

Annual Report 2013/2014



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The Australian and New Zealand Audit of Surgical Mortality, including the Northern Territory Audit of Surgical Mortality also has protection under the Commonwealth Qualified Privilege Scheme under Part VC of the Health Insurance Act 1973 (Gazetted 23rd August 2011).



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Clinical Director's report

Sincere thanks to all the surgeons and staff of the Northern Territory Audit of Surgical Mortality (NTASM) for their dedicated work and persistence in completing another year of the audit. Some salient points will encourage surgeons to persist in their participation in the audit and look to use it as both a learning tool and a modifier for surgical practice:

Overall NTASM patients are the youngest in Australia when compared with other mortality audits.

High levels of hepatic and diabetic comorbidities are present in Aboriginal persons.

Analysis of the data has confirmed that both Aboriginal and non-Aboriginal persons receive a similar level of quality surgical care.

Young Aboriginal persons have many more comorbidities compared with non-Aboriginal persons.

In patients that die under age 53 years, there are many more comorbidities noted in the Aboriginal population.

No patients had infections of the surgical site.

While the data is reliable, the numbers are still low and consolidating, caution in interpretation is indicated.

I would like to take this opportunity to thank NTASM staff for their continued excellence in managing and coordinating the NTASM process.

John North

NTASM Clinical Director.



Shortened Forms

| | |
|---------|--|
| ACT | Australian Capital Territory |
| ANZASM | Australian and New Zealand Audit of Surgical Mortality |
| ASA | American Society of Anesthesiologists |
| CIA | Clinical Information Analysis |
| CI | confidence interval |
| EDMS | Executive Director of Medical Services |
| FLA | first-line assessment |
| ICU | intensive care unit |
| IMG | International Medical Graduate |
| IQR | interquartile range |
| MBA | motorbike accident |
| MRSA | Methicillin-resistant Staphylococcus aureus |
| MVA | motor vehicle accident |
| NSW | New South Wales |
| NTASM | Northern Territory Audit of Surgical Mortality |
| NT | Northern Territory |
| QASM | Queensland Audit of Surgical Mortality |
| QLD | Queensland |
| RACS | Royal Australasian College of Surgeons |
| RAAS | Research, Audit and Academic Surgery |
| RANZCOG | Royal Australian and New Zealand College of Obstetricians and Gynaecologists |
| RR | relative risk |
| SA | South Australia |
| SASM | Scottish Audit of Surgical Mortality |
| SCF | surgical case form |
| SET | Surgical Education and Training |
| SLA | second-line assessment |
| SPSS | Statistical Package for Social Sciences |
| SQL | Structured Query Language |
| SSL | Secure Sockets Layer |
| TAS | Tasmania |
| VIC | Victoria |
| WA | Western Australia |

Executive Summary

Background

The Northern Territory Audit of Surgical Mortality (NTASM) is an external, independent, peer review audit of the process of care associated with surgically-related deaths in the Northern Territory (NT). NTASM started in 2010 and is funded by NT Health. NTASM has qualified privilege protection under Commonwealth legislation. This report covers surgically-related deaths that occurred from 1 July 2010 to 30 June 2014.

NTASM is principally designed as a feedback mechanism for participating surgeons, and to encourage reflection on surgical care and practice.

The summary data for NTASM reflects a territory that is committed to surgical audit.

Surgeons

- All surgeons in NT are participating in NTASM.
- The return rate for surgical case forms was 93% (230/248).

Hospitals

- All hospitals in NT participate in the audit. This report comprises data from the three hospitals in which surgically-related deaths have occurred across the audit period.

Aboriginal persons

- Aboriginal persons comprised 41.2% of NTASM patients (94/228). Ethnicity was not recorded in 20 patients.
- Overall, Aboriginal patients were younger than non-Aboriginal patients.

Patients

- There were 248 surgically-related deaths reported to NTASM over the four-year audit period from July 2010 to June 2014.
- The proportion of males was 60%, compared with 54% nationally.
- The median age of NTASM patients was 62 years, compared with 40 years for all NT surgical patients.
- Serious comorbidities were present in 80% of patients (163/204).
- More than half of the the patients, 86/156 (55%) were at considerable risk of death prior to surgery, as assessed by surgeons.

Clinical Incidents

- There were 44 clinical incidents* which occurred in 25 NTASM patients (*areas of concern* and/ or *adverse events*).

Operative deaths

- At least one operation was undertaken on 77% of patients (157/204).
- A total of 238 operations were performed on the 157 patients, with an average of 1.5 operations per patient.
- Multiple operations were performed on 32% of patients (50/157). The number of operations in these patients ranged from two to 10 operations.

Trauma

- Trauma was present in 29% of patients (45/154).
- Just over half of the trauma cases were associated with falls (24/45).
- Approximately one quarter of trauma cases were associated with traffic accidents (10/45).
- Approximately one third of trauma cases were Aboriginal persons (16/45).

Infection

- Infection was reported in 40% of cases (58/147).
- Of patients with infections, 68% of patients acquired the infection prior to admission (38/56).
- All NTASM patients were infection-free at the surgical site.



Recommendations

Interpretation of the NTASM report has led to the following recommendations being made. The comments are a result of comparisons between the NTASM and other states and territories within the Australian and New Zealand Audits of Surgical Mortality (ANZASM) database.

No differences in surgical care provided in the Northern Territory were noted between Aboriginal persons and non-Aboriginal persons. However, the late presentation by the former does not help when surgical care is required. Delays to surgery are predictors of death. Most of the recommendations below are therefore aimed at community nursing and social conditions to prevent surgical deaths.

Age and co-existing factors in NTASM Patients:

NTASM patients are significantly younger than ANZASM patients. This may be a reflection of the greater percentage of Aboriginal persons living in the Northern Territory. Aboriginal persons in NTASM were significantly younger than non-Aboriginal persons. Younger Aboriginal persons had more liver disease and diabetes than non-Aboriginal persons:

Recommendation: In an effort to reduce the surgical age gap between Aboriginal persons and non-Aboriginal persons, increased awareness of healthy lifestyles by education and health management is required in all communities. This may lead to improved control of diabetes and liver disease, both of which have negative consequences on longevity and surgical care. They also predispose patients to necrotising fasciitis – not uncommon in the Northern Territory.

Trauma in NTASM patients: Trauma rates since 2012 have not changed in the NTASM audit, however this rate is higher than the national trauma rate (29% vs 23%). As national rates only include data from Western Australia, Victoria, Queensland and the Northern Territory, the prevalence of trauma nationally may change once all audits collect this information. Falls and accidents accounted for most of the trauma in NTASM. Patients with falls were younger in the NTASM than other participating regions. Patients who were involved in accidents had a mean age of 27 years:

Recommendation: (1) The Department of Health should determine the causes of falls in younger people in the NT, be they in the aboriginal population or not. Prevention strategies can then be instigated.

Recommendation: (2) Younger people are more likely to be involved in accidents and it is recommended by the Royal Australasian College of Surgeons that all younger people receive education regarding alcohol and speeding.

Types of operations in NTASM patients: The most common operation (excisional debridement of soft tissue) performed on NTASM patients were the same as those performed on the total population in the Northern Territory. This is different to the most common operation performed nationally, which is exploratory laparotomy.

Recommendation: Delay in patient presentation to hospital is a challenge to providing care. This may be a result of long travel distances between a patient's home and hospitals. Remote area nurses need to educate people on the benefits of early presentation for treatment.

1. Introduction

Key points

- NTASM is an independent peer review audit of the process of care associated with all surgically-related deaths in the NT.
- This report covers the period 1 July 2010 to 30 June 2014, as audited on 1 July 2014.
- All NT surgeons are participating in the audit.
- All NT hospitals, both public and private, are participating in the audit.
- The primary aim of NTASM is to provide feedback to participating surgeons about their performance, and to encourage reflection and learning about surgical care and practice.

1.1 Background

The project is funded by NT Health. Historically, the Royal Australasian College of Surgeons became responsible for the management of the Western Australian Audit of Surgical Mortality (WAASM) in 2005. WAASM was modeled on the Scottish Audit of Surgical Mortality, which has operated since 1988. Its methodology is based on the original Scottish Audit of Surgical Mortality (SASM) (www.sasm.org.uk/).

1.2 Project governance

The project governance structure is illustrated in Figure 2. As part of the ANZASM, NTASM has protection under the Commonwealth Qualified Privilege Scheme, under Part VC of the Health Insurance Act 1973 (gazetted 23rd August 2011).

All Australian states and territories participate in the national ANZASM process. Information about the state and territory audits is available on the Royal Australasian College of Surgeons (RACS) website: www.surgeons.org.

Figure 1: Northern Territory Audit of Surgical Mortality (NTASM) project governance structure



1.2.1 Education for surgeons

NTASM has made a significant contribution to the surgical education process in the NT. In particular, NTASM has:

- Managed the audit process for the NT, including the provision of 201 first-line assessments (FLAs) and 23 second-line assessment (SLAs) reports to NT surgeons.
- Published two volumes of “Lessons from the Audit”. The Lessons from the Audit series contain case studies that highlight key issues relating to surgical practice. This publication is of interest not only to NT surgeons, but to all who are involved in patient care in the NT, from emergency department managers to hospital executive teams.
- Published the NTASM Annual Report and distributed the report to all surgeons and hospital administrators in NT.
- Distributed to NT surgeons two booklets of case studies arising from the national ANZASM audit, as well as the 2013 ANZASM National Report.

1.3 Audit process

1.3.1 Methodology

The methodology used by NTASM is outlined in Figure 2. NTASM is directly notified of all in-hospital surgically-related deaths via the surgical or medical records departments of participating NT hospitals. All cases in which a surgeon was responsible for, or had significant involvement in, the care of the patient are included in the audit, irrespective of whether the patient underwent a surgical procedure.

The clinical details relating to the management of each case are recorded on a standard, structured questionnaire known as a surgical case form (SCF), which is completed by the consultant surgeon associated with the case. The completed surgical case form is de-identified by NTASM and sent for first-line assessment to a surgeon of the same specialty, but who is from a different state. De-identification, combined with the use of assessors from outside the NT, ensures that anonymity and impartiality, are preserved, and minimises the potential for conflicts of interest. The first-line assessor will either close the case, or recommend that the case undergo further assessment in the form of a second-line assessment.

Cases may progress to second-line if:

- an area of concern or adverse event is thought to have occurred during the clinical care of the patient and warrants further investigation.
- a second-line assessment report could usefully draw attention to an area of surgical practice, providing an educational opportunity for the surgeon involved in the case or for a wider audience as part of a case note review publication.
- the information provided by the consultant surgeon was insufficient and did not allow the first-line assessor to reach a conclusion about the case.

In instances where a second-line assessment is deemed necessary, the second-line assessor is selected by the Clinical Director, based on the same criteria as for the first-line assessor. Second-line assessors are generally considered experts in the area under review.

Reporting conventions

NTASM is notified of all surgically-related deaths in all NT hospitals. Following notification of a death, NTASM provides a surgical case form for the surgeon to complete, with clinical events to be reported against the following hierarchical criteria:

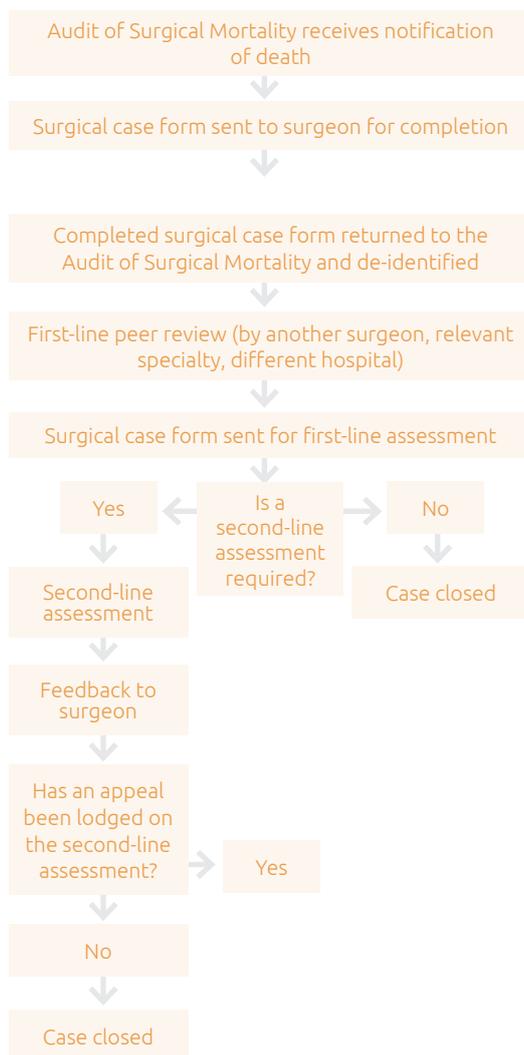
- *area for consideration*—where the clinician believes an area of care **could** have been improved or different but recognises that there may be debate about this;
- *area of concern*—where the clinician believes that an area of care **should** have been better;
- *adverse event*—an unintended “injury” caused by medical management, rather than by the disease process, that is sufficiently serious to:
 - > lead to prolonged hospitalisation;
 - > lead to temporary or permanent impairment or disability of the patient at the time of discharge;
 - > contribute to or cause death.

First-line and second-line assessors are asked to respond to the same questions as part of the review process. This results in a two-level peer-review process for those cases which undergo second-line assessment. The second-line assessment is more in-depth and more forensic, as the second-line assessors have access to all available patient information through medical records.

1.3.2 Providing feedback

- The role of NTASM is to inform, educate, facilitate change and improve practice by providing feedback. NTASM provides feedback to surgeons and hospitals in the following ways:
- surgeons receive written feedback from assessors regarding their NTASM cases.
- surgeons receive the NTASM Annual Report. The report is also available from the NTASM section of the RACS website: www.surgeons.org/ntasm.
- surgeons receive de-identified summaries of second-line assessments from NTASM and Queensland Audit of Surgical Mortality (QASM) cases in the form of the “Lessons from the Audit” series. Surgeons also receive the National Case Note Review booklet, which comprises case studies drawn from cases across Australia.
- hospitals participating in NTASM receive specific reports on aggregated, de-identified data comparing their hospital to the averages of other hospitals across Australia.
- surgeons can view online reports relating to their own audit data and assessments on the Fellows Interface at: <https://asm.surgeons.org/mortaudit/>

Figure 2: Northern Territory Audit of Surgical Mortality (NTASM) methodology



1.3.3 Audit inclusion and exclusion criteria

NTASM audits all deaths occurring in NT hospitals while the patient was under the care of a surgeon. However, patients who are deemed terminal before admission and do not have operations are excluded from the full audit process.

NTASM includes all deaths which meet one of the following criteria:

- the patient was under the care of a surgeon (surgical admission), whether or not an operation was performed;
- the patient was under the care of a physician (medical admission) and subsequently underwent a surgical procedure;
- it was a gynaecology-related case.

Cases that do not meet the inclusion criteria are excluded from the audit by the notifying hospital. A case will also be excluded in instances where NTASM is notified of a death but subsequently decides that the case does not fall within the inclusion criteria.

1.4 Reporting conventions

1.4.1 Reporting clinical incidents

In the surgical case form the surgeon is asked to document whether any clinical incidents occurred during the care of the patient. The surgeon is asked to:

- report the impact of the incident on the outcome, that is, whether the incident:
 - > made no difference to death;
 - > may have contributed to death;
 - > caused the death of a patient who would otherwise have been expected to survive.
- give their opinion as to whether the incident was preventable, using the following categories:
 - > definitely;
 - > probably;
 - > probably not;
 - > definitely not.
- indicate who the incident was associated with:
 - > audited surgical team;
 - > another clinical team;
 - > hospital;
 - > other.

1.4.2 Assessor opinion

The areas for consideration, areas of concern and adverse events contained within this report are events ascribed to the patient by either the first-line or second-line assessor. Throughout the report first-line and second-line assessors are both referred to as 'assessors'.

The assessors' opinions are asked for in:

- the categorisation of the severity of the clinical incident (consideration/concern/adverse event),
- the effect on outcomes,
- the preventability of the clinical incident,
- and with whom the incident was associated.

1.4.3 Analysis of clinical incidents

NTASM primarily focuses on areas of concern and adverse events. While data regarding *areas for consideration* are collected they are considered to be minor criticisms or suggestions regarding treatment.

Cases may be associated with more than one clinical incident. The most serious incident has been ascribed to the case in instances where an analysis looks at clinical incidents reported by case.

1.4.4 Data analysis

This report covers deaths reported to NTASM from 1 July 2010 to 30 June 2014. Four years of data collection is included in this report. All data presented in this report is from the NTASM data base unless otherwise specified. The nature of the audit process means that some cases reported to NTASM during this period will still be undergoing review as at the audit date – 1 July 2014. These cases will be included in the next annual report.

Surgeons can complete the surgical case form and first-line assessment online in the Fellows Interface, while data from paper forms is entered into the system by audit staff. Data is entered and stored in a specifically designed database, a central Structured Query Language (SQL) server database which includes a reporting engine.

Data is encrypted in the database with Secure Sockets Layer (SSL) certificates. All transactions are time stamped and all changes to audit data are written to an archive table, enabling a complete audit trail for each case. Security for this system is high and it is not possible for an unauthorised person to download data. An integrated workflow rules engine supports the creation of letters, reminders and management reports.

To maintain data integrity, all data are routinely checked against the original surgical case form and assessment forms by the project manager or another project officer. Data is cross-checked and the resources used include medical record departments, surgeons, coroner's reports, and the NTASM Clinical Director. Data is cleaned using logic testing and manually reviewed before analysis. Variables are checked for extreme or illogical values and corrections are made to the original data.

Once cleaned, the data are downloaded again before analysis. A total of 28 tables are downloaded into Excel and then copied across to Statistical Package for Social Sciences (IBM-SPSS version 19.0) for analysis. A key variable that is common to all tables can be used to combine tables. Generally, simple frequencies and cross tabulations are used to create the report. Graphs are produced using either SPSS or Excel.

Comparisons against baseline data (all surgical admissions) are possible because of the cooperation from the NT Statistics Section Department of Health at Alice Springs Hospital.

Qualitative analysis is done using standard techniques. The NTASM project manager and clinical director independently classify all qualitative information into groups. These groupings are then compared and any differences discussed until consensus is reached.

In the following report the numbers in parentheses (*n*) represent the number of cases analysed. As not all data points were completed, the total number of cases used in the analyses varies. The total number of cases included in each analysis is provided for all tables and figures in the report.

2. Audit

Key points:

- There were 248 surgically-related deaths reported to NTASM across the four years of the audit.
- NTASM is an independent peer review process of all surgically-related deaths.

2.1 Overview of NTASM

An overview of NTASM is provided in Table 1 below. Assessors completed reviews on 201 first-line assessments and 23 second-line assessments.

At the end of June 2014:

- Eighteen surgical case forms were outstanding
- Four first-line assessments were outstanding
- One second-line assessment was outstanding.

Table 1: Overview of NTASM cases in the audit report period 2010 to 2014 (n=248)

| Audit report period 2010–2014 | n |
|---|-----|
| Total deaths reported | 248 |
| Closed cases | 196 |
| Surgical case forms complete (awaiting first-line assessment) | 3 |
| First-line assessments (awaiting second-line assessment) | 2 |
| Surgical case forms not returned | 18 |
| Excluded (terminal care) | 20 |
| Excluded (error)* | 8 |

*An "error" in reporting occurs when a case is notified to NTASM which does not fulfil the inclusion criteria and therefore cannot be included in the audit.

2.2 Overview of surgical mortality rates

An overview of NT Health data (2010–2014) is outlined below:

- There were 37,594 patients who attended hospitals in the Northern Territory between 2011 and 2014 (financial years) and had a theatre procedure under anaesthesia.* This included a high number of Gynaecology patients who are now also being covered in the NTASM audit. Please note: NTASM did not receive this data for the first year of the audit (2010).

Two hundred and seventeen deaths were reported to NTASM from 2011-2014; 182 deaths were recorded by the statistics department. However

34 cases in that data set from Clinical Information Analysis (CIA) had "no data entered". The total from CIA equals the total in NTASM notifications.

This data demonstrates that NTASM has 100% sensitivity for notifications of surgical deaths. All surgical deaths are consequently going through the peer review process.

*Source: Clinical Information Analysis (CIA) team, Northern Territory Health (24 July, 2014).

3. Results

3.1 Surgeons

Key points:

- There are 27 NT surgeons participating in NTASM. Thirteen obstetricians and gynaecologists also participate.
- Locum surgeon involvement in NTASM is an ongoing challenge. Deaths related to locum surgeons are often notified to the audit office after the locum has left the hospital. This makes obtaining a completed surgical case form difficult.

Surgeon participation

Fellows of the Royal Australasian College of Surgeons (RACS)

All of the participating surgeons are Fellows of the Royal Australasian College of Surgeons, except two, who are International Medical Graduates (IMGs). Fellows of the College are able to participate as first-line and second-line assessors.

Fellows of the Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG)

All the participating obstetricians and gynaecologists are Fellows of the Royal Australian and New Zealand College of Obstetricians and Gynaecologists. Fellows of this College are able to participate as first-line and second-line assessors for gynaecology-related cases.

Surgeon participation by specialty

Table 2 highlights surgeon participation by specialty as at 1 July 2014 - the census date of this report.

Table 2: Surgeon participation by specialty

| Surgical specialties | Number of surgeons* |
|---------------------------------------|---------------------|
| General Surgery | 18 |
| Orthopaedic Surgery | 5 |
| Otolaryngology, Head and Neck Surgery | 2 |
| Obstetrics & Gynaecology | 13 |
| Plastic and Reconstructive Surgery | 2 |
| Other | 3 |
| Total | 43 |

*Included in this report are three surgeons who have either retired or left practice in the NT

Completion of surgical case forms

By the report census date, 1st July 2014, 93% of all surgical case forms had been completed and returned to NTASM (230/248):

- The median time taken to return a surgical case form was 57 days, ranging from less than one day to 425 days. The four surgical case forms that were returned in less than one day were completed online using the Fellows Interface.
- Eight cases were reported within a week.
- Most surgical case forms were completed by the consultant in charge of the cases (see Table 3 below).

Table 3: Grade of surgeon completing the surgical case form (n=207)

| Grade of surgeon completing the surgical case form | n (%) |
|--|-----------|
| Consultant | 170 (82%) |
| SET trainee | 14 (7%) |
| Service registrar | 8 (4%) |
| Fellow | 8 (4%) |
| IMG | 7 (3%) |

SET = Surgical Education and Training; IMG = International Medical Graduate.

Consultant surgeon involvement in operations

In total there were 238 operations for 157 patients, with 50 of these patients undergoing two or more operations (range 2-10). As would be expected, the level of consultant input into the surgical management of patients was high (see Table 4):

- Consultant surgeons made the decision to operate in 83% of operations (197/238).
- The consultant surgeon operated in 62% of operations (148/238).

3.1.4 Grades of surgeons operating

The distribution of grades of surgeons and their roles in the operating theatre is shown in Table 4.

Table 4: Grade of surgeon deciding, operating, assisting or in theatre (n=238)

| | Deciding | Operating | Assisting | in theatre |
|-------------------|----------|-----------|-----------|------------|
| Consultant | 83% | 62% | 12% | 21% |
| SET trainee | 5% | 13% | 21% | 5% |
| Service Registrar | 2% | 5% | 12% | 4% |
| IMG | 1% | 3% | 4% | 2% |
| Fellow | 2% | 12% | 5% | 3% |
| GP Surgeon | 0% | 0% | 0% | 0% |

SET = Surgical Education and Training; IMG=International Medical Graduate; GP=General Practice

Note: the column percentages do not add up to 100%. In many cases multiple surgeons were performing and assisting during the operation. In addition, surgeon's roles and involvement were not always provided for each operation.

As two of the participating hospitals are teaching hospitals, it is expected that Surgical Education and Training (SET) trainees and service registrars would be deciding to operate as well as performing operations. For NTASM the rate of SET trainees deciding is 5%, This is similar to the rate in Queensland public hospitals (4%)* and the national data for public hospitals from ANZASM (3%)**.

*Source: QASM database

** Source: ANZASM database

3.1.5 Specialty of surgeon

An overview of the number of patients admitted for each surgical specialty is provided in Table 5. Although there are surgeons of various specialties working in the NT, surgically-related deaths primarily occurred in three specialties: General Surgery, Orthopaedic Surgery and Vascular Surgery.

Table 5: Surgical specialty and number of patients admitted (n=248)

| Specialty | Number of patients | Percentage of all surgical patients |
|---------------------------------------|--------------------|-------------------------------------|
| General Surgery | 205 | 83% |
| Orthopaedic Surgery | 23 | 9% |
| Vascular Surgery | 14 | 6% |
| Neurosurgery | 2 | <1% |
| Otolaryngology, Head and Neck Surgery | 2 | <1% |
| Oral and Maxillofacial Surgery | 2 | <1% |
| Total | 248 | 100% |

There were no patient deaths reported for Urology, Obstetrics and Gynaecology, and Plastic and Reconstructive Surgery.

3.1.6 Surgeon specialty and age distribution of patients

Orthopaedic Surgery patients who died were older than General Surgery and Vascular Surgery patients, as can be seen in Table 6 below.

Table 6: Surgical specialty and patient age distribution (n=248)

| Specialty | Median age (years) | Interquartile range (years) |
|----------------------------|--------------------|-----------------------------|
| General Surgery (n=205) | 61 | 46–74 |
| Orthopaedic Surgery (n=23) | 71 | 60–84 |
| Vascular Surgery (n=14) | 66 | 61–74 |

3.1.7 Treating surgeon and assessor views on patient management

A comparison of surgeon and assessor views on where patient management could have been improved is provided in Table 7. The surgeon's views for each case are compared with those of the first-line assessor's views.

"Timing of operation" was twice as likely to be considered with the least concordance between Surgeons and assessors. Also the "decision to operate" was more likely to be troublesome to the surgeon than the assessor who reviewed the case.

Table 7: Surgeon and first-line assessors' views on patient management

| Patient management with areas of concern or adverse events | Surgeons' views (n=146) | First-line assessors' views (n=184) | Concordance |
|--|-------------------------|-------------------------------------|-------------|
| Preoperative management | 9% | 8% | 87% |
| Decision to operate | 9% | 6% | 67% |
| Choice of operation | 3% | 4% | 74% |
| Timing of operation | 8% | 4% | 57% |
| Intraoperative management | 5% | 5% | 96% |
| Postoperative care | 4% | 3% | 94% |

Note: More assessors than surgeons filled out this part of the form.

From this data it is clear that in nearly 10% of cases, both the surgeons and the first-line assessors considered that improved preoperative care would have been in the best interest of the patients.

3.1.8 Operation duration

Duration of operation is an important predictor of an adverse event in a surgical admission. According to Kable, Gibberd and Spigelman^[1], as the duration of the operation increases, so too does the risk of an adverse event:

- An operation of less than 60 minutes duration has an odds ratio for an adverse event of 0.8 (95% confidence interval [CI] 0.6 to 1.0) compared to an odds ratio of 4.6 (95% confidence interval [CI] 2.4 to 8.8) for an operation that exceeded 180 minutes.
- An operation of greater than 180 minutes duration has an adjusted odds ratio for an adverse event of 5.5 (95% CI 3.3 to 9.2) compared to an odd ratio of 1.0 in an operation of less than 60 minutes. (Odds ratios were adjusted for type of operation).

In NTASM there was substantial variation in the time spent in theatre for patients who died in the perioperative period.

- The median amount of time spent in theatre was 90 minutes.
- The interquartile range (IQR) was 60 minutes to 120 minutes. One quarter of NTASM cases were therefore at higher risk for an area of concern or an adverse event.
- 35 operations took 180 minutes or longer. The shortest operation was less than 10 minutes

duration, and the longest operation was 420 minutes duration.

The cases with extended time in theatre had 11 clinical incidents (eight areas of consideration, two areas of concern and one adverse event) compared with 48 clinical incidents (27 areas of consideration, 18 areas of concern and 3 adverse events) when the operation time was less than 180 minutes. The proportion of clinical incidents associated with extended operation time was 31% (11/35) compared with 30% (48/167) when the operation times were less than 180 minutes.

This indicates that NTASM data is different to that reported by Kable and colleagues as the operation time did not appear to relate to the likelihood of clinical incidents. Kable et al (2008). included five elective high volume surgical procedures and some are different to the surgical procedures performed in NTASM.

3.1.9 Surgeons' views in retrospect

Surgeons were asked whether in retrospect they would have done anything differently in terms of patient management:

- In 18% of cases the surgeon answered that they would have done something differently (35/193).

In retrospect, surgeons would have made changes in all areas of the patient's admission. A sample of comments is provided below:

- preoperative care: *"Screened for the presence of urinary tract infection prior to proceeding with surgery (i.e. at the time of pre-admission clinic)."*
- choice of procedure: *"Reconsidered the percutaneous procedure but may not have made any difference to the ultimate outcome."*
- operation timing: *"Probably would have taken patient to theatre for debridement earlier. Not sure this would have affected outcome however. Progressive demise was probably unavoidable."*
- decision to perform the operation: *"Not have done the operation; just placed the bolt (pressure monitor) and repaired facial lacerations. The decision to operate was based on the age (and other factors)."*
- duration of operation: *"Shortened debridement and escharotomies time in theatre plan."*
- postoperative care: *"Postoperative fluid management was a real issue in this case."*

3.2 Hospitals

Key points:

- All NT hospitals participate in NTASM.
- Inter-hospital transfer was required for 13% of patients.
- A delay in obtaining the main surgical diagnosis occurred in 8.9% of cases.

3.2.1 Hospital participation

All hospitals in the NT participate in NTASM. Data in this report is from three hospitals, which service Central Australia and the whole Top End of the Northern Territory. Three quarters of the reported deaths (76%) occurred in the Northern Territory's main referral hospital (188/248).

3.2.2 Hospital admissions

The majority of hospital admissions were emergencies. Emergency admissions comprised 92% (182/198) of all hospital admissions, while elective admissions comprised 8% (16/198).

Operations were performed on 94% of elective admission patients (15/16).

Operations were performed on 74% of emergency admission patients (134/180).

Inter-hospital transfer admissions occurred in 13% of patients.

3.2.3 Delays or errors in main surgical diagnosis

Delays and errors in diagnosis are important factors contributing to deaths in perioperative care.^[2] There was a delay in obtaining the main surgical diagnoses in 9% of cases (18/202).

Delays (21) were associated with:

- surgical unit (n=6);
- medical unit (n=3);
- general practitioner (n=1);
- emergency department (n=2);
- other departments or causes (n=9);

Delays were primarily due to unavoidable causes (n=7) and inexperienced staff (n=5). Other reasons for delay were due to patient: transfer, optimisation and delayed presentation to the hospital.

3.2.4 Surgical diagnosis (n= 248)

For the surgical patients the most frequent surgical diagnoses on admission were:

- peripheral vascular disease and/or leg ulcers or cellulitis (n=26)
- cerebral haemorrhage (intracerebral, subarachnoid, traumatic subdural) (n=22)
- ischaemic bowel and/or intestinal obstruction or perforation (n=21)
- malignancy (n=17)
- fractured neck of femur (n=13)
- septicaemia or septic shock (n=12)
- severe head injury and/or hypoxic brain injury (n=11)
- necrotising fasciitis (n=10)

3.2.5 Cases with operations

A total of 157 NTASM patients had 238 operations:

- In total 77% of NTASM patients had operations (157/204). No data was available for 44 cases.
- More than one operation was performed on 32% of patients (50/157).

The high rate of return to theatre seen in NTASM patients may be explained by debridement of skin or muscle being the most common operation. Debridement of skin or muscle often requires repeat operations.

The most common operations in NTASM patients, in order of frequency, were:

(Source: NTASM database, n = 157)

- debridement of skin or muscle (n=36)
- exploratory laparotomy (n=24)
- reopening of laparotomy site (n=16)
- gastroscopy (n=9)
- above-knee amputation (n=8)
- arthroscopic irrigation of knee joint (n=6)
- burr hole (or burr holes) for intracerebral pressure monitoring (ICPM) for acute head injury (n= 6)
- changing of dressings (n=5)
- fibre-optic endoscopic banding of oesophageal varices (n=5)

Between 2011 and 2014, a total of 85,352 operations were performed on 37,594 Northern Territory patients. The most common operations performed on Northern Territory patients are similar to those performed on NTASM patients.

The most common operations in Northern Territory patients (who did not die), in order of frequency, were:

(Source: Clinical Information Analysis team, Northern Territory Health, 24-July-2014, n=37,594)

- excisional debridement of soft tissue exploration (n= 6,178)
- fibre optic colonoscopy to caecum (n=3,818)
- incision and drainage of soft tissue abscess (n=3,569)
- endoscopy to duodenum (n= 3,548)
- suction curettage of uterus (n= 2,177)
- emergency lower-segment caesarean section (n= 1,865)

3.2.6 Cases with postoperative complications

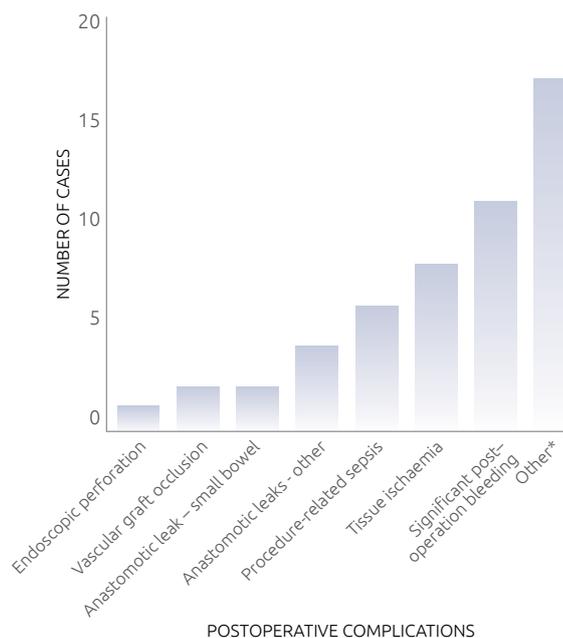
Postoperative complications are strong predictors of death.^[3] Surgeons reported that 23% of patients who died following an operation had a postoperative complication (36/157).

This is statistically significantly lower than the ANZASM rate of 34% (3,931/11,707). [Odds Ratio (OR) 0.59 (95% CI 0.41 to 0.86)].

The 36 NTASM patients experienced a total of 50 complications. Most patients had one complication, however the number of complications ranged from one to four per patient. The most frequent complications were:

- significant postoperative bleeding (n=11)
- tissue ischaemia (n= 8)
- procedure-related sepsis (n=6)
- anastomotic leak (n=5)

Figure 3: Postoperative complications in NTASM (n=50)



NTASM: Northern Territory Audit of Surgical Mortality.

*Other complications included: acute myocardial infarction (x3), aspiration, pneumonia, bleeding after second operation, extensive gastric cancer infiltration, failure to heal, lung collapse and infection, necrotising fasciitis of abdominal wall, pneumonia, prolonged ileus and respiratory failure, small bowel ischaemia, wound haematoma.

3.2.7 Use of intensive care units

Intensive care units (ICUs) are essential contributors to surgical care.^[4]

- Care in an ICU was received postoperatively by 70% of patients (141/202).
- In seven cases (3%) in which support from an ICU was not provided, the assessors believed that the patient should have received it.

3.2.8 Unplanned returns to theatre

Unplanned returns to theatre and unplanned admissions to an (ICU) are each strong predictors of death in surgical patients.^[5-7] The rate of unplanned returns to theatre is higher for NTASM patients compared with audit patients nationally.

- An unplaned return to theatre occurred in 17% of NTASM cases (25/148), while nationally it occurred in 15% of cases (339/2,314).
- The difference between NTASM and national cases is not statistically significant, RR 1.15 (95% CI 0.80 to 1.69). Numbers remain too low for definitive comparison.
- Of the patients who died in the perioperative period, 20% had an unplanned admission to the ICU (30/149) compared to those who died nationally.

3.2.9 Days in hospital before death

The length of stay for surgical patients is determined by many factors.^[8]

In Australia, for 2012-2013 the average length of stay for an acute care patient was 2.8 days in public hospitals and 2.1 days in private hospitals.^[9]

The majority of audited patients had been in hospital for a short time, with 24% of patients admitted to hospital for one day or less (60/248) (see Table 8).

Table 8: Days in hospital (length of stay) before death

(Source NTASM database n=248, ANZASM database N =15,256, and AIHW database n= 5,530,195).

| Length of hospital stay | NTASM | ANZASM | All surgical patients* in Australian public hospitals** |
|-------------------------|----------|----------|---|
| Median | 5 days | 7 days | 5 days |
| (IQR) | (1–16) | (3–17) | (1–16) |
| Minimum | <1 day | <1 day | <1 day |
| Maximum | 125 days | 761 days | not available |

IQR: interquartile range,

NTASM: Northern Territory Audit of Surgical Mortality, ANZAM: Australian and New Zealand Audit of Surgical Mortality;

AIHW: Australian Institute of Health and Welfare.

*All surgical patients includes patients who did not die.

**AIHW 2014; Australian hospital statistics 2012-13. Health services series 54. Cat. no. HSE 145. Canberra: AIHW (page 135).

3.3 Patients

Key points:

- NT audit patients are younger than those of the other state and territory audits.
- The profile of NT audit patients was similar to the national profile in the following areas: significant comorbidities, emergency admissions and gender distribution.

3.3.1 Overview of patients

During the four years of the audit 248 patient deaths were reported and 20 of these were excluded from assessment due to “terminal care”. Of the reported deaths 96% have been or are in the process of being assessed (219/228).

Operations were performed in 157 patients and a total of 238 operations were performed.

3.3.2 Gender

An overview of the gender distribution of NTASM patients, compared with other Australian audit patients, is shown in Table 9.

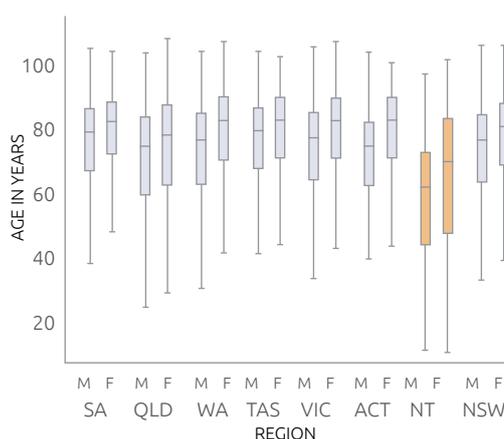
Table 9: Gender distribution of NTASM patients compared with QASM patients and patients nationally

| Regional Audits | Males | Females |
|--|-------|---------|
| NTASM | 60% | 40% |
| QASM | 59% | 41% |
| All Australian states and territories. | 54% | 46% |

NTASM: Northern Territory Audit of Surgical Mortality.

QASM: Queensland Audit of Surgical Mortality.

Figure 4: Age and gender distribution of NTASM patients compared with other Australian states and territories.



(source: ANZASM report; n=18,583)

Note: neonates excluded.

NTASM: Northern Territory Audit of Surgical Mortality, ANZASM: Australian and New Zealand Audit of Surgical Mortality.

Audit of Surgical Mortality regions include - SA: South Australia, QLD: Queensland; WA: Western Australia, TAS: Tasmania, VIC: Victoria, ACT: Australian Capital Territories, NT: Northern Territory, NSW: New South Wales.

The NT data in Figure 4 shows:

- the minimum and maximum ages were lower than other states for both males and females.
- the middle 50% of ages are lower than other states as shown in the box.
- males are younger than females which is similar to other states.

3.3.3 Age of NTASM patients and Northern Territory hospital patients

An overview of the age distribution (in 5 year intervals) of NTASM patients is shown in Figure 5:

- 80% of patients in the age groups above 60 years were non-Aboriginal persons (95/118).
- In the age groups below 60 years, 65% of the patients were Aboriginal persons (67/103).

- There were no Aboriginal persons older than 87 years in NTASM.

An overview of the age distribution of all Northern Territory surgical patients who did not die is shown in Figure 6.

- NTASM patients were older than the Northern Territory surgical patients who did not die. The median age of the NTASM patients was 62 years (see figure 4). The median age of all surgical patients was 40 years.*

Figure 5: Comparison of 5-year age group distribution of patients in NTASM for non-Aboriginal persons (n=134) and Aboriginal persons (n=94)

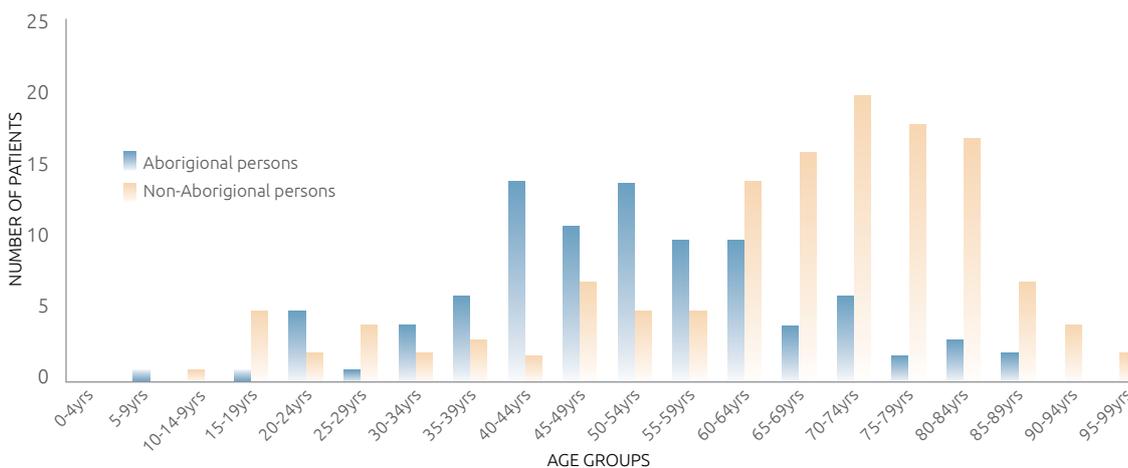
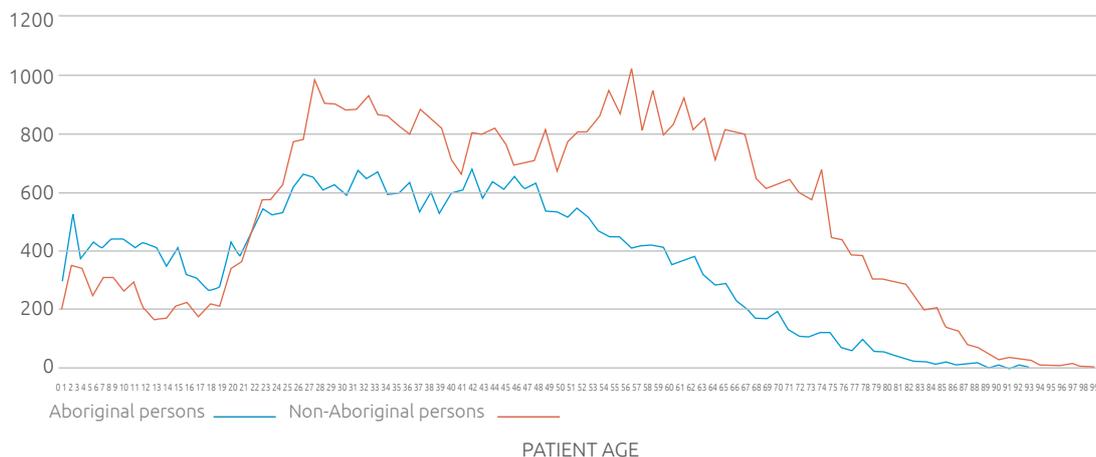


Figure 6: Distribution of all Northern Territory hospital patients by age 2011-2014

*Source: Clinical Information Analysis team, Northern Territory Health, 24-July-2014 (n=36,328)



3.3.4 ASA class

The American Society of Anesthesiologists (ASA) class is an international measure of patient risk used by anaesthetists.^[10] In the NT an ASA class is assigned to the patient by the assisting anaesthetist prior to a procedure being undertaken.

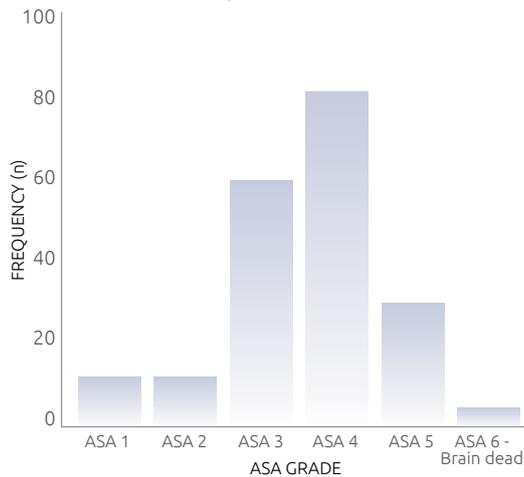
An ASA class indicating the presence of severe disease (class 3 to 6) was assigned to 82% (166/188) of NTASM patients prior to the patient going to theatre (166/188). Figure 7 shows the distribution of ASA class for NTASM patients.

ASA class definitions

- Class 1: A normal healthy patient.
- Class 2: A patient with mild systemic disease.
- Class 3: A patient with severe systemic disease which limits activity, but is not incapacitating.
- Class 4: A patient with an incapacitating systemic disease that is a constant threat to life.
- Class 5: A moribund patient who is not expected to survive 24hrs, with or without an operation.
- Class 6: A brain dead patient for organ donation.



Figure 7: Distribution of ASA class for NTASM patients (n=196)



NTASM: Northern Territory Audit of Surgical Mortality
 ASA: American Society of Anesthesiologists
 (Missing data n= 8)

The 11 patients considered ASA class 1 (a healthy patient) were admitted due to:

- accidental strangulation
- a massive bleed from a stab wound
- ruptured visceral and multiple fractures (motor vehicle accident [MVA])
- a severe traumatic head injury (MVA)
- left subdural, subarachnoid haemorrhage, right haemopneumothorax (MVA)
- severe head injury with diffuse axonal injury (MVA)
- multisystem trauma (pedestrian involved in MVA)
- severe closed head injury (motorbike accident MBA)
- severe traumatic brain injury (MBA)
- severe cerebral ischaemia due to self-harm
- spontaneous massive subarachnoid haemorrhage

3.3.5 Malignancy

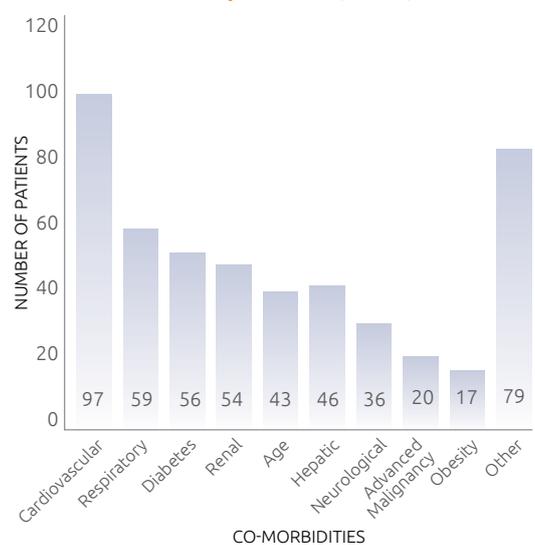
- Metastatic malignancy is a predictor of death in surgical patients.^[11]
- Malignancy was present in 22% (45/205) of patients.
- A malignancy was present in 28% (35/126) of non-Aboriginal patients. In 74% (26/35) of these patients the malignancy was considered to have contributed to death.
- A malignancy was present in 13% (10/79) of Aboriginal patients. In 60% (6/10) of these patients the malignancy was considered to have contributed to death.

- This shows that the relative risk of malignancy in Aboriginal persons was half that of non-Aboriginal persons. RR 0.46 (95% CI 0.24 - 0.87). This difference is statistically significant, and is probably due to the difference in ages of the two patient groups.

3.3.6 Comorbidities

According to the literature, comorbidities are a stronger predictor of mortality than the type of surgery.^[4] Serious comorbidities were present in 80% of audit patients (163/204) and most patients had more than one serious comorbidity present. The distribution of comorbidities is shown in Figure 9.

Figure 8: Distribution of comorbidities in NTASM patients (n=163)



Note: The most common "other" comorbidities were: alcohol abuse, vascular disease, mental health/dementia, Coagulopathy, heavy smoking, malnutrition and hypertension

The most frequent comorbidities present in patients were cardiovascular disease, respiratory disease, diabetes and renal disease.

3.3.7 Risk of death

While the risk of surgical mortality is generally low, in certain circumstances some patients are at a higher risk.^[12]

Surgeons were asked to rate the overall risk of death, prior to surgery, for each patient. The distribution of the risk of death is shown in Figure 9.

The risk of death was considerable or expected in 62% (97/156) of patients, similar to the risk across all Australian states and territories 62% (8,592/13,794)*.

* ANZASM Report 2013

Figure 9: Distribution of patient risk of death prior to surgery, as perceived by surgeons (n=156)

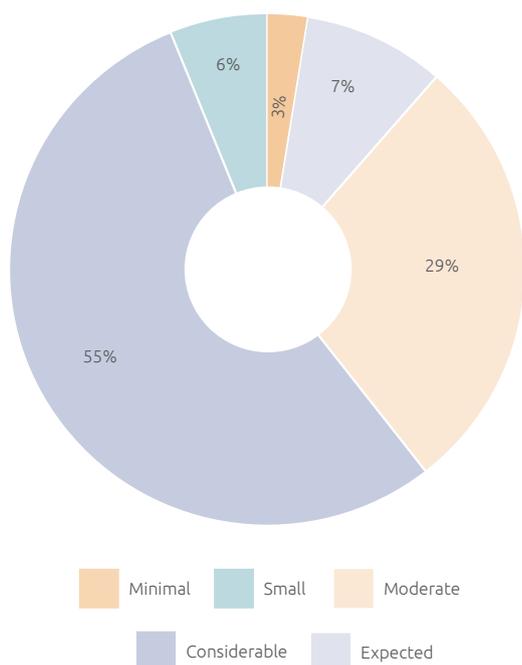
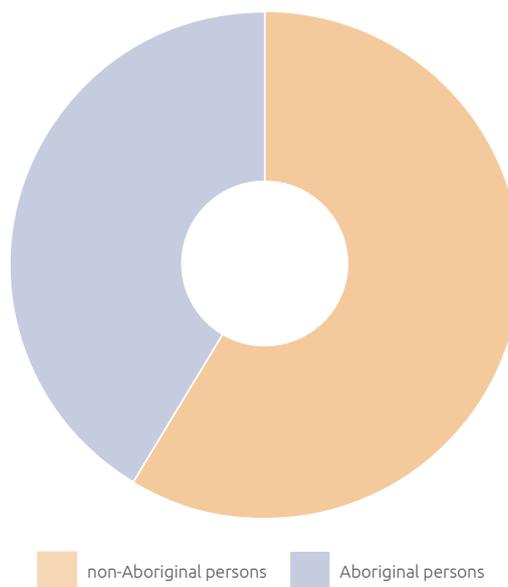


Figure 10: Surgically-related deaths of Aboriginal persons and non-Aboriginal persons in the NTASM, 2010–2014



3.4 Aboriginal persons

Almost a third of the population in the Northern Territory are Aboriginal persons (30%), the highest of any Australian state or territory.^[13] This is reflected in the surgical audit population in which the percentage of Aboriginal persons is 41%.

3.4.1 Aboriginal persons and surgically-related deaths

The proportion of NTASM patients who were of Aboriginal descent, and who were identified as an Aboriginal person, is shown in Figure 10.

- 41% (94/228) of NTASM patients were Aboriginal persons.

3.4.2 Aboriginal persons and age

- Aboriginal persons who died in the perioperative period were younger than non-Aboriginal persons (see Table 10).
- The difference in median ages between Aboriginal persons and non-Aboriginal persons was 19 years.
- The age distribution of Aboriginal persons and non-Aboriginal persons is shown in Figure 6.

Table 10: Age at death of Aboriginal persons and non-Aboriginal persons (n=231)

| | Age at death of Aboriginal persons (n=94) | Age at surgical death of non-ATSI patients (n=112) |
|--------------|---|--|
| Median (IQR) | 51 years (43–60) | 70 years (57–78) |
| Minimum | 8 years | 14 years |
| Maximum | 87 years | 99 years |

IQR: interquartile range.

3.4.3 Aboriginal persons and ASA class

An ASA class of 3 or higher was recorded for 86% (66/77) of Aboriginal patients. At a minimum these patients presented with severe disease prior to undergoing surgery. Figure 11 shows the distribution of ASA class for Aboriginal persons. This data is not age adjusted.

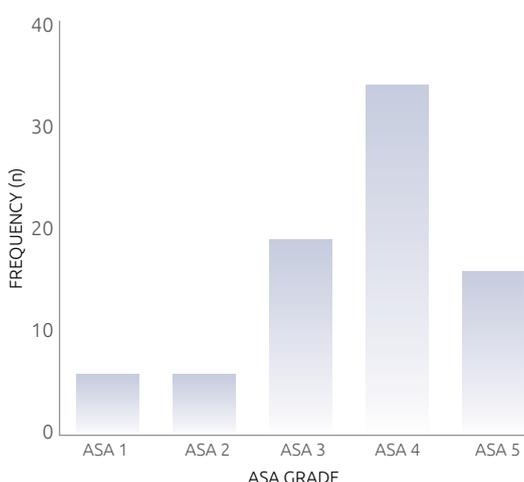


Nationally, an ASA class of 3 or higher was present in 84% (15,604/18,583)* of all audit patients. This data is not age adjusted.

* ANZASM Report 2013

(Note: see section 3.3.4 for ASA class definitions.)

Figure 11: Distribution of ASA class in Aboriginal persons in NTASM (n=77)



Missing data: n=17

ASA: American Society of Anesthesiologists

NTASM: Northern Territory Audit of Surgical Mortality

- The five Aboriginal persons considered ASA class 1 (a healthy patient) were admitted due to:
 - > left subdural, subarachnoid haemorrhage, right haemopneumothorax —(single MVA).
 - > massive bleed from stab wound.
 - > spontaneous massive subarachnoid haemorrhage.
 - > severe traumatic head injury (pedestrian in MVA).
 - > multisystem trauma (pedestrian in MVA).

3.4.4 Aboriginal persons and malignancy (n=79)

- Malignancy was present in 13% (10/79) of Aboriginal persons and 28% (35/126) of non-Aboriginal persons.
- The difference in the malignancy rate is most likely a reflection of the younger median age of Aboriginal patients.

3.4.5 Aboriginal persons and comorbidities (n=78)

The prevalence of comorbidities is a problem for the surgical care of Aboriginal persons:

- Audit data shows serious comorbidities were present in 85% (66/78) of Aboriginal

persons, compared with 77% (97/126) of non-Aboriginal persons. This data was not adjusted for age and the difference was not statistically significant, RR 1.10 (95% CI 0.96 to 1.26).

- However, when patient age was capped at 53 years or younger, a considerable difference emerged between Aboriginal persons and non-Aboriginal persons (see Table 11).

Table 11: Serious comorbidities in Aboriginal persons aged 53 years or younger (n=73)

| | Serious comorbidities present (%) | Cases (n) |
|------------------------|-----------------------------------|-----------|
| Aboriginal persons | 75% | 33/44 |
| Non-Aboriginal persons | 35% | 10/29 |

Younger Aboriginal persons are at twice the risk of serious comorbidities than non-Aboriginal persons.^[14] This is confirmed in the current NTASM audit data, which has a risk ratio of 2.18 (95% CI 1.28 to 3.70) for serious comorbidities in younger Aboriginal persons compared with younger non-Aboriginal persons.

3.4.6 Aboriginal persons and operations

- There were 38% (60/157) of NTASM patients who had operations and were Aboriginal persons compared with 62% (97/157) were non-Aboriginal persons.

3.4.7 Aboriginal persons and risk of death (n=60)

Based on surgeon perception, a higher proportion of Aboriginal persons were at considerable or expected risk of death (73%) than non-Aboriginal persons (53%) (Table 12).

Table 12: Percentage distribution of patients at risk of death

| Risk of death | Aboriginal persons (n= 60) | Non-Aboriginal persons (n=96) |
|----------------|----------------------------|-------------------------------|
| Small | 2% | 4% |
| Minimal | 2% | 8% |
| Moderate | 23% | 32% |
| Considerable | 68% | 47% |
| Expected death | 5% | 8% |

3.5 Clinical incidents

In order to remain under the protection of qualified privilege these findings have been expressed in terms that cannot identify the patient, the surgeon or the hospital.

Clinical incidents, as defined by NTASM, include:

- **area for consideration** – where the clinician believes an area of care could have been improved or different but recognises that there may be debate about this
- **area of concern** – where the clinician believes that an area of care should have been better
- **adverse event** – an unintended “injury” caused by medical management, rather than by the disease process, that is sufficiently serious to:
 - > lead to prolonged hospitalisation
 - > lead to temporary or permanent impairment or disability of the patient at the time of discharge
 - > contribute to or cause death.

Over the full audit period assessors identified 56 areas of consideration and 44 clinical incidents (areas of concern and adverse events).

- As areas of consideration are minor criticisms, or suggestions regarding treatment they are not discussed further in this report.
- Clinical incidents (**areas of concern** and **adverse events**) encompass issues that are specific to surgical care and may relate to hospital or patient management issues. They are areas of care that were suboptimal and need to be improved.

The 44 clinical incidents occurred in 25 patients, with 11 patients experiencing two or more clinical incidents.

The rate of clinical incidents in the NT is 10.1% (25/248). This compares favourably to national data that shows that the prevalence of clinical incidents across all Australian states and territories is 12% (2,292/18,583)*.

* Source: ANZASM Report 2013

A summary of the 44 clinical incidents from this audit are described below:

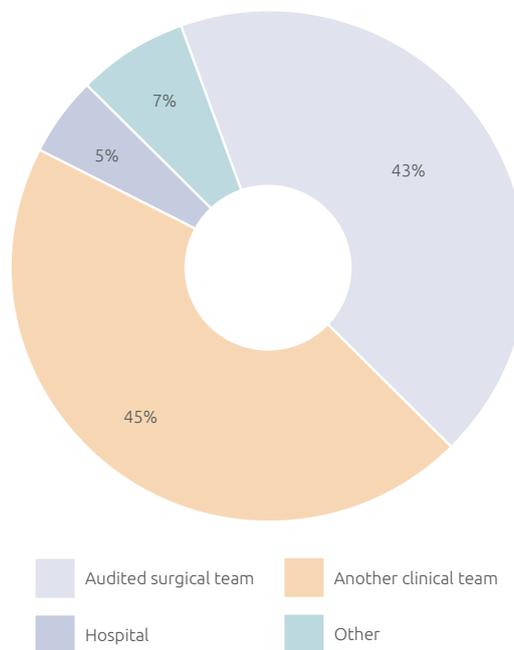
- there were 38 areas of concern and six adverse events;
- 38 of the 44 clinical incidents were considered to be preventable.

Associations:

- 18 of the 44 clinical incidents were associated with the surgical team;
- 19 of the 44 clinical incidents were associated with another clinical team;
- two clinical incidents were associated with a hospital issue;
- three clinical incidents were associated with other causes (ICU, radiology and an initial procedure);
- associations were not provided for two clinical incidents.

The distribution of association of clinical incidents is highlighted in Figure 13.

Figure 12: Distribution of association of clinical incidents (n= 44)



In general terms the preventable clinical incidents consisted of:

Patient assessment problems:

- inadequate preoperative assessment;
- delay in diagnosis;
- incorrect procedure selection.

Delays:

- delay in transfer to surgical unit;
- delay to surgery;
- delay to re-operation;
- delay in recognising a bleeding complication.

Incorrect therapy or incorrect use of drains or catheters:

- postoperative care unsatisfactory;
- unsatisfactory medical management;
- incorrect therapy.

Communication failures:

- poor communication between physician and surgeon;
- poor documentation.

Technical:

- preoperative cardiac assessment inadequate;
- general coagulopathy related to endoscopic operation.

Complications related to equipment:

- equipment not available.

3.6 Trauma

Note: care should be used in the interpretation of data relating to trauma as numbers are still low.

Trauma has a higher prevalence in the NTASM patients compared with national audit patients. Currently only Queensland, Northern Territory, Western Australia and Victoria provide trauma data to ANZASM.

In NTASM a higher proportion of non-Aboriginal persons presented with trauma than Aboriginal persons. There were 45 NTASM patients who were recorded as having had trauma.

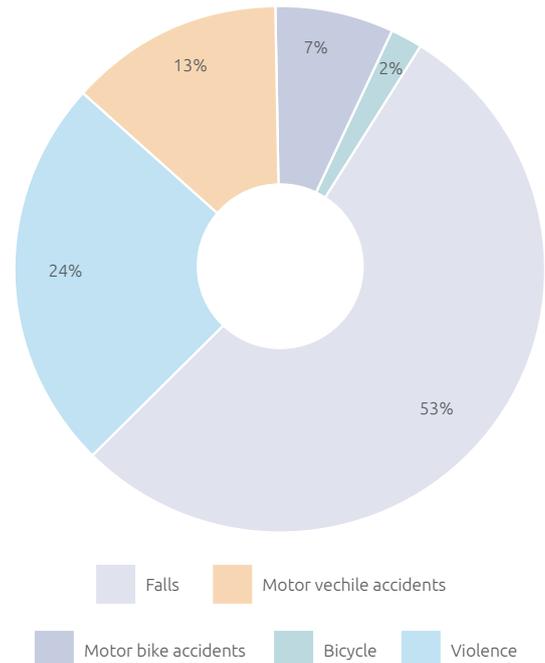
Trauma is most commonly due to falls, both in NTASM patients and national audit patients. However, the causes of trauma and the age at which trauma occurs are quite different.

In addition to falls, there was a high prevalence of other causes of trauma in NTASM patients (see Figure 14).

The trauma rate arising from accidents or violence was similar. The numbers in these areas are too low to compare with national data.

- The proportion of NTASM patients who presented with trauma was 29% (45/154). In the 2013 national audit report, the prevalence of trauma was 23% (908/3,987). This indicates that there is a statistically significant higher rate of trauma presentation in the NT compared with the national rate, RR 1.28 (95% CI 1.00 to 1.65).
- The distribution of trauma was 36% aboriginal persons (16/45) and 64% non-aboriginal persons (26/45).

Figure 13: Distribution of causes of trauma in NTASM (n=45)



NTASM: Northern Territory Audit of Surgical Mortality

The most frequent cause of trauma was falls.

3.6.1 Falls

Falls were the most frequent cause of trauma in NTASM accounting for 53% of patients with documented trauma (24/45):

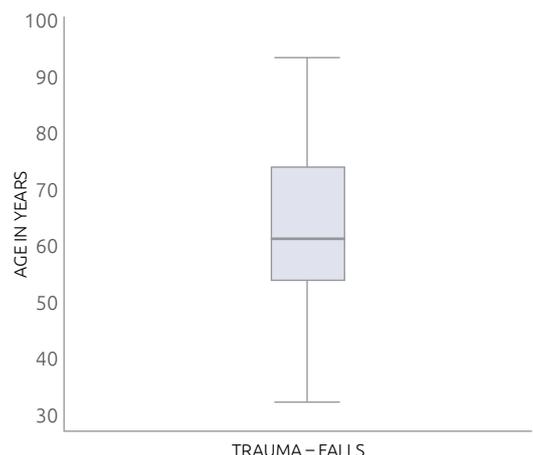
- 54% of the falls occurred at home (13/24).
- 12% of the falls occurred in hospital (3/24).

Falls occurred in a considerably higher proportion of ANZASM patients - 82% of trauma patients (745/908).

The median age of NTASM patients who experienced a fall was 62 years, with ages ranging from 35 years to 93 years (Figure 15).

The median age of ANZASM patients who experienced a fall was considerably older at 83 years.

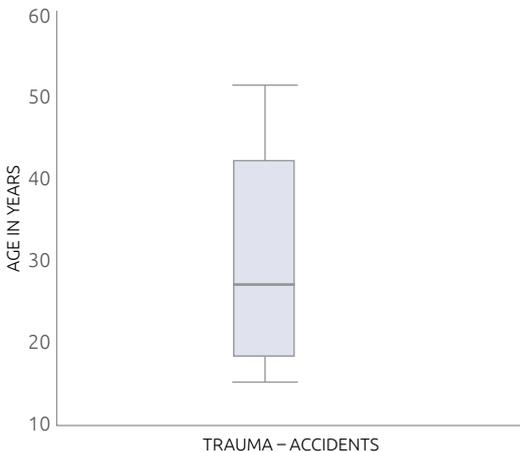
Figure 14: Age distribution of patients where trauma was the result of a fall (n=24)



3.6.2 Accidents

Ten trauma cases were from traffic accidents (six MVAs, three MBAs and one bicycle accident). The median age of patients who were involved in a traffic accident was 27 years. Ages for this group ranged from 16 years to 51 years (Figure 16).

Figure 15: Age distribution of patients where trauma was the result of an accident (n=10)

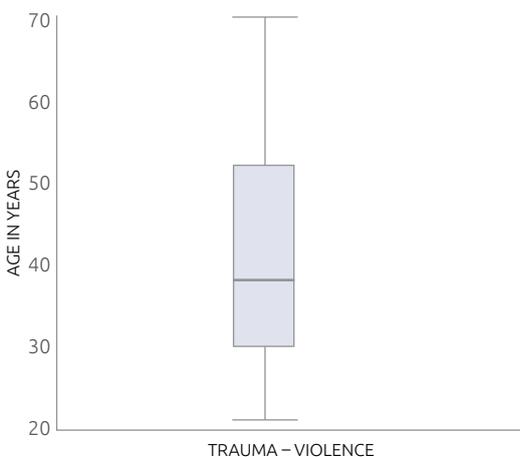


3.6.3 Violence

The median age of the 11 patients who experienced violence was 39 years (ranging from 22 years to 70 years). The age distribution of patients where trauma was the result of violence is shown in Figure 17.

Public violence and domestic violence each accounted for approximately one third of the cases (public violence: 3/11; domestic violence: 3/11).

Figure 16: Age distribution of patients where trauma was the result of violence (n=11)



3.7 Infection

Note: care should be used in the interpretation of infection data as the numbers are still low.

The infection rate of NTASM surgical patients is higher than those in other Australian states (See Figure 18). However, there is a difference in WHEN those infections were acquired. Most infections in NTASM patients were acquired prior to admission.

Nationally, the majority of infections were acquired during the admission of the patient.

3.7.1 Infections and operations

All NTASM patients were infection-free at the surgical site.

- Three patients acquired an infection preoperatively.
- An infection was acquired postoperatively in 11 patients.
- Three patients had invasive surgical site infections.

3.7.2 Infection rates

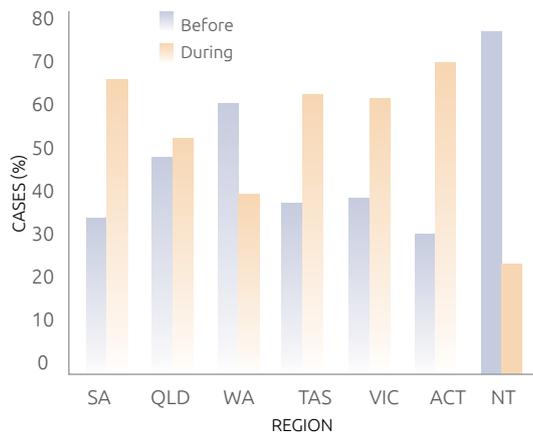
- 40% (58/147) of patients had a clinically significant infection, compared with 22% nationally (1,589/7,233). This result is statistically significant and shows that NTASM surgical patients have twice the probability of having an infection than surgical patients nationally, RR 1.80 (95% CI 1.46 to 2.20). The rates of infection acquired by NTASM patients before and during admission are shown in Figure 18.
- 36% (31/87) of non-Aboriginal patients and 45% (27/60) of Aboriginal patients died with a clinically significant infection.

3.7.3 Timing of infection

- Of the NTASM patients who died with a clinically significant infection 68% (38/56) were admitted with an existing infection and 32% (18/56) acquired the infection during their admission. This is different to national data, which shows that fewer patients (45%) were admitted with an existing infection (708/1589)*. (see Figure 18)
*Source: ANZASM data 2013
- Infections were acquired prior to admission in 77% (20/26) of Aboriginal patients with an infection.
- Infections were acquired prior to admission in 60% (18/30) of non-Aboriginal patients with an infection.

Figure 17: Infections acquired before and during admission by region

(source: ANZASM database, n= 1,589)



ANZASM: Australian and New Zealand Audit of Surgical Mortality.

3.7.4 Types of infections

The types of organisms identified in NTASM patients are different to those identified in ANZASM patients. This is possibly due to the increased soft tissue infections and necrotising fasciitis found in the Northern Territory. The frequency of organisms identified in NTASM and ANZASM is seen in Figure 19.

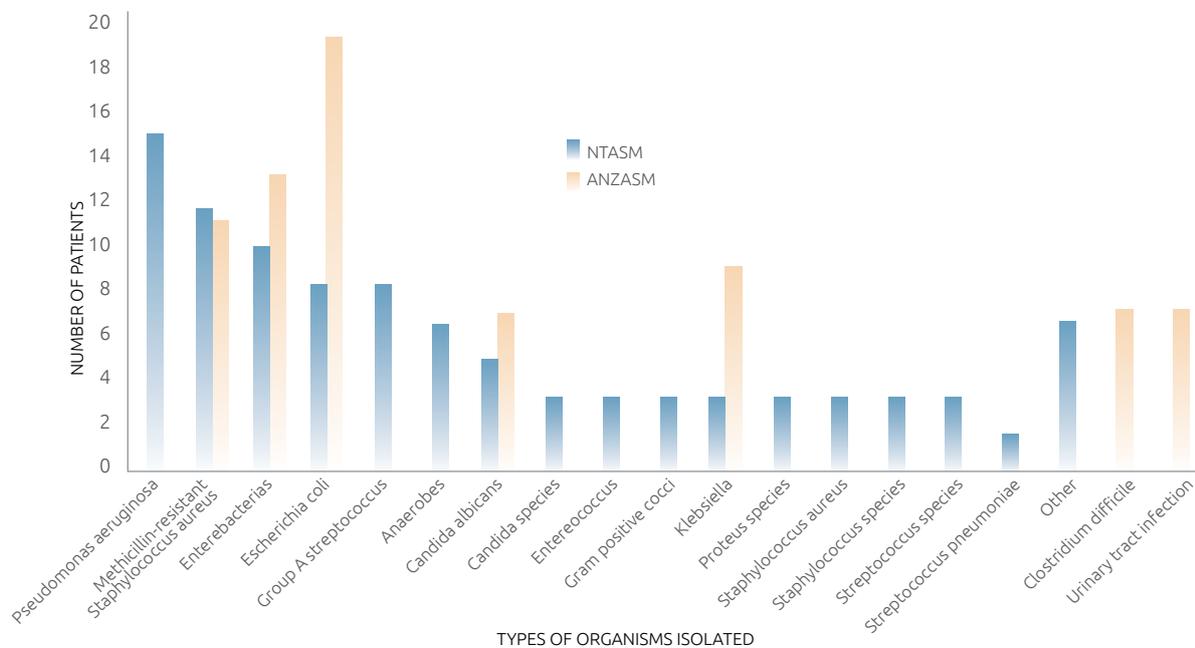
The most frequent species of organism identified in NTASM patients was *Pseudomonas aeruginosa* (15%). *Pseudomonas* infections are considered as hospital acquired infections.^[15] Serious *Pseudomonas* infections usually occur in immune-compromised and or hospitalised patients. Hospital patients most at risk are those on ventilators, with catheters, with surgical wounds or with burns. This organism is also found in non-chlorinated swimming water and has been identified in necrotising fasciitis in the Northern Territory.^[16] This organism was not identified as a frequent pathogen in the national data.

Staphylococcus aureus was isolated in only 3% of cases. This is much lower than the national rate of (27%).

Methicillin-resistant Staphylococcus aureus (MRSA), however, was isolated at a similar rate in NT (12%) as nationally (11%).

Streptococcus Group A was isolated in 8% of NTASM cases, and was not identified in the national data as a frequent pathogen. This organism is also often associated with necrotising fasciitis (Type II) infections.^[15, 17]

Figure 18: Types of organisms identified in NTASM patients compared with those identified in ANZASM patients as reported by surgeons (NTASM: n= 61, ANZASM database, n= 593)



NTASM: Northern Territory Audit of Surgical Mortality.

ANZASM: Australian and New Zealand Audit of Surgical Mortality (only NSW does not provide data regarding infections)

Other: includes a variety of organisms isolated once.

Note: One *Enterococcus* isolate was vancomycin resistant



Conclusion

Although the numbers are still low, results from the NTASM are consolidating and a broad picture of surgical deaths in the NT is emerging. Some of the major findings to date include:

- Age at death in the NTASM was significantly younger than the rest of Australia.
- Age at death of Aboriginal persons was significantly younger than non-Aboriginal persons.
- Younger Aboriginal people had many more co-existing factors increasing risk of death, particularly liver disease and complicated diabetes.
- No significant discrepancies of surgical care were identified between Aboriginal and non-Aboriginal persons.
- Rates of trauma have not changed over the years and is the same in both Aboriginal and non-Aboriginal persons.
- Cerebral haemorrhage and severe head injury together remain the commonest surgical diagnosis at final admission.
- Although the infection rate of patients in NTASM is high, no infections were acquired at the surgical site.

Areas For Consideration in Management

Duration of operation is an important predictor of an adverse event in a surgical admission. One quarter of NTASM cases were therefore at higher risk for an area of concern or an adverse event. There were thirty-five operations that took 180 minutes or longer. This highlights a potential area for improvement.

Postoperative complications are strong predictors of death. Of the 157 patients who had operations and died, surgeons reported that 23% had a postoperative complication. This is similar to the ANZASM where the rate was higher, at 34%. However the second-line assessors noted more problems in postoperative care than at any other stage, being 32% overall in the NT.

Aboriginal Persons

This report highlights the significant physical disadvantages and difficulties that still exist within Aboriginal populations. Aboriginal persons who died in the perioperative period were significantly younger, by a median of 19 years. Although Aboriginal persons comprise 30% of the NT population, in the age groups below 60 years, 65% of all deaths were in Aboriginal persons. When comparing similar age groups (at or under 53 years), Aboriginal persons had twice the risk of serious comorbidities than non-Aboriginal persons. Importantly however, no significant discrepancies of surgical care were identified between Aboriginal and non-Aboriginal persons.

Trauma

Trauma has a significantly higher prevalence in the Northern Territory (29%) than nationally (23%), and has not changed over the years of this report. Death from head injury in young males remains a serious problem in the NT. Although trauma is most commonly due to falls, both in NTASM and nationally, in NTASM data, falls occur at a much younger age, at a median of 62 years, compared to national data, at 83 years. Given the small NT population, rates of trauma due to traffic accident remains high (10 NTASM trauma cases), but remains less common than trauma due to violence (11 NTASM patients). Public violence accounted for a third of the cases (3/11) and domestic violence accounted for another third (3/11). These numbers are low, so caution in interpretation is indicated. However the message is getting stronger with each year's data.

Clinically Significant Infections

The rates of clinically significant infections in NTASM (40%) are significantly higher than those in Australia as a whole (22%). Encouragingly, no infections were acquired at the surgical site. For NTASM patients, most infections (68%) came prior to admission. This is very different from the overall Australian data which shows that 45% of ANZASM patients with infections acquired them prior to admission rather than during admission. Necrotising fasciitis remains a serious and relatively common condition in the NT (10 cases in this report). This likely relates to an increased incidence of factors in the NT that are associated with and are thought to predispose to the development of necrotising fasciitis, including diabetes, malnutrition, alcohol abuse and heavy smoking.

With regards,

Dr John Treacy FRACS

NTASM Chairman



Acknowledgements

Our sincere thanks go to all assessors who have responsibly completed and promptly returned first- and second-line assessments. This assessment process is a small but integral part of safety and quality in surgical care. As surgeons we need to make this an integral part of our daily activity. These audit and feedback mechanisms form part of our learning process. Surgeons learn well by self-reflection.

Second-line assessors need particular thanks for their excellent reports. Their reviewing of cases (and medical records), along with forensic assessment and responses, form a significant portion of feedback to surgeons. Assessors' comments (modified and de-identified) are regularly used as part of the *Lessons from the Audit*.

Although there are occasional complaints about second-line assessment processes, these are rare and often relate to a lack of information available to the second-line assessor at the time of their assessment activity.

Without committed assessors to review the activities of their surgical peers, NTASM could not exist nor could the data be gleaned from such an important quality assurance process.

The Northern Territory Audit of Surgical Mortality also acknowledges the support and assistance of many individuals and institutions that have assisted in the development and continuation of this project, including:

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References

1. Kable A, Gibberd R, Spigelman, A. Predictors of adverse events in surgical admissions in Australia. *International Journal for Quality in Health Care* 2008; **20**(6): 406-11.
2. North JB, Blackford FJ, Wall, D et al. Analysis of the causes and effects of delay before diagnosis using surgical mortality data. *British Journal of Surgery* 2013; **100**(3): 419-25.
3. Fevang BT, Fevang J, Stangeland L, Soreide O, Svanes K, Viste A. Complications and death after surgical treatment of small bowel obstruction: A 35-year institutional experience. *Annals of Surgery*. 2000; **231**(4): 529-37.
4. McNicol L, Story DA, Leslie K et al. Postoperative complications and mortality in older patients having non-cardiac surgery at three Melbourne teaching hospitals. *Medical Journal of Australia*. 2007; **186**(9): 447-52.
5. Lefavre KA, Macadam SA, Davidson DJ, Gandhi R, Chan H, Broekhuysen HM. Length of stay, mortality, morbidity and delay to surgery in hip fractures. *Journal of Bone & Joint Surgery British Volume* 2009; **91**(7): 922-927.
6. Vogel TR., Dombrovskiy VY, Lowry SF. In-hospital delay of elective surgery for high volume procedures: the impact on infectious complications. *Journal of the American College of Surgeons* 2010; **211**(6): 784-90.
7. Ehsani JP, Jackson T, Duckett SJ. The incidence and cost of adverse events in Victorian hospitals 2003-04. *Medical Journal of Australia* 2006; **184**(11): 551-5.
8. Bellomo R., Goldsmith D, Russell S, Uchino S. Postoperative serious adverse events in a teaching hospital: a prospective study. *Medical Journal of Australia*. 2002; **176**(5): 216-8.
9. Australian Institute of Health and Welfare. *Australian hospital statistics 2012-13. Health services series no. 54. Cat. no. HSE 145*. 2014 [cited 2014 September 03]; Available from: <http://www.aihw.gov.au/publication-detail/?id=60129546922>.
10. Cuvillon P, Nouvellon E, Marret E et al. American Society of Anesthesiologists' physical status system: a multicentre Francophone study to analyse reasons for classification disagreement. *European Journal of Anaesthesiology*. 2011; **28**(10): 742-7. doi: 10.1097/EJA.0b013e328348fc9d.
11. Kowdley GC, Merchant N, Richardson JP, Somerville J, Gorospe M, Cunningham SC. Cancer surgery in the elderly. *ScientificWorldJournal* 2012; 2012: 303852.
12. Harris I, Madan A, Naylor J, Chong S. Mortality rates after surgery in New South Wales. *Australian and New Zealand Journal of Surgery* 2012; **82**(12): 871-7.
13. Australian Bureau of Statistics. *3101.0 - Australian Demographics*. Dec 2012 June 20 2013. [cited 2013 July 29]; Available from: <http://www.abs.gov.au/ausstats/abs@.nsf/mf/3101.0>.
14. Burke V, Zhao Y, Lee AH et al., Health-related behaviours as predictors of mortality and morbidity in Australian Aborigines. *Preventive Medicine Journal*. 2007; **44**(2): 135-42.
15. Centers for Disease Control and Prevention. Healthcare-associated Infections (HAIs); *Pseudomonas aeruginosa* in Healthcare Settings Atlanta: *Centers for Disease Control and Prevention*; 2013 [updated May 7, 2014; cited 2014 29 October]
16. Bailey T, Mileva M, Zardawi I. Necrotising fasciitis in the Northern Territory of Australia. *Pathology*. 2014;46:S107-S8 10.1097/01.PAT.0000443694.89576.ef.
17. Sarani B, Strong M, Pascual J, Schwab CW. Necrotizing Fasciitis: Current Concepts and Review of the Literature. *Journal of the American College of Surgeons*. 2009;208(2):279-88

NOTES

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