	151	58	8	2	8	10	2	0	239

Appendix B — Classification form

Case classification

Deaths attributable to anaesthesia	
Category 1	Where it is reasonably certain that death was caused by the anaesthesia or other factors under the control of the anaesthetist.
Category 2	Where there is some doubt whether death was entirely attributable to the anaesthesia or other factors under the control of the anaesthetist.
Category 3	Where it is reasonably certain that death was caused by both surgical and anaesthesia factors.

Explanatory notes:

- The intention of the classification is not to apportion blame in individual cases but to establish the contribution of the anaesthesia factors to the death.
- The above classification is applied regardless of the patient's condition before the procedure. However, if it is considered that the medical condition makes a substantial contribution to the anaesthesia-related death subcategory H should also be applied.
- If no factor under the control of the anaesthetists is identified which could or should have been done better, subcategory G should also be applied.

Deaths in which anaesthesia played no part	
Category 4	Surgical death where the administration of the anaesthesia is not contributory and surgical or other factors are implicated.
Category 5	Inevitable death which would have occurred irrespective of anaesthesia or surgical procedures.
Category 6	Incidental death which could not reasonably be expected to have been foreseen by those looking after the patient, was not related to the indication for surgery and was not due to factors under the control of anaesthetist or surgeon.
Unassessable deaths	
Category 7	Those that cannot be assessed despite considerable data but where the information is conflicting or key data is missing.
Category 8	Cases which cannot be assessed because of inadequate data.

Casual or contributory factors in category a death	
Subcategories	
A. Preoperative	
(i) Assessment	This may involve failure to take an adequate history or perform an adequate examination or to undertake appropriate investigation or consultation or make adequate assessment of the volume status of the patient in an emergency. Where this is also a surgical responsibility the case may be classified in Category 3 above.
(ii) Management	This may involve failure to administer appropriate therapy or resuscitation. Urgency and the responsibility of the surgeon may also modify this classification.
B. Anaesthesia technique	
(i) Choice or application	There is inappropriate choice of technique in circumstances where it is contraindicated or by the incorrect application of a technique which was correctly chosen.
(ii) Airway maintenance including pulmonary aspiration	There is inappropriate choice of artificial airway or failure to maintain or provide adequate protection of the airway or to recognise misplacement or occlusion of an artificial airway.
(iii) Ventilation	Death is caused by failure of ventilation of the lungs for any reason. This would include inadequate ventilator settings and failure to reinstitute proper respiratory support after deliberate hypoventilation (for example, bypass).
(iv) Circulatory support	Failure to provide adequate support where there is haemodynamic instability, in particular in relation to techniques involving sympathetic blockade.
C. Anaesthesia drugs	
(i) Selection	Administration of a wrong drug or one which is contraindicated or inappropriate. This would include "syringe swap" errors.
(ii) Dosage	This may be due to incorrect dosage, absolute or relative to the patient's size, age and condition and in practice is usually an overdose.
(iii) Adverse drug reaction	This includes all fatal drug reactions both acute such as anaphylaxis and the delayed effects of anaesthesia agents such as the volatile agents.
(iv) Inadequate reversal	This would include relaxant, narcotic and tranquillising agents where reversal was indicated.
(v) Incomplete recovery	For example, prolonged coma.
D. Anaesthesia management	
(i) Crisis management	Inadequate management of unexpected occurrences during anaesthesia or in other situations, which, if uncorrected, could lead to death.
(ii) Inadequate monitoring	Failure to observe minimum standards as enunciated in the ANZCA Professional Documents or to undertake additional monitoring when indicated, for example, use of a pulmonary artery catheter in left ventricular failure.
(iii) Equipment failure	Death as a result of failure to check equipment or due to failure of an item of anaesthesia equipment.
(iv) Inadequate resuscitation	Failure to provide adequate resuscitation in an emergency situation.
(v) Hypothermia	Failure to maintain adequate body temperature within recognised limits.
E. Postoperative	
(i) Management	Death as a result of inappropriate intervention or omission of active intervention by the anaesthetist or a person under their direction (for example, recovery or pain management nurse) in some matter related to the patient's anaesthesia, pain management or resuscitation.
(ii) Supervision	Death due to inadequate supervision or monitoring. The anaesthetist has ongoing responsibility but the surgical role must also be assessed.
(iii) Inadequate resuscitation	Death due to inadequate management of hypovolaemia or hypoxaemia or where there has been a failure to perform proper cardiopulmonary resuscitation.
F. Organisational	
(i) Inadequate supervision, inexperience or assistance	These factors apply whether the anaesthetist is a trainee, a non-specialist or a specialist undertaking an unfamiliar procedure. The criterion of adequacy of supervision of a trainee is based on the PS42 Statement on staffing of accredited departments of anaesthesia on supervision of trainees.
(ii) Poor organisation of the service	Inappropriate delegation, poor rostering and fatigue contributing to a fatality.
(iii) Failure of interdisciplinary planning	Poor communication in peri-operative management and failure to anticipate need for high dependency care.
G. No correctable factor identified	
Where the death was due to anaesthesia factors but no better technique could be suggested.	
H. Medical condition of the patient	
Where it is considered that the medical condition was a significant factor in the anaesthesia related death.	